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How to improve researchers' communication, collaboration and commercialization of R&D in regions?

Совершенствование условий для коммуникаций и коллабораций между исследователями, коммерциализации исследований и разработок в регионах

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Abstract

The article presents a comprehensive analysis of the current state of the Russian Federation's regions in terms of the created conditions for cooperation between research teams and the commercialization of scientists' results of intellectual activity. The authors made an analysis of the estimated indicators, as well as the calculation of the integral index characterizing the given indicators. Case studies of the most developed regions are presented. The resulting conclusions can be the basis for the development of a regional environment that promotes scientific activity.

Аннотация

В статье представлен комплексный анализ современного состояния регионов Российской Федерации в части созданных условий для сотрудничества между исследовательскими коллективами и коммерциализации результатов интеллектуальной деятельности ученых. Авторами проведен анализ оценочных показателей, а также представлен расчет интегрального индекса, характеризующего приведенные показатели. Приведены кейсы наиболее развитых регионов.Полученные в результате выводы могут стать основой для развития региональной среды, содействующей научной деятельности.

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Ключевые слова: коммуникации, коллаборация, наука, исследования и разработки, регион, коммерциализация

Introduction

The relevance of research the development of science is determined by the undisputed priorities identified in the country'skey strategic documents: the Strategy for Scientific and Technological Development of the Russian Federation, Presidential Decree No. 204 of May 7, 2018 "On National Targets and Strategic Development Challenges of the Russian Federation for the period up to 2024 year"and a number of others.

In the last document, in particular, it was noted that there is the need to accelerate the technological development of the Russian Federation, as well as increasing the number of organizations that carry out technological innovation to 50 percent of their total number. Among the priorities assigned to the Government of the Russian Federation are the issues of creating competitive scientific teams and laboratories, including international ones, the formation of cooperation system with organizations operating in the real sector of the economy, the integration of universities and scientific organizations and others.

It is the effective forms of cooperation in the scientific sphere, the involvement of the maximum number of stakeholders into the scientific and technical activities within the framework of joint projects, which can provide an additional synergy effect from interaction, as well as identify those R&D priorities that can be implemented in practice.

A comprehensive study of the issues of scientific collaborations and the commercialization of R&Dis due to the formulations laid down in the Strategy for Scientific and Technological Development of the Russian Federation. The task block "Interaction and cooperation" presupposes the formation of an effective communication system in the field of science, technology and innovation, increasing the susceptibility of the economy and society to innovations, and the development of knowledge-based business.

In addition, the need for communication and collaboration is due to the trend of digitalization and globalization of the economy, a significant complexity of modern research, requiring the involvement of qualified specialists from various fields (Tantchou, 2017).

The purpose of this paper is a comprehensive assessment of issues of interaction and cooperation in the scientific and technical sphere, including those aimed at commercializing the results of intellectual activity in the Russian Federation's regions.

Collaborations in the scientific and technical sphere are actively studied in the literature. Scientists from the Massachusetts University Olson, Zimmerman & Bose (2008) define the scientific collaboration as an organizational association of scientists, including researchers of various organizations, supporting extensive and repetitive human interaction, focused on a common field of research and providing access to data sources, exhibits and tools, required to perform the research task.

The questions of definitions and classifications of various forms of collaborations are thoroughly studied in the work by Korobkina & Omelchenko (2017). The authors describe their key characteristics of collaborations, using approaches characterizing their various aspects:

- Resource aspect consists in the availability of the organization's special resources necessary to enter into a particular collaboration;
- Organizational aspect –the key organizational characteristics of collaborative activities;
- Process aspect - definition and implementation of key processes, rules, approvals that occur in the process of collaboration;
- Competence aspect - ensuring the exchange of explicit and implicit knowledge in the process of collaboration, which as well ensures the formation interdisciplinary competencies (Beecher Maurer *etal.*, 2013);
- Ecosystem aspect - information exchange and self-education of socio-economic systems with the emergence of synergistic effect.

In this work we also emphasize micro-level (organizational, system) collaborations and nanolevel collaborations (individual subjects of interactions).

At the same time, the CSR Foundation's study "Prospects for the Russia's Development in International Scientific Collaborations" highlights the features of modern collaborations that are not fully integrated into the proposed classification framework. Thus, the second generation of international research collaborations presupposes the fragmentation and distribution of the scientific task for maximally rapid and profound study of the scientific problem, in contrast to the first generation, which, according to the authors, was based primarily on a resource approach.

As a predominant form of cooperation, the cooperation of small scientific teams, along with large scientific institutes, universities and organizations, is highlighted, which is the integrated interrelationships of micro- and nano level (Knobel, et al., 2013).

Collaboration development tools include collaboration design, training in collaboration, team management (Olin & Ingerman, 2016; Heaton, *etal*., 2016), networking technologies (Maggioni et al., 2013; Yunwei & Shu, 2013). For example, Kolfschoten and de Vreede-design approach (2009) for collaborative engineering that incorporates existing process design methods, pattern-based design principles, and insights from expert facilitators regarding design challenges and choices.

The aspects of learning both in and for collaboration are considered in the work of Fenwick (2012). After introducing complexity principles that appear in accounts of professional practice and education, selected studies are presented that draw from complexity science to examine professional collaboration in fields of management, social and health care, and education.

Collaborative learning facilitates the provision of effective collaborations between scientists and entrepreneurs, which is considered as case studies by Hoes *et al*. (2008).

The issues of commercialization of scientific results are one of the aspects of collaborations problem of scientists with stakeholders, which is currently quite relevant (Olswang & Goldstein, 2017; Simakova, 2012). The introduction of R&D results in some cases is difficult due to inadequate communication between R&D and businesssector'srepresentatives.

Materials and methods

Within the framework of the theoretical framework of the study, indicators that characterize the potential of the Russian Federation' subjects in terms of developing conditions for communication and collaboration between researchers, the commercialization of R&D, and achieved results that characterize the corresponding potentialwere identified. The choice of indicators was made on the basis of the criteria of their completeness, accessibility and compliance with the chosen subject of research.

The list of performance indicators included:

1. The number of created clusters (at the time of the survey - March 2018)
2. The number of created technology parks (at the time of the survey - March 2018)
3. Innovative activity of organizations (2016)
4. The number of created Small Innovative Enterprises (2017)
5. The number of winners of megagrants program (at the time of the survey - March 2018)
6. The number of winners of the competition for the development of cooperation of Russian universities, research institutions and manufacturing enterprises (at the time of the survey - March 2018)
7. Indicator of the number of potentially commercialized patents (2016)

In the framework of research, a comprehensive evaluation of the investigated characteristics was made. Itbased on the calculation of the integral index. For this task the initial data were originally normalized using the maximin technique. Relative indicators were used in the calculations to ensure comparability of the data and representing the intensity indicators of the traits (correlated with the number of organizations involved in R&D or the number of researchers).

The values of the sub indexes of potential IP_k^j are calculated by the distance method according to the formula:

$$\mathrm{IP}_k^j = \sqrt{\frac{\sum_{i=1}^{n}\left(1-\overline{p}_{k,j}^{\,i}\right)^2}{n}} \qquad (1)$$

where p - normal potential indicator, *k* — the number of the corresponding thematic block (factor) (k = 1,…,5), n — the number of indicators included in the corresponding subindex of the potential, j = 1, …, N, N — the number of the Russian Federation' subjects, N=85.

Similarly, the values of the subindexes of result IR_k^j are calculated by the formula:

$$\mathrm{IR}_k^j = \sqrt{\frac{\sum_{i=1}^{n}\left(1-\bar{r}_{k,j}^{i}\right)^2}{n}}, \qquad (2)$$

where r - normal result indicator, k — the number of the corresponding thematic block (factor) (k = 1,…,5), n — the number of indicators included in the corresponding sub index of the result, j = 1, …, N, N — the number of the Russian Federation' subjects, N=85.

The integral indicator is calculated as the sum of subindexes.

Analysis and discussion

The development of cooperation of region'seducational, scientific and industrial organizations can be provided on the basis of various information and communication platforms. Clusters and technology parks promise theinfrastructure organizationsfor the development of cooperation.

Thus, clusters are emphasized in the work by Smorodinskaya (2013) as a network innovative ecosystems of a special class, which include a wide range of independent agents of different profile interacting with each other in the mode of continuous coordination, relying on network platforms or other institutions that are supporting the collaboration. Technology parks as integrated elements of innovation infrastructure are also create conditions for the implementation of cooperation and interaction in the framework of the implementation of scientific, technical and innovation activities of residents.

Data analysis of the official website of the National Center for Monitoring the Innovation Infrastructure of Scientific and Technical Activities and Innovation Systems has made it possible to determine the number of clusters and technology parks in each subject of the Russian Federation.

Data on the number of innovative territorial clusters received from the official website of the National Center for Monitoring the Innovation Infrastructure of Scientific and Technical Activities and Innovation Systems were supplemented by data from the regional centers of cluster development.

As a result, it was revealed that 155 territorial clusters were created in 45 regions of Russia (53% of their total number). The activities of these elements of the innovation infrastructure are regulated by both federal and regional regulations.

The largest number of clusters were created in St. Petersburg. The Center for Cluster Development of St. Petersburg (CCD) as a structural unit of "Technology park of St. Petersburg" is currently oversees the activities of 12 territorial clusters: information technology and radio electronics, medical and pharmaceutical industry, composite, transport engineering, machine tool industry, clean technologies for the urban environment, the development of innovations in energy and industry, jewelers, "Transport and infrastructure construction", water supply and water disposal, Autoprom North-West", a unified cluster "Innograd of Science and Technology".

The second position on the number of created clusters is occupied by the Voronezh region and the Republic of Tatarstan. On their territory there are 8 innovative territorial clusters. The third place took Moscow and the Rostov region –there are 7 innovative territorial clusters.

Territorial clusters are currently either not created, or there is only an initiative to create themin 40 regions of Russia (47% of their total number).

Up to date, the cluster strategy is one of the effective tools of public policy to increase the competitiveness of the economy with the wide use of scientific and innovation potential. The creation and development of clusters will ensure a multiplicative effect of the economy development of each particular region and the country as a wholethrough the use of a positive synergy effect.

One of the tools for linking the factors in the cluster are scientific and technological parks which allow to unite the disparate innovative resources of enterprises and universities.

It was determined that currently 137 technology parks have been created in 46 Russian regions (54% of the total number of regions). According to the number of such objects, Moscow occupies the first place where 31 technology parks operate, that makes up almost a quarter of all technology parks created in Russia. The following positions, as well as the number of clusters, are occupied by the Republic of Tatarstan and Voronezh region, where 7 and 6 objects of innovation infrastructure operate respectively. 43 regions has 5 or fewer such objects. In 39 regions there are no such structures.

One of the outcome indicators characterizing communications and collaborations between researchers, as well as the effective commercialization of R&D in the subjects of the Russian Federation, is the innovative activity of organizations.

Analysis of the official website of the Federal State Statistics Service for the year 2016 showed that organizations in 29 Russia'sregions (34% of the total number of regions) has innovative activity higher than the average for Russia (8.4%).

The highest innovation activity (over 20%) was showed by the organizations in the Chuvash Republic (24.5%), in the Republic of Tatarstan (21.3%) and in the Penza region (20.1%), the lowest innovation activity (less than 1%)was showed by the organizations from Karachay-Cherkessia republic (0.8%) and the Chechen republic (0.3%).

In the past decade, due to the increased attention of the state and the scientific community to the links between science and business, universities in many countries has begun to massively go beyond their traditional functions of education and research and promote academic entrepreneurship. An example of the realization of academic entrepreneurship in Russia is the small innovative enterprises created by the universities (SIE). The number of created SIEs is an indicator of the result, that ensuring commercialization of R&D and characterizing the activity of their innovation activity.

According to the official database "Accounting and Monitoring of Small Innovative Enterprises in the Scientific and Educational Sphere" of the Ministry of Education and Science of Russia 2429 SIEs were created in all regions of Russia (according to the register of 2017, were considered only those SIEs that are operating at universities).

The largest number of SIEsoperate in Moscow - 248 and St. Petersburg - 161. A significant proportion of SIEs is outside of Moscow and St. Petersburg, which indicates the development of small innovative entrepreneurship in the regions. It should be noted Belgorod and Tomsk regions - 123 and 115 SIEs, respectively. The lowest number ofSIEs (only 1) was established in the Smolensk and Arkhangelsk regions, the Karachay-Cherkess Republic, the Altai and Tyva republics, and the Kamchatka region. In the Nenets, Yamalo-Nenets and Chukotka autonomous districts, the Republic of Ingushetia, Magadan region and Jewish autonomous region these structures were not identified.

As a result of data analysis from the official site of "Megagrants", the total number of winners of megagrant competitions held in accordance with the Resolution of the Government of the Russian Federation No. 220 was received for the entire period of the contest for each region of Russia. This indicator shows the region's competitiveness in implementing major research projects, organizing scientific collaborations, and interacting with profile enterprises.

For the entire period of the competition for Russia 236 megagrants were received. Of these, 73 megagrants were received by higher education institutions and scientific organizations in Moscow. Among the Moscow universities Lomonosov Moscow State University became the owner of megagrant 14 times. In addition, it should be noted the contribution of such national research universities as MEPhI and the Higher School of Economics (each university has 7 mega grants).

The universities from St. Petersburg won a competition of megagrants 73 times, from Nizhny Novgorod region - 22times, from Novosibirsk region - 21times, from Moscow region - 15times and from Tomsk region - 12times. Universities from 24 Russia'sregions became winners less than 10 times. In 55 regions there are no winners of competitions for grants of the Government of the Russian Federation for state support of scientific research conducted under the guidance of leading scientists in Russian universities.

The next indicator, which demonstrates the possibilities of scientific collaborations, is the number of winners of the competition for the development of cooperation of Russian universities, scientific institutions and manufacturing enterprises.

Analysis of the official website "Development of cooperation of Russian universities, scientific institutions and industrial enterprises" allowed to determine the number of winners for each region for the entire period of the competition.

The leader for the development of cooperation of higher education institutions, scientific institutions and manufacturing enterprises is Moscow (90 complex projects-winners). Then follows such regions as St. Petersburg - 39 projects, the Republic of Tatarstan - 25 projects and the Moscow region - 24 projects. In 34 subjects of the Russian Federation there are no winning projects for this competition.

The best stimulator of the development of science and technology in the interests of market saturation with goods are patents. The issue of organizations' interest in acquiring rights to patents and patent licenses (contracts) for the use of inventions, industrial designs is currently very relevant. The indicator of the number of potentially commercialized patents characterizes the intellectual property objects created in the region.

As the analysis result of official websites of the Federal State Statistics Service and the Federal Monitoring System of Scientific Organizations for the year 2016, it was determined that Moscow, (962.48), St. Petersburg (235.32) and the Moscow Region (148.54) took the leading positions by this indicator. The lowest indicator has the Nenets Autonomous District and the Republic of Tyva - 0.08. The indicator of the number of potentially commercialized patents for the Chukotka Autonomous District has not been determined.

The results of this block's analysis showed that the regions differ significantly in the intensity of cooperation between enterprises, universities, researchers and the commercialization of R&D.

The leading group for most of the indicators of this block includes Moscow, St. Petersburg, the Republic of Tatarstan and the Moscow region.

The results of integral index calculating are shown in Table. 1.

Table 1.
Integral assessment of conditions for communication and collaboration between researchers, commercialization of R&D

Russian Federation' Subject	Subindexofpotential	Rank	Subindexofresult	Rank	Integralindex	Rank
CentralFederalDistrict						
Belgorod region	0,2160	18	0,4039	1	0,5327	2
Bryansk region	0,0000	60	0,1644	34	0,1644	57
Vladimir region	0,3080	8	0,2182	16	0,4590	6
Voronezh region	0,2727	13	0,2300	14	0,4400	11
Ivanovo region	0,0000	60	0,1684	31	0,1684	55
Kaluga region	0,2276	16	0,0863	66	0,2943	34
Kostroma region	0,0000	85	0,1833	26	0,1833	54
Kursk region	0,0195	58	0,1336	52	0,1505	62
Lipetsk region	0,3753	3	0,1422	49	0,4641	5
Moscow region	0,0473	50	0,1762	30	0,2151	47
Oryol region	0,2929	10	0,0933	63	0,3589	18
Ryazan region	0,0796	44	0,1557	40	0,2229	44
Smolensk region	0,2094	20	0,0697	72	0,2646	37
Tambov region	0,0677	48	0,1680	33	0,2243	43
Tver region	0,0000	60	0,1396	51	0,1396	67
Tula region	0,0000	60	0,2170	17	0,2170	46
Yaroslavl region	0,0770	45	0,1766	28	0,2400	40
Moscow	0,0283	55	0,2748	7	0,2953	32
North-WestFederalDistrict						
The Republic of Karelia	0,1647	24	0,1680	32	0,3051	27
Komi Republic	0,0289	54	0,0510	78	0,0784	77
Arhangelsk region	0,1455	26	0,1324	54	0,2586	38
Vologda Region	0,2894	11	0,1482	45	0,3947	15
Kaliningrad region	0,0268	56	0,1405	50	0,1636	58

Russian Federation' Subject	Subindexofpotential	Rank	Subindexofresult	Rank	Integralindex	Rank
Leningrad region	0,0000	60	0,1528	42	0,1528	61
Murmansk region	0,1292	27	0,0634	73	0,1844	53
Novgorod region	0,3413	6	0,0798	70	0,3938	16
Pskov region	0,0000	60	0,2137	19	0,2137	48
St. Petersburg	0,0874	38	0,2960	5	0,3575	20
Nenets Autonomous District	0,0000	60	0,0513	76	0,0513	80
SouthernFederalDistrict						
Republic of Adygea	0,0000	60	0,1285	55	0,1285	69
Republic of Kalmykia	0,0000	60	0,1063	61	0,1063	72
Republic of Crimea	0,1007	34	0,0509	79	0,1465	66
Krasnodar region	0,0221	57	0,1162	58	0,1356	68
Astrakhan region	0,5225	1	0,1500	43	0,5941	1
Volgogradregion	0,0000	60	0,0837	68	0,0837	75
Rostovregion	0,1794	22	0,1764	29	0,3241	25
Sevastopol	0,0000	60	0,1487	44	0,1487	64
North-CaucasianFederalDistrict						
The Republic of Dagestan	0,0803	43	0,0510	77	0,1272	70
The Republic of Ingushetia	0,0000	60	0,0021	85	0,0021	85
Kabardino-Balkaria Republic	0,0000	60	0,1476	46	0,1476	65
Karachay-Cherkess Republic	0,0000	60	0,0146	84	0,0146	84
Republic of North Ossetia-Alania	0,0869	39	0,0887	65	0,1679	56
Chechen Republic	0,1090	32	0,1446	48	0,2378	41
Stavropolregion	0,0000	60	0,1541	41	0,1541	59
VolgaFederalDistrict						
Republic of Bashkortostan	0,1289	28	0,1973	22	0,1272	70
Mari El Republic	0,0000	60	0,3519	3	0,0021	85
The Republic of Mordovia	0,2102	19	0,2397	12	0,1476	65
Republic of Tatarstan	0,1815	21	0,3474	4	0,0146	84
Udmurt republic	0,1743	23	0,1976	21	0,1679	56
Chuvash Republic	0,0856	41	0,2739	8	0,2378	41
Perm region	0,0696	47	0,2168	18	0,1541	59
Kirov region	0,2764	12	0,1132	60	0,1272	70
Nizhny Novgorod region	0,0910	35	0,2731	9	0,0021	85
Orenburg region	0,0763	46	0,0786	71	0,1476	65
Penza region	0,3431	5	0,1620	35	0,0146	84
Samara region	0,0901	37	0,2248	15	0,1679	56
Saratov region	0,0308	52	0,1269	56	0,2378	41
Ulyanovskregion	0,0908	36	0,1836	25	0,1541	59
Uralfederaldistrict						
Kurgan region	0,3986	2	0,1603	36	0,4950	3
Sverdlovsk region	0,0318	51	0,1877	24	0,2135	49
Tyumen region	0,0162	59	0,1999	20	0,2129	50
Chelyabinsk region	0,0819	42	0,2327	13	0,2956	31
Khanty-Mansi Autonomous Area - Yugra	0,2306	15	0,0907	64	0,3004	29

Russian Federation' Subject	Subindexofpotential	Rank	Subindexofresult	Rank	Integralindex	Rank
The Yamalo-Nenets Autonomous District	0,2929	10	0,1578	39	0,4045	13
SiberianFederalDistrict						
Altai Republic	0,0000	60	0,0569	74	0,0569	78
The Republic of Buryatia	0,1475	25	0,1598	37	0,2837	35
Tyva Republic	0,0000	60	0,0228	83	0,0228	83
The Republic of Khakassia	0,0000	60	0,0414	82	0,0414	82
Altai region	0,2184	17	0,2644	10	0,4250	12
ZabaikalyeTerritory	0,1094	31	0,1269	57	0,2224	45
Krasnoyarsk region	0,0303	53	0,2768	6	0,2987	30
Irkutsk region	0,2669	14	0,1578	38	0,3826	17
Kemerovo region	0,3205	7	0,1801	27	0,4429	10
Novosibirsk region	0,0857	40	0,2541	11	0,3180	26
Omskregion	0,1115	30	0,1334	53	0,2301	42
Tomskregion	0,1070	33	0,3848	2	0,4507	7
FarEasternFederalDistrict						
The Republic of Sakha (Yakutia)	0,3527	4	0,1475	47	0,4482	9
Kamchatka region	0,0000	60	0,0851	67	0,0851	74
Primorsky region	0,0000	60	0,1922	23	0,1922	52
Khabarovsk region	0,1128	29	0,1059	62	0,2068	51
Amur region	0,0000	60	0,1135	59	0,1135	71
Magadan region	0,0000	60	0,0817	69	0,0817	76
Sakhalin region	0,0653	49	0,0428	81	0,1053	73
JewishAutonomousregion	0,0000	60	0,0471	80	0,0471	81
ChukotkaAutonomousDistrict	0,0000	60	0,0515	75	0,0515	79

The analysis demonstrates a fairly large number of regions with zero index of the subindex of potential, which shows the absence on their territory of objects of innovative infrastructure and associations of research and production structures that promote cooperation and collaboration in R&D. The highest indicators are in the Astrakhan, Kurgan, Lipetsk regions, the Republic of Sakha (Yakutia), the Penza region. The questions of the value of the indicators and, accordingly, the final values of the subindex lie in the plane not only the level of development of collaborative structures on the territory, but also are associated with the specifics of their accounting. Obviously, that the correct presentation of the results of activities and their mapping in the database, which became the basis for the formation of the information research base, provided an opportunity for regions that a priori are not being leaders in the field of the infrastructure for the development of science and technology to get high performance ratings.

Belgorod, Tomsk regions, the Republics of Mari El, Tatarstan, St. Petersburg became leaders by the value of the subindex of the result. It is noted that significant indicators of the Republic of Mari El are largely due to the high intensity of the indicators identified in the process of analysis, which is due to the low number of organizations engaged in R&D, as well as a small number of researchers.

Leading position son, the value of the integral indicator are occupied by the Astrakhan, Belgorod, Lipetsk regions, the Republic of Tatarstan, the Kurgan region. The given values of the indicators also demonstrate a high influence of intensity indicators, primarily in the Astrakhan and Kurgan regions. At the same time, the high intensity of the results indicates that there are opportunities for its replication and distribution to expand the R&D sector in these regions.

The main recommended mechanisms for combining intellectual resources are:

- Software tools that oblige participants to involve students in scientific research,

involve academic staff of academic institutions in teaching activities;
- Identification of existing collaborations between scientists, organizations and creating conditions for maintaining and strengthening such collaborations through the creation of new organizational forms;
- Creation of large centers with an extensive infrastructure for solving strategic state tasks.

The financial mechanisms for supporting the activities of scientific collaboration from the state, as a rule, include sources of competitive and program financing. Among the sources of funding for the activities of scientific collaborations are the following measures: competitive financing through the activities of the Federal Target Program of the Ministry of Education and Science of Russia; grants of the Russian Foundation for Basic Research; grants of the President of the Russian Federation, grants of the Russian Humanitarian Scientific Foundation, programs of the Presidium of the Russian Academy of Sciences; programs of the Russian Academy of Sciences; projects of state corporations - Rosatom, Gazprom.

Within the framework of this study, from the point of view of the region'sparticipation, it is necessary to talk about collaborations that take place between scientists, researchers and representatives of private business, for which software tools are a form of support, and the defining factors of integration are territorial and social affinity, common themes of projects and studies. Territorial proximity promotes the formation of channels for the transfer of knowledge and innovation between scientific organizations and business. Social affinity within the framework of the collaboration results from the creation of close formal and informal links between its participants.

In this case, the scientific collaboration is an infrastructural element of the regional scientific and technological complex, which includes scientific organizations, the infrastructure that ensures the functioning of scientific teams and the projects that they implement, and high-tech enterprises in the region. The government bodies of the Russian Federation' subjects act in this case as the regulator of the system of professional interaction in the triangle "science - business - society".

The close interaction of research teams from organizations of different profiles takes place within the framework of such infrastructure elements as the common use center and the unique scientific installation. The integration of the scientific infrastructure is subordinated to two functionshere: the attraction of intellectual resources of the common use center and the unique scientific installation, on the one hand, and the development of processes for the commercialization of the results of scientific work, on the other.

The most effective models for the development of regional scientific and intellectual integration (collaboration) designed to bring together the main stakeholders of scientific and technological development, i.e. business, government, the scientific community, are special territories with a special legal regime for the conducting of economic activities, regional scientific and technological clusters, technological platforms and others. The regional cases of such structuresarebelow.

1. Creation of zones of advanced development based on the cluster approach:

    - Formation of a portfolio of competitive clusters of modern and "smart" economies;
    - Balanced spatial development ensures high competitiveness of the environment;
    - Infrastructure is globally competitive.

Republic of Tatarstan

Within the framework of the Strategy for social and economic development of the Republic of Tatarstan up to 2030, three types of clusters are forecasted: key clusters (science and education), innovative clusters of the "smart" economy ("smart" information technologies, "smart" infrastructure, "smart" materials, "smart" cars and others) and clusters of modern economy (agro-industrial and oil and gas chemical complexes, wood processing and automotive industry and others).

Kirov region

Strategic alliance: nuclear-innovation cluster and Vyatka State University

The main tasks of cluster interaction in the implementation of a long-term development strategy lie in the areas of development of R&D related to the expansion of non-energy applications of nuclear technologies.

The purpose of the cluster is the formation of a comprehensive infrastructure aimed at the generation, packaging and commercialization of innovative products in the field of nuclear technology and nuclear medicine.

2. Formation of technological platforms of regional level as a tool for coordination of participants in the regional scientific and technological complex which determines the prospects for technological development within the relevant industry or technological direction

Regional technological platforms allows:

- To unite the efforts of regional authorities, business, science and education in the implementation of priority areas of innovative development of the Russian Federation’subject;
- To strengthen the influence of high-tech business on the definition and implementation of the most important tasks of scientific and technological development, important for its development;
- To mobilize participants to develop the most promising for the region innovation and technology market sectors in terms of the impact on the economy and employment of the population.

Krasnoyarsk region

In accordance with the Strategy of Innovative Development of the Krasnoyarsk region for the period until 2020, 13 priority directions for the formation of regional technological platforms (RTP), focused on technological modernization of the economy of the region, are identified.

The topic of regional technological platforms corresponds to the priorities of the "technological breakthrough", as well as to national priorities.

For 9 of them in the public domain there are passports approved by the Order of the Government of the Krasnoyarsk region. The list includes: "Information and telecommunication and space technologies for the innovative development of Siberia"; "Food security of Siberia"; "Energy, energy efficiency and energy saving"; "Innovative technologies for the integrated use of forest resources"; "Innovative technologies of a building complex. New materials and design solutions"; "Integrated development of deposits of solid minerals"; "Innovative technologies in metallurgy"; "Translational medicine"; "Educational innovative technologies for the economic and socio-cultural development of the Krasnoyarsk region" and others.

Belgorod region

An important aspect of the development of V.G. Shukhov’sBelgorod State Technological Universitywas the implementation of a pilot project with the administration of the Belgorod region to create a Regional Technology Platform.

Forming a joint scientific innovation regional model of interaction between the university and enterprises; provides a symbiosis of technological start-ups, small enterprises, large high-tech business; as well as creating a network of innovative infrastructure, PR-companies are performing to form a new region’s brand as an innovative and technological center of Russia.

Yaroslavl region

A cooperation agreement was signed between the Government of the Yaroslavl Region and Yaroslavl State University, Yaroslavl State Technological University, Rybinsk State Aviation Technical University on the creation of the scientific and technological platform "Agency for Technological Development of the Yaroslavl Region". The scientific and technological platform is based on the integration processes of scientific and educational organizations of the Yaroslavl region and their cooperation with organizations of the real sector of the economy.

The objectives of the interaction between the government and the leading universities in the region are to promote the breakthrough scientific and technological development of the Yaroslavl region, the introduction of world-class technology solutions at industrial enterprises in the region, the development of small innovative companies focused on export, and the promotion of the National Technological Initiative in the Yaroslavl Region.

3. Creation of the special economic zones (SEZ) of the regional level of the technical-innovative type, providing the creation and implementation of scientific and technical products, bringing it to industrial use, including the manufacture, testing and sale of pilot batches, as well as the creation of software products, data collection,

processing and transmission systems, systems of distributed computing and the provision of services for the implementation and maintenance of such products and systems.

On the territory of the Lipetsk region the special economic zone of regional level of technical-innovative type "Lipetsk-Technopolus" was created. It includes 17 participants providing with developed engineering infrastructure.

Specialization of the special economic zone of technical-innovative type: the creation and sale of scientific and technical products, bringing it to industrial use, including the manufacture, testing and implementation of pilot batches, as well as the creation of software products.

The advantages of project of the special economic zone of regional level are a favorable investment climate, the absence of restrictions on the volume of investment projects, developed engineering infrastructure, a package of state support measures, the availability of qualified personnel, a variety of choice of areas, services in the "one window" mode.

The activities of the special economic zone of regional levelare regulated by the Law of the Lipetsk Region of August 18, 2006. No. 316-OZ "On special economic zones of regional level".

Management of the special economic zone of the regional level of the technical and innovative type is carried out by: the supervisory board of the special economic zone of the regional level, the branch executive body of the state power of the region - the management of the innovative and industrial policy of the Lipetsk region.

These practices are used in various regions of the Russian Federation, and there is a nationwide approach, which is given in the regional standard of the National technology initiative. It is a set of guidelines that are designed to streamline the work of authorities, the scientific community and business communities in the regions to collect and test scientific and innovative projects. Such tools include, in particular, the leadership Institute. Identification, support and acceleration of regional leaders of research and innovation projects create the basis for the formation of a loyal community of researchers who support them.

In addition, it is advisable to create special spaces-boiling points, where it is possible to conduct various types of events that unite the research community.

The third important factor that ensures the influx of young researchers into the system of projects of the National technology initiative is the system of their identification and support in regional universities.

These tools create opportunities for improving communication and collaboration between researchers in the regions.

Conclusions

The study shows a significant diversification in the indicators characterizing the degree of collaboration between scientists and the level of commercialization of developments in the Russian Federation's regions. The system of indicators, the choice of which is based on the availability of official data, does not fully allow us to characterize the content characteristics of the collaborations, which requires additional research.

The case studies of regions actively contributing to the development of the system of collaborations which were showed in the paper are the basis for their replication and use in practice of other territories. All this will significantly expand the indirect methods of influence on the subjects of economic activity, providing the conditions for further generation of knowledge and innovations and their transfer to the economic sectors.

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