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Regional Institutions to Support Science and Innovation: Mechanisms to Improve the Efficiency of Their Operation

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Abstract. The administration of science and innovations is one of the most actively studied areas of knowledge in modern research in the field of management. The article concentrates on an overview of the existing practices of the organisations supporting science, research and development, and innovations in the regions of the Russian Federation. At present, in developed countries all over the world, high-tech product exports tend to occupy a substantial share in the country economics. The costs of R&D have a significant contribution to the value of such products. Consequently, the creation of high-tech products is directly related to the proper functioning of the research and innovation sector, which is impossible without a well-built system of research and innovations support organisations, both at the national and regional levels. The attraction of the research community to innovation activities through financial support leads to a significant increase in the scientific potential of regions and the state as a whole, which cannot but the most positively affect the economy. State support for innovations is a set of measures taken by state authorities of the Russian Federation and local administrative agencies in accordance with the national and local laws in order to create the necessary legal, economic and organisational environment; as well as the incentives for legal and physical entities who carry out innovation activities. The Strategy of Scientific and Technological Development of the Russian Federation specifies the organisations supporting science, R&D and innovations as an important element of the research and innovation system and one of the key elements of the Science National Project. Their effective operation is to facilitate the development of Russia and ensure the ability of the country and its regions to effectively meet major challenges. As part of the article, we analyse regional models of the science, R&D and innovation support organisations

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that are currently in force and those being proposed by Russian and foreign authors. We also evaluate the network cooperation of various types of regional support organisations with each other, taking into account the synergy effect. As a result, the most effective mechanisms and practices of the organisations supporting science, R&D and innovations at the regional level in the Russian Federation should be determined. In addition, we will define the goals of regional infrastructure elements of the research and innovations support organisations focused on the consumer in the innovation cycle. The data obtained in the research will contribute to the formation of an effective operation system and application of the best Russian and foreign practices by the existing science, R&D and innovations support organisations in the future.

Keywords: organisations supporting science, R&D and innovations, regional funds, life cycle of innovation, triple helix model, experienced customer, regional innovation system, support mechanisms.

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Research area: economy.

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Introduction

As of today, the world experiences a period of serious shock: against the background of the COVID-2019 pandemic, experts note the upper turning point of the global economic crisis and the recession in the world economy, which are catalysed by negative processes in the oil market of the Russian Federation. For the Russian Federation, the transition to an innovation-oriented-development model will be one of the solutions to transform the country from an exporter of hydrocarbons and other natural resources into a high-tech nation that manufactures high value-added products, which are based on research and inventions of Russian scientists (Qingrui et al., 2007; Wong, 2012; Nureev, 2012; Nureev, Sokolov, Akhmadeev, 2016; Javed, 2017; Nureev, Simakovskii, 2017; Pyzhev et al., 2015).

For more than 20 years, the Russian Federation has been trying to switch into the innovation-based economy, which is confirmed by the developed legal and regulatory framework and strategic goals. The necessary tools for supporting research and innovations have been formed, support organisations have been created and are functioning, not only at the federal but also at the regional level. However, the effect of their functioning does not exceed the investments made. Each year, the indicator of innovation activity in Russia decreases and according to Rosstat (Russian Federal State Statistics Service), in 2018, it fell to 12.8% compared to 14.6% in 2017 (Nureev, Simakovskii, 2017). Furthermore, in the annual rating of innovative countries compiled by the Bloomberg agency, over the past seven years, Russia had dropped from the16th place in 2012 to the 27th place in 2019. The main criteria, where Russia shows poor performance according to the rating, are the intensity of research and development, added value in production and labour efficiency (Bloomberg, 2020).

According to the data of the Accounts Chamber of the Russian Federation, currently, the federal budget is the primary source of funding for research and innovations in Russia, namely, it is 60-70% of total expenses. The existing research and innovations funding mechanisms by attracting extra-budgetary funds do not lead to an increase in their amount, which contradicts the development priorities of the Russian Federation. In addition, the management system for research and innovations is

not focused on the formation of consumer demand for Russian research output and creation of new scientific knowledge recognised in the international academic community (Izotova, 2020). Should the key function of the organisations supporting research and innovations, in particular, commercialisation of the Russian scientists' developments and arrangement of their entering the open market be realised, that would increase the number of the innovative products released by Russian enterprises and expand their production volumes.

1. The theoretical framework of research

First of all, the organisations supporting research and innovations (or development institutions; both terms are used in different sources) operate in accordance with Federal Law No.127-FZ dated 23.08.1996 (as amended on 26.07.2019) "On Science and State Scientific and Technical Policy". The support for research and innovations is based on its target orientation and the plurality of funding sources and can be carried out from the federal budget, local budgets of the Russian Federation regions and cities, as well as by individuals in the forms that do not contradict Russian laws[1]. In order to approach the definition of this key concept for this article, let us consider its classification based on the approaches of various authors.

In the research of Ye.A. Monastyrnyi and other authors, it is proposed to divide the research and innovations support organisations by the nature of their influence on the context of the organisation functioning – into two main types, financial and non-financial organisations. The task of financial institutions is to reduce the development barriers within the same context, while the task of non-financial organisations is to change the context to increase competitiveness (Monastyrnyi, Saklakov, 2013; Polterovich, 2009).

Another classification proposed in the articles of O.S. Grozova, A.Yu. Chalova, et al. (Chalova, Tregubova, 2013; Grozova, 2012; Beliaeva, 2008; Gil'manova, 2011) distributes the support organisations for research and innovations by stages of the innovation life cycle. Based on the existing classifications of the stages of the innovation life cycle, it is possible to distinguish three key stages as follows:

– creation of innovations, including the stages from fundamental research up to the development of a production sample;

– production and commercialisation of innovations (from preparing a product for the market entry up to the production launch);

– consumption of innovations, which combines the product supply to the market and its consumption.

In the research of V.V. Bondarenko and M.A. Fedotova (Bondarenko et al., 2018; Fedotova, 2017; Domnina, Maevskaia, 2017), a hierarchical classification of support organisations for research and innovations is proposed, including three following levels:

1) federal support organisations for research and innovations in the business structure of state budgetary or autonomous institutions, as well as state-owned companies and banks that contribute to the development of research and innovations and ensure the fundraising in this field;

2) local representative offices of federal support organisations for research and innovations in Russian regions that solve the problems of regional development. These include: regional branches of federal venture funds and federal institutions for the support and development of research and innovations;

3) regional support organisations for research and innovations established by regional authorities and financed from local budgets or having a mixed type of financing.

This classification would be incomplete without the few but still functioning municipal innovation support organisations (for example, the First Saint Petersburg Business Incubator, the Pererva City Technology Park, etc.), as well as actively developing at present private innovations support organisations (successful examples are Win!Cubator in Krasnodar, Rassvet business incubator in Lomonosov, Leningrad region, etc.).

Another classification of support organisations for research and innovations presented in modern sources is as follows (by types and

[1] See Federal Law No.127-FZ dated 23.08.1996 (as amended on 26.07.2019) "On Science and State Scientific-Technical Policy".

goals of the research and innovations support organisations):

– funds (research&innovations, investment, venture funds, etc.);

– business incubators, accelerators and technology transfer centres;

– technology parks (incl. IT-parks, R&D centres, industrial parks);

– youth innovative creativity centres, resource sharing centres and prototyping centres;

– special economic zones, on the territory of which a unique package of benefits, services and investments are provided for scientists and entrepreneurs-innovators (technopolises, knowledge cities, territories of advanced social and economic development (ASEZ or PSEDA) (Pakhomova, Tkachenko, 2014).

All types of classifications of support organisations for research and innovations given above do not imply mutual exclusion, which means that it is possible to simultaneously apply several classifications.

As of today, the overwhelming majority in the hierarchy of the operating support organisations was created with the participation of funds from the budget of the Russian Federation, that is 70%. This fact indicates that the regions are not ready to actively participate in support of research and innovations without some incentives from the federal authorities. The situation may be changed by a series of instructions from President of the Russian Federation that followed a meeting of the general committee of the Russian Federation State Council and the Presidential Council of the Russian Federation for Science and Education, in particular the ones concerning the need to integrate regional support programs with the federal ones and create new regional organisations that could act as such integrators, as well as to introduce the practice of creating the funds that would support science and R&D at the expense of the regional budget and industrial partners' funds. In fact, some regions of the Russian Federation have experience on how to create and successfully run such organisations (President of Russia, 2020).

The capital of federal support organisations is more than 1 trillion rubbles and this indicator is equal to about 3% of GDP, however, having considered the practice of foreign countries, in order to effectively influence the economy, it is necessary to bring the capitalisation of such institutions to 5-7% of GDP. Such growth cannot be achieved by the federal budget in the near future but one can try to reach such an indicator by activating the authorities and businesses of Russian regions in creating the regional support organisations (Maslikhina, 2014; Malkina, Vol'chik, Krivosheeva-Mediantseva, 2014).

Despite the fact that regional organisations are created on the initiative and at the expense of the territories, they should be related to the general structure of state policy for the formation of the innovative economy of the country and each of its regions (Bondarenko et al., 2017).

In this regard, the support measures that regional organisations can provide are identical to those provided by federal institutions, namely: tax and levy benefits, educational services, information and consulting support, assistance in the formation of design documentation, the formation of demand for innovative products, financial support (including subsidies, grants, loans and credit lines, guarantees, contributions to the authorised capital), the implementation of target programs, subprograms and carrying out measures within the state programs of the Russian Federation and its regions, export support, infrastructure provision and other forms that do not contradict Russian laws[2].

The concept of a "regional research and innovations support organisation" will not differ substantially from the concept of the federal one, which has no clear definition. According to the Ministry of Economic Development of the Russian Federation, the support organisations are instruments of state policy at various levels that stimulate the economy transition to an innovation-based type and the development of infrastructure for innovation with the use of private-public partnership mechanisms.

The goal of support organisations is to activate the development of the innovation activity, the integration of modern technologies into

[2] See Federal Law No.127-FZ dated 23.08.1996 (as amended on 26.07.2019) "On Science and State Scientific-Technical Policy|".

existing processes, overcoming infrastructural barriers and attracting investments at the national, regional and local levels (Ivanov, Bukhval'd, 2018).

According to Ye.Ye. Kharlamova, a support organisation is a financial or non-financial institution, which functioning is aimed at the development of infrastructure, innovative activity and the economy through the accumulation and redistribution of financial, intellectual, labour and other types of resources with the use of mechanisms of public-private -partnership. The role of such institutions is to catalyse investments in accordance with the priority development directions of economic sectors and individual territories by providing business entities with access to the necessary financial and non-financial resources of the respective territories (Kharlamova, Kazartseva, 2015).

Also, Russian science has a more compact and comprehensive definition of the support organisation for the research and innovations development, which, according to V.V. Bondarenko and M.A. Fedotova, is an economic entity that concentrates and directs financial resources to progressive spheres of the economy, promising innovation and the implementation of infrastructure projects (Bondarenko et al., 2017). Support organisations should be considered as mechanisms of direct government influence on stimulating a specific sector or territory (Bukhval'd, 2014; Kuznetsov, Kuznetsova, 2015).

Therefore, a regional support organisation for research and innovations is an economic entity that ensures the functioning of instruments of the direct influence of regional authorities on the stimulation, development and support of research and innovations in the region for the purpose of sustainable social and economic growth through the creation of a product with high added value, as well as the formation of scientific groundwork to create breakthrough and unique innovations.

As of January 1, 2017, there are about 340 support organisations in the regions of the Russian Federation, for the financing of the activities of which budget funds are allocated to a greater extent (Bondarenko et al., 2018). In such a case, as the research results of R.M. Nureev, V.V. Bondarenko, M.A. Fedotova, I.N. Domina, Ye.M. Bukhval'd, V.Yu. Maslikhin and others, there is a number of problems in the system of functioning of regional support organisations for research and innovations:

- insufficient regulation and regulatory – support of the functioning;
- deficiency of a unified scientific and methodological approach to the system of performance evaluation indicators;
- informational "closeness";
- lack of a unified registration system for such institutions at country level (Nureev, Simakovskii, 2017; Bondarenko et al., 2018; Fedotova, 2017; Domnina, Maevskaia, 2017; Maslikhina, 2014; Bukhval'd, 2014; Tishchenko, 2019).

2. Successful practices of the regional support organisations for research and innovations in the Russian Federation and abroad

In order to search for a possible solution to the above problems and determine the most effective mechanisms and practices for the organisations supporting science, R&D and innovations at the regional level in the Russian Federation, we will consider a number of support organisations for research and innovations that operate in the regions. Let us consider the Republic of Tatarstan and Saint-Petersburg as examples of effective regional innovation systems. The effectiveness of their functioning is confirmed by the Rating of Innovative Regions of Russia compiled by the Association of Innovative Regions of Russia (Table 1), according to which the Republic of Tatarstan and Saint Petersburg over the past five years have been included in the three most innovatively – developed regions of the Russian Federation.

The leadership of the above regions is also confirmed by the Rating of Innovative Development of the Entities of the Russian Federation compiled by the Higher School of Economics (Table 2), according to which these entities also have leading positions in the rating over the past five years (Association of Innovative Regions of Russia, 2018; National Research University Higher School of Economics, 2019; Loseva, Stroev, Abdikeev, 2018; Latypova, 2017; Mikhailova, 2018).

Table 1. AIRR Rating

AIRR	2014	2015	2016	2017	2018
Saint Petersburg	1	2	2	1	1
Republic of Tatarstan	3	3	3	3	2

Table 2. HSE Rating

HSE	2014	2015	2016	2017	2018
Saint Petersburg	3	4	3	3	3
Republic of Tatarstan	2	2	1	1	2

According to the Ministry of Economy of the Republic of Tatarstan, the innovative infrastructure of the republic consists of 23 organisations of various types: from special economic zones up to the republican venture fund (Official Tatarstan, 2020). One of the formulas to the innovative success of the Republic of Tatarstan is its regulatory framework: the region is an example of a highly developed policy of support and implementation of scientific research and innovation, and regional support organisations and innovation infrastructure are an example of a systematically functioning innovation eco-system[3]. The "Strategy for the social and economic development of Tatarstan until 2030" is the main document, on which the republic innovation system is based. The strategy is developed by three priorities such as business, science and power (Alekseev, Chemezov, 2019). Serious attention there is paid to the development of such breakthrough areas as bio-, nano-, IT-technologies, high-tech medicine, genetics, robotics and new materials (Chereshnev, Tatarkin, Glaz'ev, 2011; Ishmuradova, SHinkevich, 2017; CHerniaev, Serdobintsev, 2017). The development of the strategy is based on the functioning of a complex of support organisations in Tatarstan distributed over all stages of the innovation life cycle (see Fig. 1), which in their turn are based on the republic regulatory- documents in the field of innovation.

Analysis of the regulatory-documentation of the Republic of Tatarstan in the field of innovation[4] (see Fig. 2) showed that it covers all stages of the innovation life cycle and is a viable, well-built system that ensures the successful functioning of support organisations for research and innovations in the region (Iunusov, 2003). It should be noted that in the Republic of Tatarstan, special attention is paid to the stages of production and consumption, which make it possible to obtain an economic effect from scientific research and development.

The experience of the Investment-Venture Fund of the Republic of Tatarstan is an example of the successful long-term functioning of the financial support institution for research and innovations in the Republic of Tatarstan. This is the first regional venture fund in Russia created in 2004 by the executive office of the Cabinet of Ministers of the Republic of Tatarstan for the purposes of increasing the innovative and investment potential of the republic, developing science-intensive industries, introducing new progressive technologies into the economy of the region. The Investment- Venture Fund of the Republic of Tatarstan is a unitary non-profit organisation that operates taking into account the specifics determined by Federal Law No.127-FZ dated 23.08.1996 "On science and state research and development policy", Federal Law No. 488-FZ dated 31.12.2014 "On industrial policy in the Russian Federation" and Law of the Republic of Tatarstan No. 24-ZRT dated April 21, 2016, "On industrial policy in the Republic of Tatarstan" in the form of business entity of the fund, which gives it a number

[3] Ordinance of the Cabinet of Ministers of the Republic of Tatarstan No. 3511-r dated 28.12.2019.

[4] See Available at: https://mert.tatarstan.ru/rus/Normativno-pravovie_documenti_v_sfere_innovacii?page=1

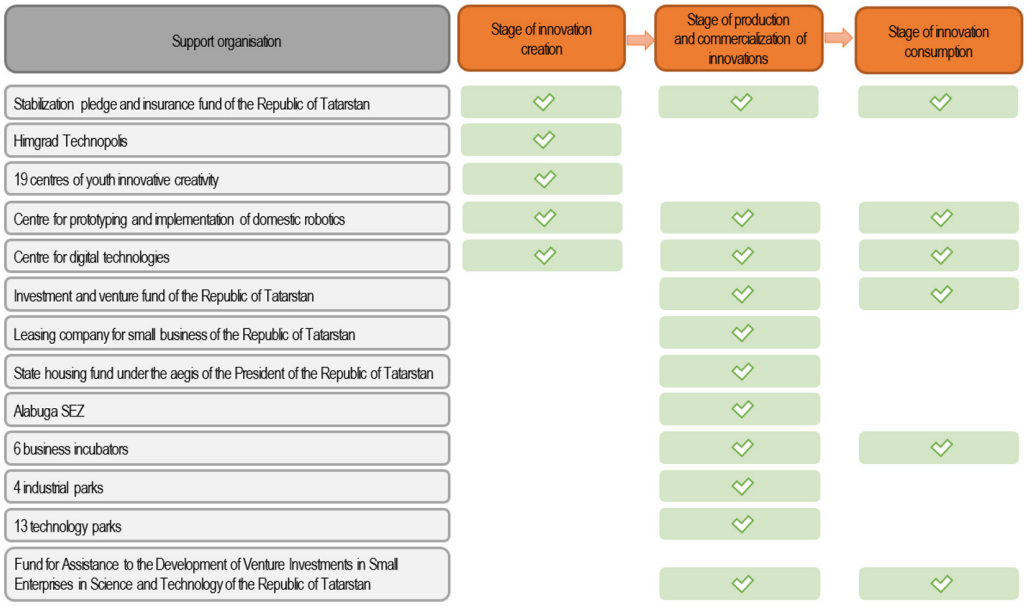

Fig. 1. Distribution of support organisations of the Republic of Tatarstan by stages of the innovation life cycle
Compiled by the authors based on https://mert.tatarstan.ru/rus/innovative_infrastructure_register.htm

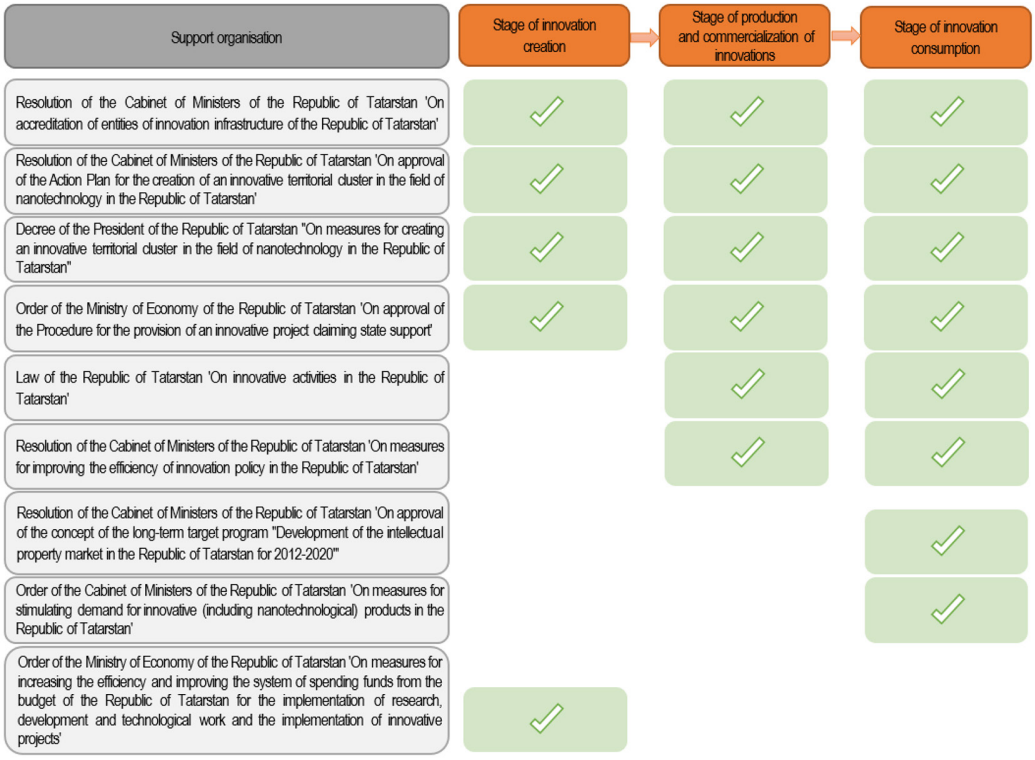

Fig. 2. Classification of regulatory documentation of the Republic of Tatarstan in the field of research and innovations
Compiled by the authors based on https://mert.tatarstan.ru/rus/Normativno-pravovie_documenti_v_sfere_innovacii?

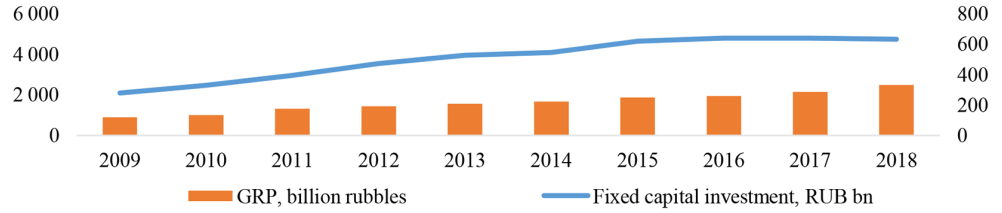

Fig. 3. Dynamics of changes in fixed capital investments and gross regional product of the Republic of Tatarstan
Compiled by the authors based on https://rosstat.gov.ru/

of additional opportunities over similar funds formed in the form of an autonomous or budgetary institution:

- the possibility of earning income from special-purpose capital;
- the ability to place funds on deposits in credit institutions, as well as to make transactions with securities (Mazilov, Ushakova, 2019; Loginova, 2020).

The Venture Fund of the Republic of Tatarstan points out three priorities for its activities: eco-system, infrastructure and investment. It is a member of the international organisations NVCA and EVCA, which allows it to actively adopt foreign experience in venture funding, as well as it is an authorised representative of the Industrial Development Fund and the Innovation Promotion Fund in the Republic of Tatarstan, thereby attracting federal funds to develop the scientific and innovative potential of its region[5] (SHinkevich, Timofeev, 2016; Gabdullin, Mironova, 2017; Plieva, Odintsova, 2015; Lapochkina, Kamenskii, Kornilov, 2018). In addition, the Venture Fund of the Republic of Tatarstan holds scholarship competitions involving funds from partner -organisations, which are large republican companies: AK Bars Bank, Himgrad, Tatneftekhim-investholding and Svyazinvestneftekhim.

Particular attention should be given to the acceleration program of the Venture Fund, which involves the promotion of Russian technology companies to the federal and global markets; the total amount of investments involved in this program amounted to 135.3 million rubbles for 5 winners in 2018. Participants of the acceleration program received not only investment support but also the opportunity to undergo special training programs in international innovation centres.

The Venture Fund of the Republic of Tatarstan is also a platform for popularising and involving investments in the innovation sector of the republic; the Russian Venture Forum is held on its basis, which is the largest Russian venture two-component event that includes congress and exposition blocks compiled by innovative companies interested in fundraising[6]. The success of support organisations of the republic is confirmed by a stable growth of the attracted investment. For the recent years, Tatarstan has been consistently among the most attractive regions for investment, which is due to the combination of high investment potential, low investment risk and stable growth of GRP (see Fig. 3).

The formula to scientific and innovative success in the Republic of Tatarstan lies in the synergistic effect and network interaction of its regional regulatory framework, executive authorities of the republic, regional organisations for support of research and innovations, cooperation with federal support organisations, focus on international experience and the involvement of large regional business in research and innovations. It should be noted that the model of the innovation system of the Republic of Tatarstan is based on the triple helix mechanism of innovation (Vol'chik, Krivosheeva-Mediantseva, 2014). It should be noted that the innovation and economic space of the Republic of Tatarstan are saturated with system

[5] Ordinance of the Cabinet of Ministers of the Republic of Tatarstan No. 3511-r dated 28.12.2019.

[6] Ordinance of the Cabinet of Ministers of the Republic of Tatarstan No. 3511-r dated 28.12.2019.

support organisations that unite key support tools in their structure, form the methodology of this activity and extend it to other support organisations for research and innovations in the region.

According to the Saint Petersburg Committee for Industrial Policy, Innovation and Trade, a system of support organisations for research and innovations are in effect in the city, which covers all stages of the development of the innovation cycle (see Fig. 4). An adjustment work for effective interaction between regional and federal support organisations is carried out. Business incubators, high-tech equipment resource sharing centres and prototyping centres provide non-financial support for research and innovative activities. The system of financial support organisations is represented by regional venture and pre-seed investment funds formed at the expense of the budget of Saint Petersburg and subsidies from the federal budget of the Russian Federation. Involvement of private investments, funds from federal support organisations and cross-border cooperation programs to the support organisations for research and innovations in Saint -Petersburg is ensured by the activities of the Program on Subsidisation of Costs of Organisations for the Formation of a Set of Applications for Receiving Funding from Development Institutions, as well as activities to stimulate the participation of organisations in Saint Petersburg in international cross-border cooperation programs[7] (Iurchenko et al., 2019).

St. Petersburg, as well as the Republic of Tatarstan, has a modern legislative framework that provides support and development of scientific and innovative activities in the region. The 'Strategy for the social and economic development of Saint Petersburg for the period up to 2035' approved by law No. 771-164 of Saint Petersburg dated 19.12.2018 is the basis of the legal framework. According to the above strategy, the mission of Saint- Petersburg is to create a global centre for the development and implementation of research and innovations, international culture and cooperation in Saint Petersburg. The first goal of the strategy declares that Saint Petersburg is a city of innovations. Achievement of strategic goals is based on the regulatory documentation of the[8] region in the field of innovation[9], which we classified similarly to the regulatory documentation of the Republic of Tatarstan (see Fig. 5).

St. Petersburg Technopark is the specialised platform and one of the non-financial support organisations for research and innovations at all stages of the innovation cycle in Saint Petersburg. St. Petersburg Technopark is a technopark structure that fully complies with the definition of a technology park from the Resolution No. 316 of the Government of the Russian Federation dated 15.04.2014 (as amended on 24.12.2019) 'On approval of the "Economic development and innovative economy" state program of the Russian Federation'; it is a collection of technological infrastructure objects, including real estate objects fully or partially owned by an entity of the Russian Federation and/or a municipality and/or private property, including land plots, office buildings, laboratory and production facilities, engineering facilities, transport, residential and social infrastructure created for the implementation of activities of small and medium-sized businesses in the high-tech field and managed by the management company[10]. And also corresponding to generally accepted international examples of technopark structures, it is an organisation managed by specialists, the main goal of whom is to increase the well-being of the local community by promoting an innovative culture, as well as the competitiveness of innovative business and scientific organisations. In order to achieve these goals, the technopark stimulates and manages the flows of knowledge and technology between universities, research institutes, companies and markets (Berkovich, Antipina, 2016; Molchanov, Molchanov, 2014). The structure of Saint Petersburg Technopark includes the Ingria business incubator, the Cluster Development Centre, the Prototyping

[7] Available at: https://cppi.gov.spb.ru/komitet/obshaya-informaciya/

[8] Available at: https://cppi.gov.spb.ru/komitet/docs/

[9] Available at: https://cppi.gov.spb.ru/innovations/programmy-podderzhki-innovacij/

[10] Resolution No. 316 of the Government of the Russian Federation dated 15.04.2014 'On approval of the "Economic development and innovative economy" state program of the Russian Federation'.

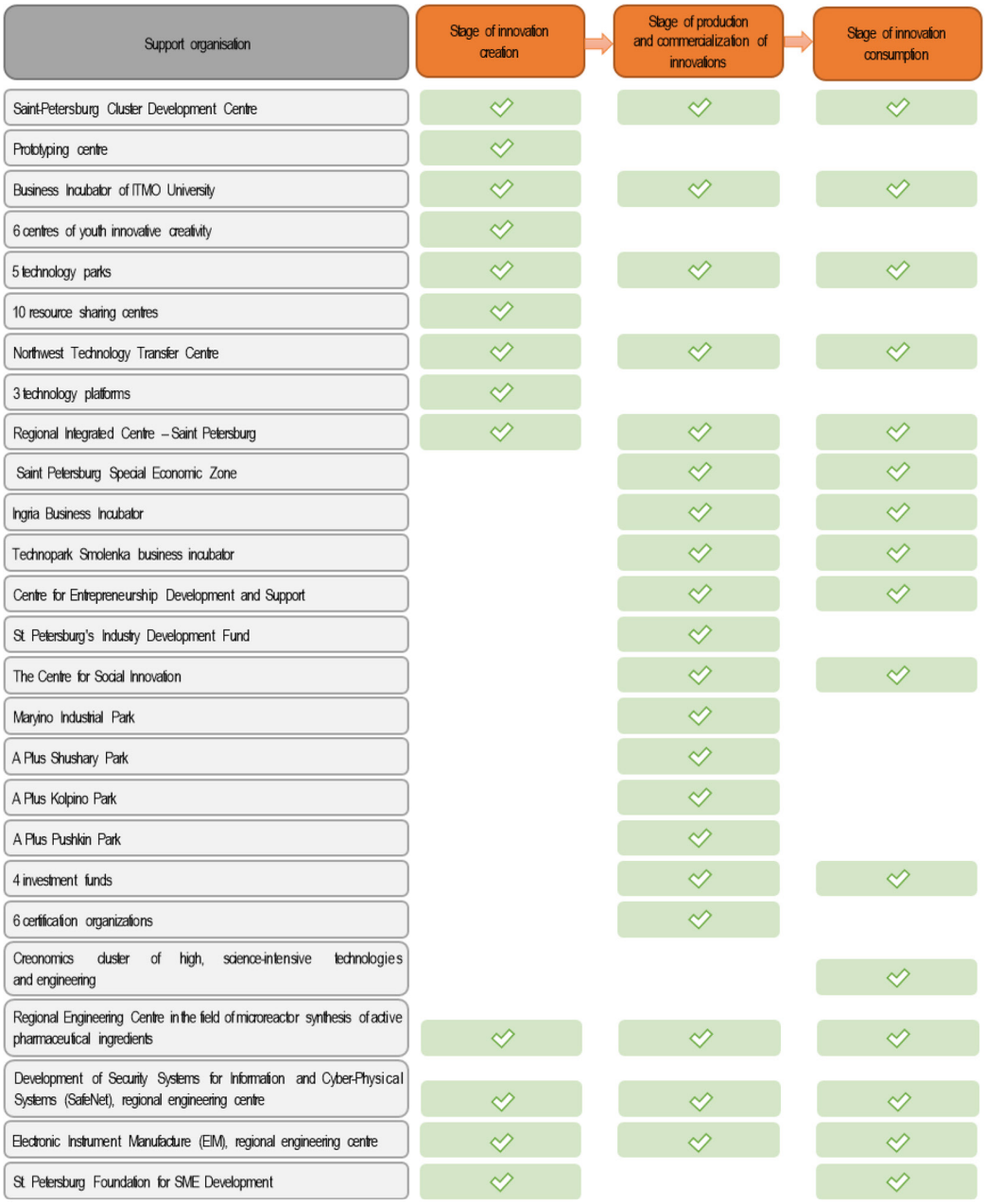

Fig. 4. Distribution of support organisations of Saint Petersburg by stages of the innovation life cycle
Compiled by the authors based on: http://inno.gov.spb.ru/catalog/innovative_objects/

Centre, the Regional Engineering Centre in the field of Microreactor Synthesis, the Regional Engineering Centre for the Development of Information Technologies, Radio Electronics, Instrument Manufacture, Communication Facilities and Information Telecommunications, SafeNet regional engineering centre'[11].

The Ingria business incubator is worth special attention in the structure of St. Petersburg

[11] Available at: https://ingria-park.ru/

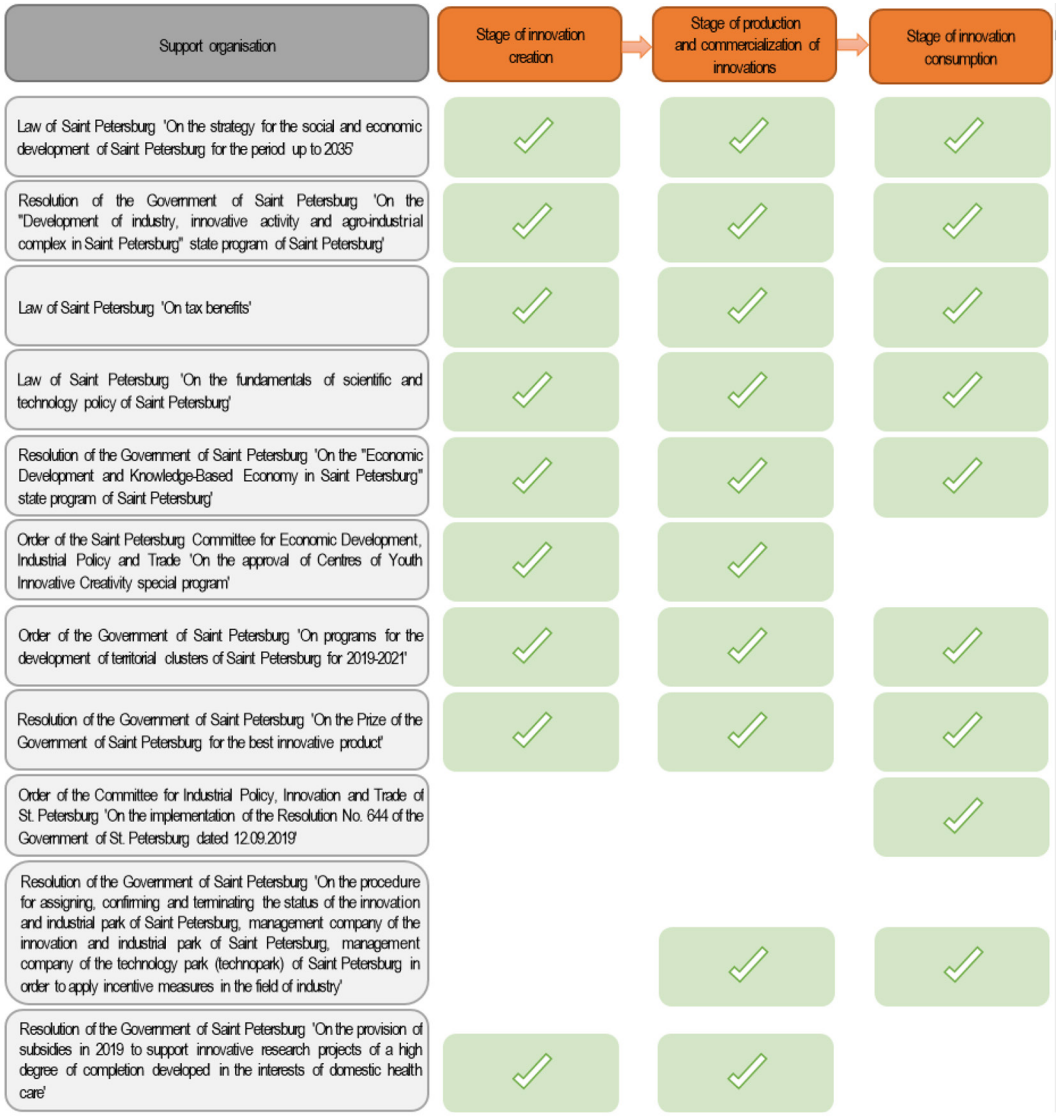

Fig. 5. Classification of regulatory documentation of the Saint Petersburg in the field of research and innovations
Compiled by the authors based on: https://cppi.gov.spb.ru

Technopark. It is a classic business incubator, namely a business incubation organisation that supports the creation and growth of new enterprises with tangible and intangible resources for a flexible period financed by a sponsor and taking rent or, less often, shares from incubated companies (Hausberg, Korreck, 2020). The Ingria business incubator was created in 2008 by the government of Saint Petersburg and the Finnish company Technopolis Ventures, which is the largest company for the development of innovative and highly intelligent business in the Baltic region. The operation of the business incubator is based on the own model of Technopolis Ventures, which has been officially approved for 25 years in Finland, which includes incubation technology from idea up to creation of a ready-made business based on proven principles of providing technology park services. A feature of the model is the provision of services according to the 'advisor' principle; the incubator produces projects or startups helping

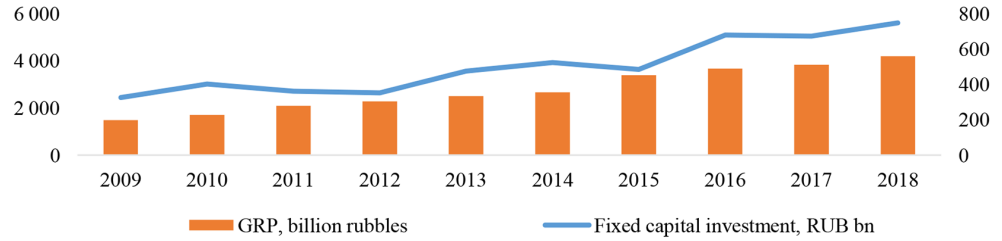

Fig. 6. Dynamics of changes in fixed capital investments and gross regional product of Saint Petersburg
Compiled by the authors based on https://rosstat.gov.ru/

to bring them to venture funds or to enter the market. Services are provided on a 'one-stop-shop' principle and are divided into three types as follows:

- 'green box', that is training;
- 'yellow box', that is consultations, inspection, rent of shared premises;
- 'red box', that is services (Lupanova, 2009).

The Ingria business incubator [12] is the site of the Innovation Promotion Fund, which allows attracting federal funding for the development of residents. It participates in Osiris and Twin campus international programs. This business incubator is one of the most successful Russian practices of support organisations, which is confirmed by the international UBI Global rating of the best business incubators and accelerators, in which it was ranked the 8th[13]. Within 11 years, this support organisation has managed to attract more than 2.9 billion rubbles of investment for more than 500 residents, which, in their turn, received a total revenue of more than 5.6 billion rubbles (Liashenko, 2018).

Both in Saint Petersburg and in Tatarstan, there is a tendency of stable investment growth (see Fig. 6), which indicates the success of the support organisations on the one hand, and favourable conditions in the region for creating businesses on the other hand.

Thus, as factors in the successful functioning of the innovation system of Saint Petersburg and its support organisations for research and innovations, it is possible to define the following: a developed legal framework to support research and innovations, the established top-of-the-line support institution, the functioning of which is based on a successfully tested international model, and a network interaction of regional support organisations with institutions of the federal and international level.

The experience of the Krasnoyarsk Territory is interesting as another successful regional experience in the creation and effective functioning of support organisations for research and innovations. As a regulatory framework for support organisations for research and innovations in the region, there is Law No. 13-6629 of the Krasnoyarsk Territory dated 22.12.2011 'On science, R&D and innovations in the Krasnoyarsk Territory' with a separate section dedicated to the support institutes for research and innovations defining their tasks as follows:

a) creation of a unified system for the use and commercialisation of science, R&D and innovation activities outputs;

b) creating opportunities for joining efforts and resources of subjects of science, R&D and innovations in the development and commercialisation of projects, the introduction of products to the market;

c) increasing the share of innovative products in the total production volume of local manufacturers.

The law also determines the composition of the support organisations for the Krasnoyarsk Territory: business incubators, technology parks, industrial parks, industrial technology parks, engineering centres, funds

[12] Available at: https://ingria-startup.ru/about/

[13] Available at: http://old.economy.gov.ru/minec/about/structure/depino/201814034

for the support of scientific, scientific-technical, innovative activities (Zelenskaia, Sokolova, 2012).

The most interesting example of support organisations for research and innovations in the Krasnoyarsk Territory is Krasnoyarsk Regional Fund of Support for Science and R&D, regional state autonomous institution. The Regional Science Foundation carries out its activities through open competitions, the result of which is financial support for a limited number of research projects. The activities of the Regional Science Foundation include three areas: support for fundamental and exploratory scientific research, support for applied scientific research and support for young scientists, within the framework of which competitions are held for various target audiences. This makes it possible to build a system of support for research and experimental developments, the authors of which are not only eminent scientists but also schoolchildren, students, graduate students, young scientists and professionals[14].

In particular, the experience of supporting fundamental and exploratory (oriented) research through joint regional competitions with the RFBR, funded on a parity basis, seems interesting. The standard model of regional competitions of the RFBR and the entity of the Russian Federation in the Krasnoyarsk Territory is supplemented by the Regional Science Foundation, which performs the functions of a regional operator. The Krasnoyarsk Territory is a preliminary platform for approving new models of competitions held by the RFBR in the regions of the Russian Federation. The competition'r Yenisey Siberia' is one of such preliminary competitions, which is held in order to meet the needs of business for solving R&D tasks. In order to hold it, a special list of interdisciplinary thematic areas was formed compiled jointly by the Government of the Krasnoyarsk Territory, RFBR and industrial partners – organisations participating in the Yenisey Siberia comprehensive investment project. The projects that passed the expert-competitive selection were financed by the RFBR, the Regional Science Foundation and industrial partners in whose interests the project is being implemented on a parity basis (Rumiantsev, Panteleeva, 2018).

This experience is an example of the introduction of the triple helix model into the innovation system and the solution to the problem of forming an experienced customer of research and development in the region

As a successful foreign experience in the functioning of innovation systems and support organisations for research and innovations, let us consider the experience of Jyvaskyla – the region of central Finland. The economic crisis of 2008 was the incentive for changes in the regional innovation policy, after which the following structural changes took place in the Jyvaskyla region: the two largest companies in the region, namely Nokia and Metso Paper, cut production and began to lay off specialists, as a result of which a large number of highly skilled labour was released on the labour market (Oksanen, Hautamäki, 2014).

Anti-crisis measures included assistance in job searching, starting own business, the opportunity to take postgraduate studies or participate in special research programs of the University of Jyvaskyla sponsored by the Finnish Technology and Innovation Funding Agency (Oksanen, Hautamäki, 2014).

The regional authorities have defined new strategic business development goals for central Finland and revised the concept of development for central Finland. As a result, a regional development plan was developed, namely the Regional Strategic Program 2011-2014. In 2009, a new business incubator was created in Jyvaskyla, which contributed to the establishment of new technological startups. The formation of an accessible urban innovation environment based on closed production facilities was the next stage in the formation of an innovative eco-system; its effective implementation served as the successful completion of the creation of an innovation eco-system based at Jyvaskyla (Pitkänen, 2010).

Regional companies, regional and municipal authorities, as well as the national Ministry of Economy, were the main participants and initiators of the above changes. The fact that state

[14] See: Grant Strategy of the Krasnoyarsk Regional Science Foundation for 2019–2021 Available at: http://www.sf-kras.ru/wp-content/uploads/2019/03/Grantovaya-strategiya-Kraevogo-fonda-nauki-na-2019-2021-1.pdf

funding organisations and regional companies were convinced of the need for joint development and overcoming the current unfavourable economic situation was the determinant factor in the success of the late changes. The participants in these transformations within the framework of the above model can be called regional support organisations for research and innovations. As a result of this experience, a systematic model for creating an innovation eco-system was born (Pitkänen, 2010).

The experience of Jyvaskyla is interesting because the university showed a key interest in creating a ring of small innovative companies in the region, which launched a mechanism for network interaction between regional business, the state and the released human capital, which made it possible to solve the problem of an experienced customer in order to commercialise the university developments and the organisation of technology-intensive production, as well as to preserve the image of an innovative region. This experience reflects the effectiveness of the triple helix mechanism of professor Itskowitz.

Let us consider the experience of Dortmund, Germany, as another successful experience in creating support organisations for research and innovations and a successful regional innovation system. Dortmund is located in the federal state of North Rhine-Westphalia in western Germany. In terms of population, this area is the largest in Germany. For over 100 years, the economy of Dortmund has been based on coal mining and steel production. In 1997, the two largest steel-casting companies in Germany, Thyssen and Krupp Hoesch, decided to merge and close their steel production in Dortmund.

It was the time when the concerned parties in Dortmund began to think of the development of an innovative economy in the region. Looking for the innovative ways to restructure the region's economy, the concerned parties such as universities in Dortmund, municipal authorities, the representative office of Chamber of Commerce and financial institutions of Dortmund considered the creation of the Dortmund Technology Centre. As a result of network interaction, the technology centre was created in the form of a joint-stock company, and the above parties became its shareholders. This activated the triple helix mechanism of innovation (Becker, Herrmann, 2014; Popodko, Nagaeva, 2019).

The structure of the Dortmund Technology Centre has become a model for German innovation centres. It was focused on both innovation and technological development and subsidiaries. In other words, it supported the development and application of technology products, as well as helped and encouraged young entrepreneurs who wanted to start their own business. The Technology Centre has become one of the most successful and largest centres in Germany. About 190 residents work in the complex of 10 buildings, and the staff number is more than 1,500 employees. The Dortmund Technology Centre has retained its focus on the main areas of research carried out in Dortmund. Together with the Technology Centre, the Dortmund Technopark was created, which had a common spatial environment with the Technology Centre and the University of Dortmund. The park was intended for companies that start implementing projects at the early stages of the innovation cycle or for residents, graduates of a business incubator based at the Technology Centre. It also specified the possibility of providing services to companies interested in contacts with scientific institutions but not in need of support from the Technology Centre. In 2013, more than 250 companies with more than 8000 employees were residents of the Technology Centre (Becker, Herrmann, 2013).

The results of the activities of the Dortmund Technology Centre are the creation of 16 thousand workspaces throughout Germany, tax payments to the federal states of North Rhine-Westphalia (about 20 million euros per year), 35% of companies create intellectual property, which in 20% of cases is internationally successful, the share of personnel with higher education increased up to 70%. These indicators justify the investment and ideas that were initially enclosed in this innovative project (Gundel, Luttmann, 2008).

The experience of Dortmund can be useful to some domestic regions as a tool for di-

versifying the economy focused on one of the raw material industries, for example, the coal industry like in the case of Dortmund.

Conclusion

Having analysed the successful practices of the functioning of regional support organisations and innovation systems, we can conclude that the success of their functioning is based on the mechanism of network interaction of the entire regional innovation system and mutually beneficial cooperation on the part of regional and federal (national) authorities, large regional business and regional scientific research and educational complex, which fully reflects the regional triple spiral mechanism of innovation. Regional institutions should provide support in the development of innovations at all stages of their life cycle, and the authorised executive body should provide a regulatory framework for the functioning of these institutions and coordination within the regional innovation system. The goal of each support institution for research and innovations should be to prepare its beneficiary for the next support institution in the innovation cycle. Thus, the mechanism of the innovation conveyor is launched in the region. It is worth noting the fundamental difference between domestic and foreign mechanisms in the formation of support organisations for research and innovations. Domestic practice implies the creation of infrastructure and the attraction of personnel to it (formation using infrastructure mechanisms), whilst the foreign approach is to create an infrastructure around the released or newly formed human capital (formation using personnel mechanisms).

The carried out research shows that the problems identified as a result of research of R.M. Nureyev, V.V. Bondarenko, M.A. Fedotova, I.N. Domina, Ye.M. Bukhval'd, V.Yu. Maslikhin and other Russian scientists regarding the functioning of institutions for support and development have not been fully solved even in the most successful regional practices. The Republic of Tatarstan and Saint Petersburg managed to approach the closest solving the problem of insufficient regulatory actions and regulatory support for the functioning of regional support organisations. They have an extensive regulatory component that ensures the functioning of support organisations for research and innovations at all stages of the innovation life cycle. Also, in the above regions, they managed to overcome the problem of the informational closeness of regional institutions quite successfully by publishing information about the activities of such organisations on their official websites, in public reports posted on the portals of regional executive authorities and in strategic documents of the organisations themselves.

Two other problems are as follows: as of today, the lack of a unified scientific and methodological approach of indicators for evaluating the effectiveness of the functioning of regional support organisations to the system and the absence of a unified accounting system of regional support organisations remain unresolved both in the Russian Federation and abroad.

In order to develop the research – and innovation sector in the regions and increase the efficiency of the functioning of support organisations, it is necessary to introduce the triple helix mechanism of innovation in the regions based on the experience of the successful regional practices described above, and the regions with experience in using the triple helix mechanism, in their turn, need to switch to quadruple helix mechanism (in order to prevent stagnation in scientific- and innovative development), in which society becomes a new participant, namely the end consumer in the chain of innovation with its request for knowledge of technology and user functions. The pinpoint successful functioning of regional support organisations for research and innovations is impossible and inappropriate, and the solution to the problems of the absence of a unified scientific and methodological approach to the system of indicators for assessing the effectiveness of the functioning of regional support organisations and the absence of a unified accounting system of regional support organisations is possible by updating and improving the current legislation only at the federal level. The possibility of forming support organisations using personnel mechanisms based on the experience

of western countries is also worth considering. In further research, we plan to develop a methodology for evaluating the effectiveness of the functioning of regional innovation systems based on the synergistic effect of the interaction of its elements.

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Региональные институты поддержки науки и инноваций: механизмы повышения эффективности их функционирования

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Аннотация. В современных исследованиях в сфере менеджмента управление наукой и инновациями является одной из наиболее активно изучаемых областей знания. Статья посвящена обзору действующих практик функционирования институтов поддержки научной, научно-технической и инновационной деятельности в регионах Российской Федерации. Сегодня большая часть денежных средств поступает в экономику развитых стран мира за счет экспорта высокотехнологичных товаров, затраты на научно-исследовательские работы в которых составляют значительную долю в их стоимости, а значит, создание высокотехнологичной продукции прямым образом связано с нормальным функционированием научной и инновационной сферы, что невозможно без грамотно выстроенной системы институтов поддержки научной и инновационной деятельности как на общегосударственном, так и на региональном уровне. Привлечение научного сообщества к инновационным разработкам путем финансовой поддержки ведет к значительному увеличению научного потенциала регионов и государства в целом, что не может не отразиться на экономике самым положительным образом. Государственная поддержка инновационной деятельности — совокупность мер, принимаемых органами государственной власти Российской Федерации и органами государственной власти субъектов Российской Федерации в соответствии с законодательством Российской Федерации и законодательством субъектов Российской Федерации в целях создания необходимых правовых, экономических и организационных условий, а также стимулов для юридических и физических лиц, осуществляющих инновационную деятельность. В соответствии со Стратегией научно-технологического развития Российской Федерации институты поддержки научной, научно-технической и инновационной деятельности являются важным элементом системы науки и инноваций и одним из ключевых элементов национального проекта «Наука», и их эффективная деятельность должна способствовать развитию России и обеспечению способности

страны и ее регионов эффективно отвечать на большие вызовы. В рамках публикации проводится анализ действующих на сегодняшний день и предлагаемых отечественными и зарубежными авторами региональных моделей институтов поддержки научной, научно-технической и инновационной деятельности и оценивается сетевое взаимодействие различных типов региональных институтов поддержки между собой с учетом эффекта синергии. В результате будут определены наиболее эффективные механизмы и практики функционирования институтов поддержки научной, научно-технической и инновационной деятельности на региональном уровне в Российской Федерации и определены цели элементов региональной инфраструктуры институтов поддержки науки и инноваций, ориентированные на потребителя в инновационном цикле. Полученные в исследовании данные будут способствовать формированию эффективной системы функционирования и применению лучших отечественных и зарубежных практик в существующих институтах поддержки научной, научно-технической и инновационной деятельности в будущем.

Ключевые слова: институты поддержки научной, научно-технической и инновационной деятельности, региональные фонды, жизненный цикл инноваций, модель тройной спирали, квалифицированный заказчик, региональная инновационная система, механизмы поддержки.

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