

SERVICE COMPONENT OF INNOVATION INFRASTRUCTURE IMPACT ASSESSMENT: A REGIONAL EXAMPLE

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Abstract. Changes in the world economy and the crisis of 2020 have aggravated the problem of structural stability of the economy and economic security. Under these conditions, the demand for services in the creative economy will grow dynamically, as the most valuable goods are ideas, imagination and creativity. The *aim* of the article is to consider the impact of the service component on innovative development at the regional level. *Methodology.* For the purposes of the study, the main types of services provided by the most common institutional forms of innovation infrastructure are summarized. Classification by the criterion of the type of services is useful for monitoring the provision of the innovation system with different elements of innovation infrastructure. Services are considered in the applied context of assessing the effectiveness of innovation policy at the regional level. On the basis of analysis of world practice of innovation policy the spheres of financial and economic stimulation of innovation activity within which the corresponding service component can be considered are determined. *Results.* Within the framework of alternative approaches to neoclassical economics, based on evolutionary economics and Schumpeterian economics, the authors argue for services as an important component of a proactive industrial policy that can address these failures and is based on the institution of mentoring, small business service provision, development of technology parks and much more. The main types of services provided by the most common institutional forms of innovation infrastructure are summarized. Classification of services is based on the criterion of the type of services, useful for monitoring the provision of the innovation system with various elements of innovation infrastructure. Services were considered in the applied context of assessing the effectiveness of innovation policy at the regional level. *Practical implications.* On the basis of analysis of the world practice of innovation policy the spheres of financial and economic stimulation of innovation activity, within which the corresponding service component was considered, were determined. *Value/originality.* Longitudinal data and relevant calculations provide a better understanding of the impact of innovation infrastructure services on the main economic indicators of regional development.

Key words: innovation development, technology transfer, services, impact, regional economy.

JEL Classification: L84, O32, R11

1. Introduction

Changes in the world economy and the crisis of 2020–2021 have aggravated the problem of structural stability of the economy and economic security. Under these conditions, the demand for services in the creative economy will grow dynamically, as the most valuable goods are ideas, imagination and creativity. On the other hand, service development strategies raise the issues of building partnerships, in particular by involving customers in the processes of service design and digital transformation of business processes.

At the same time, these trends require the development of new approaches to the management of business models in the service sector.

According to experts, one of the main reasons for the lack of success of innovative projects and the small number of such projects is the lack of quality management at all levels of the project development chain, as well as the lack of a systematic view of the project initiators to have a clear idea of the project development strategy.

The state and development of business management in the service sector largely determines the

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effectiveness of innovative development of the economy, as the functioning of this sphere creates conditions for freeing up time and contributes to high labor productivity. The increasing role and influence of services on the economy necessitates the search and implementation of ways to improve the efficiency of business models.

It is important to consider services in the applied context of national innovation policy. Developed and developing countries use different methods of state stimulation of innovation in the entrepreneurial sector. The most common are state programs to support innovation within state priorities, legislative, financial and tax tools at the state and regional levels to promote innovation in all areas of business. Based on the analysis of world practice of innovation policy and national specifics, it is possible to identify areas of financial and economic stimulation of innovation, within which we can consider the appropriate service component.

2. Literature review

In alternative approaches to neoclassical economics, based on evolutionary economics and Schumpeterian economics, there is a need to consider systemic failures rather than market failures. Services are an important component of a proactive industrial policy that can address these failures and is based on the institution of mentoring, small business services, the development of technology parks, and more.

Based on these theories, services in the innovation sphere can be defined as a component of the innovation infrastructure, including special organizational structures (subjects and objects) designed to ensure more effective use of resources aimed at innovation, to promote the integration of science and production, the formation and development of innovative economic entities, establishing cooperation between them, their implementation of innovative projects by providing logistical, financial, informational, expert and consulting, organizational, and staffing support (Mukhamedyarov, Divaeva, Khabibrakhmanova, 2013).

In the knowledge economy, service becomes a critical component (Kniazevych, 2014). In this case, service is defined as the process of transferring intangible resources (service distribution) for their practical use in innovative activities. Such peculiarities of development of innovation economy, first of all, concern its infrastructural component as the sphere of provision of intangible resources for implementation of innovation projects through service and provision of knowledge-intensive services. Service is closely related to complexity, which is manifested in the activities of the subjects of the innovation process through the

dissemination of service offerings at all stages of the innovation process.

It is important that in the last decade, due to the introduction of new information technologies, the boundaries between the services of different economic agents are noticeably blurred (Dvorkina, 2001). This is especially true for information and analytical services, which are characterized by the intersection of services (one of the reasons for mutual interest and integration trends in the information environment) and the ability to provide users with access to documents, information, knowledge, and thereby meet information needs (B2B, G2B, B2C).

Thus, in the sphere of services it is possible to note existence of double connection: innovations in the sphere of services are effective means of overcoming crises, promotion of competitive products and development of high-tech services, and services are the factor of creation of innovations.

A similar approach was used in research (Kokurin, Nazin, 2011), in which the elements of infrastructure based on the sphere of the external environment, aimed at ensuring innovation, were grouped. In accordance with this logic, the following groups of innovation infrastructure were identified: transport and communication; information and telecommunications; credit and financial sphere; stock market; intermediary institution; enterprises and firms providing special services.

In the context of the growing role of the service component of most business processes in the innovation sphere (Colman, Bing Ang, 2016; Klimenko, 2020; Saxena, 2021), the strategic aspects of developing strategies in the context of regional smart specialization (Omelyanenko, Prokopenko, Omelyanenko, 2021) and digitalization (Omelyanenko et al, 2021; Omelyanenko V., Omelianenko O., 2021; Robul et al, 2020) are an urgent problem.

The study is devoted to determining the impact of the service component of the innovative development at the regional level.

3. Methodology

For the purposes of the study, the main types of services provided by the most common institutional forms of innovation infrastructure are summarized. Classification by the criterion of the type of services is useful for monitoring the provision of the innovation system with different elements of innovation infrastructure. Services are considered in the applied context of assessing the effectiveness of innovation policy at the regional level. On the basis of analysis of world practice of innovation policy the spheres of financial and economic stimulation of innovation activity within which the corresponding service component can be considered are determined. A set

of research methods was used to achieve the goal and solve the set tasks:

- theoretical: analysis and systematization of scientific sources in order to identify the state of development of the problem of the impact of services on innovation development;
- structural and logical analysis – to determine the components, criteria and performance indicators of service provision;
- comparison – to characterize the different options for building business models in the service sector;
- generalization – to justify the impact of strategic vectors of transformation of the service sector on innovation development.
- statistical: methods of descriptive statistics, correlation methods – for expert assessment of the impact of the service component of innovation policy on key indicators of the development of the region's economy;
- system analysis, modern management theory – to study the components of the impact of the service component of innovation policy.

4. Results and discussion

Subjects of innovative development services

Based on the study (Maslova, 2017), the main types of services provided by the most common institutional forms of innovation infrastructure are summarized.

Technology platform is a communication tool aimed at enhancing efforts to create promising commercial technologies, new products or services, attracting additional resources for research and development based on the participation of all stakeholders (business, science, government, society), improving the regulatory framework in the field of innovative development.

Engineering Center provides engineering consulting services of research, design, calculation and analytical nature; provides feasibility studies of projects, recommendations in the field of production organization and management of industrial, infrastructure and other facilities.

Innovation and technology centers are created to facilitate the development of small and medium-sized knowledge-intensive businesses, to implement the results of intellectual activities of educational institutions and research organizations. The centers contribute to the realization of their innovation potential by providing a full range of infrastructure services and contributing to the formation of synergies between the participants. The centers provide small innovative enterprises and firms with laboratory and production space, research and development equipment, office, demonstration and conference rooms, as well as legal, financial, engineering, marketing and other services.

Certification centers act as performers in the field of certification services. They carry out comprehensive

certification procedures, from the collection and preparation of the necessary package of documents to product testing and documentation of compliance.

Cluster development centers are specialized organizations created by regional executive authorities to implement the cluster policy in the region. The purpose of cluster development centers is to create conditions for the development of territorial clusters, to facilitate the coordination of projects of the participants of territorial clusters, and to increase the competitiveness of small and medium-sized enterprises. Thus, the centers act as a link between various subjects of innovative activity.

Innovative territorial cluster is an association of enterprises, equipment suppliers, specialized production and service services, research and educational organizations connected by relations of territorial proximity and functional dependence in the production and sale of goods and services.

Classification of services focused on innovative development

Classification by the criterion of the type of services is useful for monitoring the provision of the innovation system with different elements of innovation infrastructure. The analysis showed that this logic of classification is quite common in research, and it is also the main in the official interpretation of this term. In this case, the following groups are distinguished:

- production and technological;
- expert consulting;
- financial;
- informational;
- personnel;
- sales.

An important point when grouping services by type of service is the composition of the elements of each group. There are no generally accepted approaches, especially with regard to financial and industrial-technological groups. Factors in choosing the composition of elements should be the type of services and their specificity, due to the purpose of creating such an element. Based on the highlighted essential characteristics of innovation infrastructure, the production and technological group includes centers of collective use of scientific or high-tech equipment and technopark structures (science parks, science and technology parks, technology parks, high-tech parks, innovation technology centers, innovation business incubators, etc.).

Based on certain essential characteristics and expected results of functioning of innovative infrastructure, its formation, necessary for the development of innovative entrepreneurship, should be based on the following principles:

1. Balanced construction of the system in the areas of support, as the absence of a certain element to provide

a certain type of service or its presence in the amount not consistent with other elements, will slow down the development of the entire system. For example, the insufficient development of the financial component of the innovation infrastructure can lead to a lack of financing of innovative projects, and thus inhibit the creation of innovative entrepreneurial structures in technology parks, innovative business incubators, or, conversely, the insufficient development of technology parks. There is a situation of lack of innovative projects that require funding.

2. The balance of building a system of services at all stages of innovative entrepreneurship: research, scientific production, production and sale of innovative products within the provided type of services.

3. Formation of elements of innovation infrastructure, taking into account the existing innovation and economic potential of the territory and the priorities of socio-economic development.

4. The presence of a project to create an element of innovation infrastructure with clearly defined indicators of development over time (necessary to monitor the development and evaluation of effectiveness).

Within these principles, there is a clear correspondence with the strategic vectors, in particular sustainability and cooperation. From the perspective of the strategic vector "product as a service", it is advisable to consider more in-depth scientific and methodological approaches to the classification of services in the context of innovation and technological development. The classification of industrial services is based on two criteria – the stage of the life cycle of industrial products and the functional purpose of industrial services, which allows us to systematize the diversity of these services as follows:

- services for the development and implementation of industrial products in production (R&D, industrial design, engineering, etc.);
- ancillary production services (services for adjustment, maintenance, repair of production equipment, etc.);
- supply and marketing services (purchasing, warehousing, transport, sales logistics, etc.);
- service services (warranty repair, service of sold products);
- administrative services (marketing, management, personnel services, etc.).

Descriptive statistics

Development of the service sector of innovation infrastructure occurs in relationship with the real sector of the economy, affecting the increase in the index of industrial production, labor productivity, increasing the level of innovation activity, which ultimately leads to GDP growth, but it can occur asynchronously. In this connection, the impulse (initial) and lagging (resulting) variables based on the action of multiplicative effects were determined by mathematical modeling (Table 1).

For the first set "Index of physical volume of innovation infrastructure services – GRP" the greatest cross-correlation dependence is observed at time lag 2 with a tendency of increasing dependence and synchronous changes in both indicators.

In the second set "Index of physical volume of innovative infrastructure services – Index of labor productivity" the highest cross-correlation dependence is also observed at time lag 2. For the third set "Index of physical volume of innovative infrastructure services – Index of industrial production" the largest cross-correlation dependence is observed at time lag 2.

For the fourth set "Index of physical volume of innovation infrastructure services – Index of innovation activity" and the fifth set "Index of physical volume of innovation infrastructure services – Index of volume of state grant financing of research and development" the highest cross-correlation dependence is observed at time lag 1.

According to the sixth "Index of physical volume of innovation infrastructure services – Index of human capital in research and development" and the seventh set "Index of physical volume of innovation infrastructure services – Index of regional competitiveness", the highest cross-correlation dependence is observed at time lag 2.

For the eighth set "Index of physical volume of innovation infrastructure services – Index of production of innovation products" the highest cross-correlation dependence is observed at the time lag of 0. For the ninth set "Index of physical volume of innovation infrastructure services – Export activity index" the largest cross-correlation dependence is observed at time lag 2.

All values of cross-correlation coefficients are statistically significant (p-value less than 0.05). The analysis of the obtained results shows that the influence of the innovation infrastructure factor is most noticeable in the short term in the immediate sphere of innovation activity. At the same time, in the longer term, the importance of innovative services is also evident in the main macro indicators of regional development.

Thus, the development of the service sector of innovation infrastructure is an effective multiplier for the transition to a new stage of development of the entire regional macroeconomic system, ensuring the balance in the sphere of production, services, innovation infrastructure and innovation.

To determine the contribution of industrial services in the development of production, the production function model was used to reveal the relationship between the resulting parameter – value added growth, and the factors affecting it from the perspective of the innovation infrastructure services sector – the increase in the share of services provided by the innovation infrastructure and the labor productivity index.

Table 1

Sets of pulse and lag variables

| Nº of set of variables | Impulse variable | Lagging variable | Time lag (in years) | Cross-correlation coefficient | Time lag (in years) | Cross-correlation coefficient | Time lag (in years) | Cross-correlation coefficient |
|------------------------|--|---|---------------------|-------------------------------|---------------------|-------------------------------|---------------------|-------------------------------|
| 1 | Index of physical volume of innovative infrastructure services | GRP | 0 | 0,511 | 1 | 0,780 | 2 | 0,891 |
| 2 | Index of physical volume of innovative infrastructure services | Labor productivity index | 0 | 0,311 | 1 | 0,557 | 2 | 0,689 |
| 3 | Index of physical volume of innovative infrastructure services | Industrial production index | 0 | 0,278 | 1 | 0,444 | 2 | 0,486 |
| 4 | Index of physical volume of innovative infrastructure services | Index of innovation activity | 0 | 0,370 | 1 | 0,525 | 2 | 0,491 |
| 5 | Index of physical volume of innovative infrastructure services | Index of the volume of state grant funding for research and development | 0 | 0,401 | 1 | 0,587 | 2 | 0,498 |
| 6 | Index of physical volume of innovative infrastructure services | Research and Development Human Capital Index | 0 | 0,291 | 1 | 0,523 | 2 | 0,835 |
| 7 | Index of physical volume of innovative infrastructure services | Region Competitiveness Index | 0 | 0,390 | 1 | 0,681 | 2 | 0,719 |
| 8 | Index of physical volume of innovation infrastructure services | Index of production of innovative products | 0 | 0,755 | 1 | 0,711 | 2 | 0,601 |
| 9 | Index of physical volume of innovative infrastructure services | Export activity index | 0 | 0,397 | 1 | 0,486 | 2 | 0,731 |

The model of the production function of the innovative infrastructure services sector, obtained on the basis of regression analysis, has the following form:

$$Y = 0,31 \cdot X_1^{-0,27} \cdot X_2^{1,22}$$

Y – value added growth, %;

X_1 – increase in the services provided by the innovation infrastructure, %;

X_2 – labor productivity index in industry, %.

Based on the model obtained, we can conclude that the greatest influence on the increase in value added in industry has the indicator of labor productivity, which is characterized by a positive elasticity coefficient of 1.22. The indicator of growth of the volume of innovation infrastructure services provided showed a negative impact with the elasticity coefficient (-0.27), which indicates a lack of incentives and mechanisms for development of the innovation infrastructure services sector, capable of providing increased innovation activity and growth of industrial production in the real sector of the economy.

Policy in the service sector, focused on innovative development

Consider the main groups of services in the applied context of national innovation policy.

The first group is state programs to support innovative business. In particular, state programs of financial and technical support for innovative businesses that carry out research and development on state priorities (USA, Japan, Great Britain, India, China).

The second group is financial assistance programs. These include:

- 1) targeted grants for research and development (in almost all developed countries);
- 2) direct financing (subsidies, loans), which reach up to 50% of the cost of creating new technologies and products (France, USA);
- 3) creation of funds for the implementation of innovations (England, Germany, France, Switzerland, the Netherlands);
- 4) loans, in particular interest-free (Sweden); gratuitous loans to cover 50% of the costs of innovation (Germany).

The third group is programs for providing various benefits (tax, compensation, customs and others). Note such tools as:

- 1) simplification of taxation for enterprises working in the field of innovation, exclusion from taxation of research and development costs, preferential taxation of universities and research firms (USA, UK, India, China, Japan);
- 2) government programs to reduce risks and compensate for risky losses (USA, Japan);
- 3) free services of patent attorneys on applications from individual inventors, exemption from duties (Netherlands, Germany, Japan, India);
- 4) deferral of payment of duties (or complete exemption from them), if the invention relates to the field of energy saving (Austria);
- 5) reduction of state duties for individual inventors, insurance and providing them with tax benefits (Austria, Germany, USA, Japan), as well as the creation of special infrastructure to support them (Japan). Participation in these programs involves the provision of appropriate advisory services.

The fourth group – programs for the formation of innovation infrastructure. In this group we can highlight:

- 1) creation of state organizations that provide scientific, technical, financial and production support for innovative business (USA, Japan, India, China);
- 2) creation of a wide network of venture capital funds for the implementation of innovative projects (implemented in various ways in almost all developed and developing countries).

It is proposed to consider the financial aspects of innovative development in order to determine their hierarchy and relationship in the context:

- 1) programs of innovative development of state enterprises; programs of innovative development of private enterprises;
- 2) programs for selection and implementation of innovative projects by private enterprises;
- 3) programs for selection and implementation of innovative public-private projects, including international ones.

According to the authors, the basic principles of financing of these programs of development of the innovation system should be the following:

- it is expedient to carry out financing within the limits of the approved strategy (program) of innovative development of the country or region (territory);
- it is advisable to finance specific activities or provide a specific amount of services to clients (preferably with joint investment from local budgets, partial payment for services by clients or investors, depending on the stage of innovation processes of the project);
- it is necessary to focus on existing organizations of innovation infrastructure that have contacts and practical experience with enterprises and research

organizations, and gradually carry out their development.

Compliance with these principles will make the state support of the innovation system comprehensive, as well as make it possible to evaluate its effectiveness.

5. Conclusions

In developed countries, funding for innovation comes from both public and private sources, as part of systemic development strategies that take into account, among other things, a number of related development services. Research shows that these mechanisms have become more diverse and complex, and adapting to them is one of the most significant challenges for modern states and businesses.

Thus, the analysis of the regional case proves that the success of innovation is largely determined by the forms of its integrated organization and methods of service support.

The analysis of selective approach to service support of innovative activity allowed determining that startups and small innovative business need, first of all, expert (mentor) support. The state can support certain elements of infrastructure (business incubators, technoparks, gas pedals, consulting centers, technology transfer centers, etc.) for some time. At the stage of startups entering international markets, joint cooperation of business and government is necessary to achieve the maximum effect of international competitiveness of developments (products) and the possibility of gaining access to foreign investment, which can be done with the help of export support measures.

Based on the analysis, the priority measures to solve the problems of innovative development on the basis of the service component include:

- expansion of the range of services to support innovation in private technological small and medium-sized enterprises, in particular by creating a system of competitive grants (for research or cost recovery) from innovation funds in priority areas of innovation;
- increasing the stimulating role of the tax system and creating demand for new innovative products through maximum attention to public procurement, as well as procurement for the needs of natural monopolies and large enterprises with predominant state participation.

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