FORMATION OF INNOVATION INFRASTRUCTURE OF THE REGION
BASED ON THE BUSINESS PROCESSES ALLOCATION MATRIX*

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ABSTRACT
The article considers the issues of formation of innovative infrastructure in regions with a high level of
innovative potential of enterprises of the defense industry complex. The authors argue that the
commercialization of the innovative potential of defense enterprises is the most important factor of
innovative development and diversification of the country's economy. The study shows the decisive
role of the innovation infrastructure in solving the problems of commercialization of innovative
potential of defense enterprises. The purpose of the research is to theoretically substantiate and
develop a methodological tool for the formation of a regional innovation infrastructure in the context
of the commercialization of the innovative potential of defense industry enterprises. Methods of
system and comparative analysis, grouping and classification, methods of making managerial
decisions were used in the study. Practice shows that the formation of an innovative infrastructure of
regional innovation systems is fragmentary, and therefore leads to the creation of its individual objects.
It also does not take into account the nature of innovative activity and the tasks of innovative
development of the territory. The article focuses on the analysis of scientific approaches of domestic
and foreign researchers, which concluded that the regional innovation infrastructure should be built
based on the integration of two approaches: cluster and integrated development of the territory. In the
course of the study, factors that take into account the determining role in the creation of a regional
innovation infrastructure and necessitates the development of a new conceptual approach to its
formation are identified. The most important difference of the author's approach is the deviation from
the generally accepted division of the innovation project at the stage and the proposal of its
decomposition into business processes, the effective distribution of which ensures maximum
involvement in the implementation of innovative projects of business entities that form the innovative
infrastructure of the region. Unlike the work of other researchers, the authors consider the innovation
infrastructure of the region as a target component of the national and international innovation
infrastructure, which ensures the creation, financing and commercialization of innovations based on
the achievement of financial stability, commercial and budgetary efficiency of innovation activity
subjects. The developed methodical toolkit allows to distribute business processes that are ineffective
for enterprises of the defense industry complex among subjects of innovation activity, and to
determine the architecture of the innovation infrastructure of the region. The methodological toolkit is
of particular interest for government bodies involved in the formation, functioning and development of
innovation infrastructure in regions with a high level of innovative potential of enterprises of the
defense industry complex.

Keywords: defense-industrial complex, innovative potential, commercialization, innovative
infrastructure, business processes.

INTRODUCTION
Nowadays, the main direction of the development of the Russian economy is the diversification of its
industries and the transition from traditional raw materials growth factors to an innovative
development model.

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In addition, the global economic crisis of 2008-2009 and economic sanctions against Russia require the acceleration of its transition to an innovative development path, contributing to the stability and efficiency of the country's economy.

The most important direction in solving the problem of innovative development of the country is the commercialization of the innovative potential of high-tech industries, including the defense industry complex. Along with this, the commercialization of the accumulated innovative potential of defense industry enterprises can become the basis for its reproduction in order to ensure the country's defense capability, the stability and strategic competitiveness of defense enterprises and the development of the economies of the regions where such enterprises are located.

The involvement of defense industry enterprises in the process of commercialization contributes to the formation of an additional internal source of development in the form of own extrabudgetary funds derived from the use of the established scientific and technical potential for the production of high-tech civilian products.

At the same time, the Government of the Russian Federation has established a planned share of high-tech civilian and dual-use products in the defense industry, which by 2030 should be at least 50%. This determines the need for reorientation of defense industries to produce high-tech civilian products. Despite the fact that the share of civilian products at defense industry enterprises increases annually (in 2016 it was about 16%), the share of high-tech civilian products remains very low.

Thus, the main tasks of innovation development of the defense industry are:
1. Ensuring the country's defense capability, that is, timely and high-quality execution of the state defense order;
2. Orientation of the defense industry enterprises to the production of modern competitive civilian products for high-tech industries;
3. Increase in the share of high-tech civilian and dual-use products manufactured by defense industry enterprises: by 2020 - no less than 17%, by 2025 - no less than 30%, by 2030 - no less than 50%.

As a rule, defense industry enterprises do not have practical experience in the markets of high-tech civilian products. As a result, there are no management mechanisms related to the commercialization of their innovative potential.

The solution of such tasks requires state support. To this end, the Ministry of Industry and Trade has developed a roadmap that provides the formation of infrastructure, the study of markets where high-tech civilian products may be in demand, as well as measures to stimulate demand and promote these products.

However, in the absence of experience in the markets of high-tech products and mechanisms related to the commercialization of their innovative potential, the innovative infrastructure is the only factor ensuring innovative development of the country based on commercialization of the innovative potential of the defense-industrial complex.

Taking into account that the regions are primarily interested in developing the regional economy based on commercialization of the innovative potential of the defense industry enterprises located on their territory, the regions should become the center of the country's innovative development and solve the problems of the formation of a regional innovation infrastructure.

In this regard, the role of regional innovation infrastructure objects that create conditions for the effective implementation of innovative projects in the region based on the commercialization of the innovative potential of enterprises of the military-industrial complex is significantly increasing in the solution of problems of innovation development [1].

**The research method.** Qualitative methods of analysis were used in the article because of the lack of necessary statistical information, the complexity of the quantitative measurement and the nature of the relationships between the subjects of the processes.

The article analyzes modern approaches to the formation of the innovation infrastructure of the
regions, identifies the factors that determine the conditions for the effective operation of regional innovation infrastructure facilities.

The need to take into account the factors that determine the conditions for the effective implementation of innovative activities in the region justifies the need to develop a new conceptual approach to the formation of a regional innovation infrastructure in the context of commercializing the innovative potential of defense enterprises.

To implement the proposed conceptual approach, the authors developed a methodological toolkit that includes business processes allocation matrix of innovative projects of the region on objects of innovative infrastructure and a methodology for the formation of an innovation infrastructure in the region.

Main results of the study.
1. Modern approaches to the formation of innovative infrastructure in the regions. Analysis of the current state of innovation infrastructure in the most successful regions has made it possible to determine the following approaches to its formation:
   1. The approach based on the construction of technopark structures;
   2. The approach based on network forms of business interaction, including territorial innovation clusters;
   3. The approach based on integrated development of the territory.

   The first approach involves the formation of an innovation environment of the region based on the integration of science and production to create, develop and commercialize scientific knowledge and development [2]. Thus, this approach ensures the development of the region's economy and provides creating an innovative infrastructure of the region based on technopark structures (technopolis, technology parks, business incubators, technology transfer centers, etc.).

   Formation of the innovation infrastructure of the region based on technopark structures is considered in the works of Ulanova J. Yu. [12], Stroyeva O. A. [11] and others.

   Organization-economic model of the innovation infrastructure of the Russian Federation, proposed by Ulanova J. Yu., provides for the construction of three models of innovation centers: national technology parks, regional innovation centers and high technology territories [12].

   Stroyeva O. A. proposed to develop the innovative infrastructure of the region based on creating conditions for the effective functioning of the regional scientific and technological park of the Oryol region [11].

   The second approach to the formation of innovative infrastructure at the regional level is usually built on the cluster theory of Porter M. [21-23], increasing the competitiveness of the region. According to Porter's theory, the cluster is the geographic concentration of interrelated, simultaneously cooperating and competing organizations of certain spheres of activity [19; 20].

   Subsequently, the cluster was considered an important component of the regional innovation system [15; 16]. It was also called “the interaction effect of a functioning innovation system” [24, p. 183]. The cluster approach has become widespread in domestic practice and abroad. It is one of the effective tools for innovative development of regions on the basis of innovations as a source of economic growth [6; 13].

   The construction of innovative infrastructure based on the cluster model is actively applied in the sphere of high technologies of foreign countries, such as USA, Japan, Germany, Great Britain, Germany, and Finland. For example: a technological cluster in Kreminova Valley (USA), a cluster of information and telecommunication technologies Nokia (Finland) [14, p. 185], a cluster of information and communication technologies in New Delhi (India), a high-tech cluster of Cambridge (Great Britain) [18, p. 29] and others.

   The following clusters are functioning in the high-tech sector of Russia: the Sarov Innovation Cluster, the Samara Aerospace Cluster, the innovative territorial rocket engine cluster “Technopolis New Star”,

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the cluster of information technologies (IT), the cluster “Space Technologies and Telecommunications” (Skolkovo).

Some researchers consider the cluster as a form of network interorganizational interaction [14]. In this connection, the cluster approach is based on the principle of network interaction between cluster participants, in which a core competency center is formed, as well as partnership relations, which is an important factor in the economic growth of regions [17].

One of the classic examples of implementing the cluster approach of innovative development of regions is the American Silicon (Silicon) valley, the formation of which was based on the concentration of interrelated organizations, companies and institutions related to a particular industry [5, p. 40].

Later, in the process of functioning of the Silicon Valley, new branches not related to the initial branches of the cluster were emerging in it. This is due to the fact that, he basic branches of the cluster allowed to create new industries based on access to available resources, and to form new interactions, which led to the creation of a mechanism for spreading the innovation process on a global scale [5, p. 43] through an open system of network interaction between the participants.

The use of intracluster competitive advantages for the export of technologies contributes to the integration of large business in the world innovation networks, and also gives the most important advantages in modern conditions to the cluster form of network interaction.

The flexibility of innovative clusters as network structures provides an effective transfer of innovation to competitive advantage [6].

Smorodinskaya N.V. believes that the main condition for modern innovation development of the regions is the creation of an enabling environment for the organization of partnership based on the cluster-network interaction model [10, p. 77].

Evseev O.S., Konovalov M.E. propose to implement the formation of elements of innovation infrastructure in the region, which integrates and ensures interaction, and also provide support to all its participants at the stages of the innovation process [3, p. 221-224]. Panteleev A.M. offers to develop a functioning innovation infrastructure based on activation of system-forming links between the elements of an innovation infrastructure already established in the region [8, p. 14].

Thus, the cluster approach provides the formation of innovative infrastructure in the region based on innovative clusters. Partnerships, a key competence center and an open network of participants' interaction are formed in innovative clusters. The system of network interaction creates conditions for the integration of business into national and world innovative networks, as well as innovative development of the territory.

The third approach envisages a comprehensive development of the territory on the basis of high concentration in the regions of intellectual and innovative potentials by creating territories for integrated and advanced development.

Such territories contribute to the accelerated growth of the region on an innovative basis, ensure the economic coherence of territories and the integrated development of infrastructure. Relying on regional objects of innovation infrastructure, development territories can be considered as centers of high technologies [9, p.103].

The source of this approach in the national practice of innovative development of the regions is the positive experience of major global agglomerations: Tokyo-Yokohama (Japan), Jakarta (Indonesia), Delhi (India), Manila (Philippines), Seoul-Incheon (ROK), etc. [7, p. 59].

Practice shows that the formation of innovative regional infrastructure in the majority is the borrowing of positive foreign or domestic experience of innovatively developed regions. It does not take into account the nature of regional innovation activity, as well as the tasks of innovative development of specific regions. In addition, the innovation infrastructure of regional innovation systems is often
fragmentary, and the increase in the efficiency of its functioning is limited to the creation of separate objects of the innovation infrastructure that provide solving specific tasks.

It should be noted that the innovation infrastructure is often considered apart from the investment-financial and market infrastructure. The innovative infrastructure does not take into account the composition of innovative projects implemented in the territory, the innovative potential of the territory and the possibilities for its commercialization, as well as the potential of innovative enterprises that take part in the implementation of innovative projects in the region. In addition, the innovative infrastructure does not solve the task of promoting and supporting regional innovative projects. It is not considered as a component of the national and international innovation infrastructure.

The analysis of the experience of development of the innovation infrastructure of the regions made it possible to identify the main factors that determine the conditions for the effective implementation of innovative projects in the region, and, consequently, the efficiency of the functioning of the objects of the innovation infrastructure. These are factors such as the composition and features of innovative projects being implemented on the territory; economic efficiency of the implementation of innovative projects; innovative potential of the region's enterprises; purpose of innovative products; the objects of innovation infrastructure functioning in the region and their functional capabilities.

Thus, the authors believe that the formation and development of the regional innovation infrastructure should be aimed at meeting the needs of the territory in the functions of the existing and newly created regional facilities of the innovation infrastructure. The innovative infrastructure facilities are necessary for the successful implementation of innovative activities in the region. This will ensure budgetary and commercial efficiency of the functioning of innovative infrastructure facilities.

The authors of the article proposed a conceptual approach [4] to the formation of regional innovation infrastructure, developing the basic provisions of the cluster approach and the approach based on the integrated development of territories.

The most important difference of the author's approach to the formation of innovative infrastructure in the region is the deviation from the generally accepted division of the innovation project at the stage of its implementation and the proposal to decompose the innovative project into simple business processes. This approach would allow using the economic and innovative potential available in the region, as well as take into account the conditions for the implementation of business processes of innovative projects of the territory.

The proposed decomposition of innovative projects into business processes will also ensure maximum involvement in their implementation of business entities that form the innovation infrastructure of the region. At the same time, according to the authors, the possibility of including innovative infrastructure facilities in the process of implementation of innovative projects should be taken into account. This indicates the need to integrate regional innovation infrastructure into national and international innovation infrastructure.

In this regard, the innovation infrastructure of the region is seen as a target component of the national and international innovation infrastructure, built based on the decomposition of business processes of innovative projects, taking into account the network nature of the interaction of participants in the innovation process. The innovative infrastructure of the region provides the creation, financing and commercialization of innovations based on the achievement of commercial, budgetary efficiency and financial sustainability of subjects of innovation activity of the territory by involving the objects of national and international innovation infrastructure in the implementation of business processes of innovation projects in the region.

The necessity of decomposition of innovative projects into business processes is also caused by the need to take into account the specifics of the activities of defense enterprises related to the impossibility of implementing certain business processes within enterprises, since the main task of enterprises is the implementation of the state defense order. The proposed decomposition makes it possible to identify business processes that are ineffective for enterprises in the defense-industrial complex in order to transfer these business processes to other subjects of innovation activity.
Another feature of the use of defense enterprises’ potential is the lack of need and experience of these enterprises with the objects of market and investment and financial infrastructure. This causes the decomposition of innovative projects into business processes.

Thus, the proposed decomposition of innovative projects will provide the transfer of business processes to other subjects of innovation that have the appropriate competencies for their implementation. The most important condition for an efficient transfer of dedicated business processes, according to the authors, is to achieve a payback period for all participants in the implementation of the transferred business processes, which is achieved through the formation of order portfolios consisting of business processes of all the many innovative projects implemented in the territory. If this condition is not observed, business entities located in other regions of the country and the world can become participants in the implementation of business processes.

2. Matrix "RBPIP" as the instrument of architecture formation of the region's innovation infrastructure.

The most important methodological instrument for implementing the proposed conceptual approach is the matrix developed by the authors for the allocation of business processes for innovation projects on innovation infrastructure facilities. The allocation matrix of business processes of innovative projects (RBPIP) is the result of innovation projects decomposition into business processes and their distribution between objects of innovation, market, investment and financial infrastructure, as well as other business entities participating in the implementation of innovative projects in the region and forming its innovative infrastructure [1, p. 3].

The “RBPIP” matrix allows identifying the objects of the innovation infrastructure that can perform the functions of implementing innovative projects that are ineffective for the innovative enterprise of business processes. At the same time, the matrix includes existing and potential objects of innovation infrastructure, including objects of national and international innovation infrastructure that can effectively function and ensure the implementation of innovative projects.

The matrix “RBPIP” is schematically represented in Figure 1.

The use of the matrix “RBPIP” as a tool for the formation of an innovative infrastructure allows solving three main tasks:

1. Formation of network interaction of objects of innovative infrastructure;
2. Definition of objects of innovative infrastructure, which should implement the business processes of innovation projects in the region;
3. Definition of the aggregate of business processes to be implemented by the objects of the innovation infrastructure, forming the portfolios of their orders.

The first task is achieved within the framework of the implementation of a separate innovation project. The solution of the remaining tasks is carried out when considering all potential innovative projects that are implemented and are expected to be implemented on the territory.

The building of the matrix “RBPIP” allows creating a single network of interdependent objects, forming their network interaction. The composition of participants in the implementation of business processes of a certain innovation project, revealed during the use of the matrix, does not give an idea of the innovative infrastructure of the whole region. In this case, the matrix allows you to determine the requirements for the composition of innovative infrastructure facilities that are necessary for the implementation of a separate innovation project.

The “RBPIP” matrix, implementing the whole set of innovation projects in the region, allows defining the set of business processes of innovation projects and forming a portfolio of orders for each object of innovation infrastructure. In this case, the matrix enables to determine the aggregate requirements for the formation of a regional innovation infrastructure, which is necessary for the implementation of innovative projects in the region, forming its architecture. A set of business processes is formed for all innovative projects implemented on the territory that are assigned to the objects of the innovation infrastructure during the use of the RBPIP matrix. This makes it possible to assess the commercial viability of innovative infrastructure facilities that implement order portfolios, determine the objects that should be formed at the regional level, and the business processes that will be transferred beyond...
it to the objects of the innovation infrastructure of the national and international level.

3. Methods of formation of innovative infrastructure in the region. The authors developed a methodology for the formation of an innovation infrastructure in the region, taking into account the results of the distribution of business processes between potential participants in their implementation, obtained with the use of the RBPIP matrix. This methodology was made to solve the problem of determining the composition of potential participants in the implementation of business processes of innovative projects in the region and forming portfolios of their orders.

Within the framework of the methodology, the criteria for selecting the objects of the innovation infrastructure necessary for the implementation of the business process portfolios of the region's innovation projects are proposed. It also monitors compliance with the terms of recoupment of costs, budgetary and commercial efficiency of the implementation of business process portfolios with objects of innovation infrastructure.

Stages of the proposed methodology are shown in Figure 2.

Figure 1 - Matrix “RBPIP” (developed by the authors):
BP1...n – business processes of an innovative project implemented in the region; 1 - implementation of the business process; 0 - non-implementation of business process.
At the first stage, the set of innovative projects proposed for implementation included in the innovative development programs of the region is determined. Then, each innovation project is decomposed into...
business processes with their subsequent distribution between the innovative enterprise and the objects of the innovation infrastructure of the region based on the matrix “RBPIP” considered above.

Then a set of potential innovative infrastructure objects that can implement a specific business process is formed, based on the results of assessing the magnitude of their economic potential. The object of the innovation infrastructure that can implement the analyzed business process with minimal costs is selected from the formed set of participants. As a result of this assessment, business process portfolios are formed for each participant of innovation activity.

The decision to consolidate the portfolio of business processes for a particular participant is made subject to its compliance with the criterion of the recoupment of the costs of implementing the portfolio of business processes based on the break-even level calculation and the financial strength margin. The calculation of the break-even level ensures commercial efficiency of the portfolio of business processes. The stock of financial strength compensates for the risks of fulfilling financial obligations in the implementation of business process portfolios and ensures the financial stability of the objects of the innovation infrastructure.

If the implementation of the business process portfolio does not ensure a cost recovery, the participant will be provided with government incentives. It will be followed by an assessment of the budgetary and commercial efficiency of the portfolio of business processes.

If the efficiency conditions are met, the business process portfolio will be assigned to the object of the innovation infrastructure, and the object will be included in the innovation infrastructure of the region. If the achieved economic potential of participants in the implementation of the business process is not enough, a set of undistributed business processes will be formed with the subsequent formation of portfolios of technologically homogeneous business processes. The implementation of such portfolios requires expanding the scope of the existing infrastructure in the region or creating new objects with the necessary economic potential.

Further, an assessment of the economic efficiency of investment costs to create new or expand functions of existing objects of the region's innovation infrastructure is conducted. If investment costs at the stage of creating objects of innovation infrastructure do not pay off, these facilities will also be provided with state incentives, followed by an assessment of the budgetary efficiency of implementing portfolios of technologically homogeneous business processes. If the budgetary efficiency of investment costs meets the criteria, creation of new facilities will be appropriate and they will be included in the innovation infrastructure of the region.

Otherwise, functions for the implementation of portfolios of technologically homogeneous business processes are transferred to innovative infrastructure facilities located outside the region. This ensures the consolidation of business processes to objects of innovation infrastructure that are located outside the region. This process is one of the forms of integration of the national, international innovation infrastructure, which is aimed at increasing the efficiency of the implementation of innovative projects of the territory. The presence of this interaction allows to consider the regional innovation infrastructure as a target component of the national, international innovation infrastructure.

The proposed methodology for the formation of the region's innovation infrastructure, including the matrix of business process distribution, allows performing the following actions:

• To assess the availability of resources necessary for the implementation of business processes of innovative objects in the region;
• To assess the economic feasibility of current and investment sales in or outside the region;
• To determine the composition of costs for the implementation of business processes;
• To evaluate the effectiveness of the functioning of objects of innovation infrastructure and to determine the amount of their financing.

Discussion and analysis of the results. The subject of discussion is the category of “commercialization of innovative potential” of defense enterprises. At the same time, it is identified with the notion of the commercialization of innovations. In the opinion of the authors, the introduction of this category is considered justified, in connection with the fact that not only the commercialization
of innovations but also all or some of the elements of innovative potential created within the framework of the state defense order by the defense industry enterprises are being considered.

The analysis of the results allowed to draw the following conclusions. Modern experience in the formation and development of innovative infrastructure indicates the underdevelopment of market and financial infrastructure in the regions and at the federal level. The underdevelopment of such facilities significantly reduces the economic potential of innovative enterprises, thus such facilities do not attract financial resources and do not ensure the implementation of innovative products on the market. In such conditions, innovation infrastructure, according to the authors, should reflect the territorial location of the markets for innovative products, which, of course, transcends the boundaries of the region, but, simultaneously, contributes to solving the tasks of developing innovative activities of the territory.

The authors think that the proposed conceptual approach and the developed methodological toolkit meet the basic principle of the formation of the innovation infrastructure of the regions, the principle of integrating the regional innovation infrastructure into the market, investment, and financial infrastructure, as well as into the national and international innovation infrastructure. Such integration provides attraction of additional financing for the implementation of innovative projects, the formation of demand for innovative products, including high-tech products for civilian use, and improving the efficiency of implementing the final stages of innovative projects.

Formation of the region's innovative infrastructure by the proposed methodical tool provides for the creation of markets for the sale of innovative products. As a result, the objects of innovation infrastructure that perform the functions of promoting innovations to the market and attracting sources of financing will be created. Particular attention should be paid to the choice of forms and the development of mechanisms for the formation of network interaction between the objects of innovation infrastructure and other subjects of innovation in the process of implementing innovative projects in the region.

Thus, the proposed instruments make it possible to formulate a regional innovative infrastructure adequate to the tasks of innovative development and diversification of the country's economy, taking into account the composition and features of the implementation of innovative projects of the territory, in particular projects for commercializing the innovative potential of defense enterprises. In addition, the proposed tools identify the need to ensure the network interaction of objects of innovation infrastructure in the implementation of individual innovation projects. It can be concluded that these tools can be used to develop the economies of regions that have a significant innovative potential of defense industry enterprises.

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