

Ways to intensify innovation capacity of the regional economy

Igor V. Antonenko
 Institute of Economics and Finance
 Volgograd State University
 Volgograd, Russia
 AntonenkoIV@volsu.ru

Dmitry A. Ovcharov
 Institute of Economics and Finance
 Volgograd State University
 Volgograd, Russia
 OvcharovDA@volsu.ru

Abstract – Today, building and intensifying innovation capacity of the regional economy is viewed as a priority in Russia as it will help to set a path towards sustainable economic growth. The present paper aims to provide a scientific basis for enhancing the innovation capacity at the regional level. Universal research methods, system, historical, and statistical analyses, typological and classification modeling as well as structural and functional, subject-object, descriptive and comparative analyses provide the methodological basis of the study. The analysis of research and innovation activity in the regions of the South Federal District (SFD) has revealed the capacities of R&D sector and abilities of the industrial sector to use existing scientific reserves. It made it possible to define a number of measures to intensify innovation and technology development for a certain region of the South Federal District taking into account the specificity of this region. IT technologies, electronics, and manufacturing technologies are considered to be promising ones to intensify the innovation capacity of the SFD regions. IT systems technology can become the technology that will bring the regions to the world high-technology goods market. R&D in the sector of manufacturing technologies is mainly focused on transport vehicles and equipment production, metallurgical production, electrical equipment production, electronic and optical equipment production. Thus, the Rostov, Volgograd, and Krasnodar regions have good prospects to create the IT cluster which will contribute to mutual exchange of knowledge and close cooperation.

Key words – *innovation development, regional innovation capacity, innovation attractiveness of regions, production capacity, knowledge generation*

I. INTRODUCTION

The present paper focuses on building and intensifying innovation capacity (IC) of the regional economy which responds to social and economic needs of the country and meets the society's demands.

Studies conducted by Boudeville, J. Lasuén, G. Mensch, P. Pottier, C. Freeman laid the theoretical basis for research on innovation capacity [4, 8].

S. Glaziev, A. Dagayev, V. Inozemtsev, V. Kushlin, A. Rumyantsev, G. Fetisov analyzed innovation capacity from the technological stage perspective [5].

I. Agatseva, N. Beketov, I. Boyko, A. Bolshoy, M. Gokhberg, V. Guzhov, A. Dagayev, I. Dezhina, O. Inshakov, and others focused on a methodological analysis of the transformation and transaction factors of innovation capacity building and development at the regional level, and effectiveness and efficiency of innovation policies [1, 6].

The present paper aims to provide a scientific basis for enhancing the innovation capacity of the regional economy. This involves a number of objectives: to justify a methodological framework of a factor approach to research on innovation capacity of the economic system; to offer the tools for innovation capacity intensification at the macro- and meso-levels taking into account the current trends in science and technology; to present arguments for the choice of promising areas of innovation-technology development at the regional level.

The object of the study – innovation capacity development of the regional economy.

The subject of the study – managerial, organizational and economic relations emerging in the process of building and intensifying innovation capacity of the regional economy.

II. MATERIALS AND METHODS (MODEL)

Studies of the Russian and foreign authors on innovation development theory, production factors, economic and innovation mechanism, and regional problems of innovation activity provide the basis for the present research.

The author's studies and research, monographs, and academic papers on the issues under the analysis, as well as the data provided by the Federal State Statistics Service form an information and empirical basis of the present research.

Laws and regulations of the President and the Government of the Russian Federation and the constituent entities of the Russian Federation provide legal and regulatory framework of the research.

III. RESULTS AND DISCUSSION

A. Transformation and transaction factors affecting innovation capacity building

To investigate factors that affect innovation capacity we use a factor approach proposed by O. Inshakov who distinguishes two groups of production factors: transformation and transaction factors [6]. Within the framework of the first group, we have investigated ‘Knowledge generation’ element of the innovation system, grounded the internal reserves for innovation capacity formation with regard to the regions of the South Federal District, and revealed technological trajectories of their innovation capacity development. It’s recommended to find new markets for technologically bound products within the knowledge intensive projects trajectory (production of electronic and optical equipment, and chemical production). As for the sectoral trajectories that provide specialized supply (equipment and machinery production), it’s advisable to develop special elements and technologies used as a basis for modifications and improvements of the products. Within the sectoral trajectories of scale with a great scale effect (processing industries), it is recommended to develop internal R&D divisions, to adapt exported technologies to the Russian conditions and to form own research strategies [2].

The organizational factor, that includes organization of innovation activities management, organization of education and science system, and knowledge transfer by means of innovation infrastructure, covers all the levels of the innovation system and promotes formation of all five innovation capacity elements (external, internal, motivation, resource, result). Information resource (formalized and non-formalized knowledge) contributes to building and development of innovation capacity of a territory and together with the human factor ensures the result of IC intensification.

The human and institutional factors play a key role in the formation of links between the transformation and transaction factors of IC development; the first one integrates the functions of the technological, organizational and nature factors and promotes the IC development of the economy, and the latter affects both directly and indirectly the human, technical, organizational, information and resource factors; it forms an institutional subsystem of the regional innovation system (RIS) and is implemented in the form of formal and informal norms and rules of the RIS subsystems.

B. Tools to intensify innovation capacity of the regional economy

The tools for intensifying innovation capacity of the regional economy are presented in accordance with the stages of innovation process and in the form of technological platforms based a number of basic technologies that contribute to the interaction of the subjects of innovation activity (Table I).

TABLE I. THE TOOLS FOR INNOVATION CAPACITY INTENSIFICATION IN ACCORDANCE WITH THE CURRENT TRENS IN SCIENCE AND TECHNOLOGY IN THE SFD REGIONS

| The constituent entities of the Russian Federation | Areas of development of science and technology | Tools for innovation capacity intensification | Technological platforms | Results and problems addressed |
|---|--|--|---------------------------------|---|
| Rostov region | IT technologies and electronics; New materials and chemical technologies; Aerospace technologies; New transport technologies | Administrative; Fiscal | IT technologies and electronics | Development and creation of IT systems technology; Development of aerospace technologies |
| Volgograd region | Living systems technologies; Synthesis of drugs and food supplements, manufacturing technologies, New transport technologies | Administrative; Federal Target Programs; Technical standards (GOST P 52249-2009); Fiscal | Pharmacy | Development and production of innovation drugs; Training of scientific personnel; Development of fundamental pharmacy |
| Krasnodar region | Production and processing of agricultural raw materials; Manufacturing technologies; Aerospace technologies; IT technologies and electronics | Fiscal; Administrative | Manufacturing technologies | Development of technologies for production and processing of agricultural raw materials; Development of technologies for processing of renewable raw materials; Bioengineering; Biotechnologies |

Source: compiled by the author.

The feasibility study of the technological platforms of the SFD regions is based on the assessment of intensive and extensive innovation activity which affects the effectiveness of creation and distribution of technologies.

We have revealed the challenges of the regulation system for innovation processes aimed at building and development of innovation capacity of the region based on the analysis of the current situation in the SFD regional innovation system and regions’ specialization.

The system of legal methods is considered to be the major driving force for the entrepreneurial activity in the innovation sphere. The regional level lacks legal regulation mechanisms for commercialization of R&D results and the protection of

intellectual property during knowledge intensive technologies transfer.

Tax benefits are used as the instrument of budget policy that indirectly affects the IC resources. The tax laws should ensure support and promotion of research, innovation activity, demand on innovations and R&D results. Tax benefits should be focused on the priority areas of science and technology in order to develop an investment stimulation mechanism.

Institutional instruments such as grants and R&D contracts are viewed as the instruments for the indirect impact on the IC intensification at the macro and meso levels.

At the 'state – business' level innovation capacity is intensified by means of cooperative agreements and commercialization of R&D results, and technology transfer. It is highly advisable to establish legal procedures for the transfer and usage of state-sponsored industrial property.

The technological platforms relevant for the SFD regions, such as pharmacology, IT technologies and electronics, manufacturing technologies, will provide links among the educational, resource, technological, R&D, and cluster-sector RIS subsystems [3].

C. Promising areas of innovation and technology development of the SFD regions

In order to define promising areas of the IC intensification for the SFD regions, we have developed a methodology based on the combination of indicators of technological development and innovation activity of the SFD regions in one innovation-technology matrix. Such a matrix makes it possible to characterize indirectly innovation demand and supply and to evaluate its dynamics [7].

The assessment of the technological level of the regional economy has been conducted using the production technological level index (I_p) which is calculated as the regional labour productivity (P) in relation to the labour productivity of the leading region – Moscow with the maximum I_p index of 100%. The formula will be as follows:

$$I_p = (P / \max P) \cdot 100 \% \quad (1).$$

Similarly, the assessment of the innovation activity level for the SFD regions is conducted using the innovation activity index (I_{ac}) which is calculated as the relation of the R&D unit cost indicator (G) to the indicator of the leading region:

$$I_{ac} = (G/\max G) \cdot 100 \% \quad (2).$$

All SFD regions have I_p and I_{ac} from 0 to 100%.

The SFD regions have been ranged by their technological and innovation levels using the following scale: low ($I_p; I_{ac} \leq 27 \%$); middle ($27 \% < I_p; I_{ac} \leq 66 \%$); high ($I_p; I_{ac} > 66 \%$).

Thus, in terms of technological level and innovation activity degree the SFD regions have been divided into three groups which made it possible to combine I_p и I_{ac} in one innovation and technology field (Table II).

TABLE II. THE MATRIX OF INNOVATION-TECHNOLOGY DEVELOPMENT OF THE SFD REGIONS

| | Low technological level of production $I_p \leq 27 \%$ | Middle technological level of production $27\% < I_p \leq 66 \%$ | High technological level of production $I_p > 66 \%$ |
|---|--|--|--|
| High innovation activity degree $I_{ac} > 66 \%$ | The SFD regions are absent | The SFD regions are absent | The SFD regions are absent |
| Middle innovation activity degree $27 \% < I_{ac} \leq 66 \%$ | The SFD regions are absent | The SFD regions are absent | The SFD regions are absent |
| Low innovation activity degree $I_{ac} \leq 27 \%$ | Astrakhan region, Adygeya, Kalmykia, Rostov region | Volgograd region, Krasnodar region | The SFD regions are absent |

Source: compiled by the author.

The matrix configuration shows that no one SFD region is characterized by balanced development of innovations and technologies. Almost all SFD regions show low level of technological development and low innovation activity. Only the Volgograd and Krasnodar regions have middle level of technological development with low innovation activity.

The innovation-technology development shows the need for a 'diagonal' movement within the matrix with a simultaneous increase of the level of innovation and technology development, i.e. the stage of innovation activity should correspond to the stage of technological level of the economy. With high technological level, production can 'process' incoming innovation that will result in high innovation openness of the economy. Most of the SFD regions are localized in the lower left quadrant of the matrix, it means that almost all the regions under analysis are at the initial stage of technological development and at the 'null' stage of innovation activity.

Thus, we can speak about innovation development stages of regional economies, where every stage should match a technological level and innovation activity of the economy. Therefore, modernization of the technological level of regional production will create conditions for innovation development of the SFD regions.

Using the matrix presented in Table II we can offer a procedure to select promising areas of innovation and technology development for the SFD regions.

The analysis of the matrix has shown that there are some regions that stand out among the others as they have sufficient reserves to intensify their innovation activity. These are the Rostov, Volgograd, and Krasnodar regions. Innovation and technology policies in these regions should be strengthened as the regions need “to be matured” and reach a critical level of technology development which will allow them to absorb innovations and move towards sustainable economic development [3].

The next stage includes selection of the sectors that are characterized by the high technological development compared to a regional leading sector. These sectors need special innovation technology development programs to increase their technological level of production and to attract investment in research and development. The selection of leading sectors (compared to the technology development level of the leading region) is also made for the outsider regions. At this stage, the areas of research and development are defined, and innovation sectoral diversification programs are implemented in the leading regions. The leading sectors in terms of innovation development in the Krasnodar region are manufacturing, food processing, electronic and optical equipment production, medical products production – all that can further develop the clusters, especially in the agro-industrial complex. The procedure described is recommended to perform every year in order to revise the positions of the regions and sectors in the technological hierarchy.

The analysis of R&D activity of the SFD regions [9] has shown the links among R&D/innovation activity entities, and revealed interdependence between the capacities of R&D sector and the ability of the industrial complex to implement existing scientific reserves. The analysis has also defined a number of measures that should be taken to intensify the priority areas of innovation and technology development for a particular SFD region taking into account its R&D and innovation capacities. IT technologies, electronics, and manufacturing technologies are considered to be the promising areas to intensify innovation capacity in the SFD regions. IT systems technology can become the one that will bring the regions to the world high-technology goods market. R&D in the sector of manufacturing technologies is mainly focused on transport vehicles and equipment production, metallurgical production, electrical equipment production, electronic and optical equipment production. Thus, the Rostov, Volgograd, and Krasnodar regions have good prospects to create the IT cluster which will contribute to mutual exchange of knowledge and close cooperation.

As for the Krasnodar region, ‘production and processing of agricultural raw materials’ technology needs to be developed by means of intensification of existing research, technical and technological reserves.

Living systems technologies are viewed as promising ones for the economy of the Volgograd region. Within this area, ‘synthesis of drugs and food supplements’ technology should be developed; this will contribute to the creation of a pharmaceutical cluster and better information environment for innovation projects.

IV. CONCLUSION

The analysis has led to the conclusion that various forms of intensification of innovation capacity of the regional economy have developed infrastructure focused on the implementation of certain functions within the regional innovation system. A functional approach allowed us to present the innovation infrastructure model. The institutional interaction of the innovation infrastructure and the RIS subsystems are based on direct and indirect links.

Innovation capacity development within a regional economy can be intensified in a number of organizational forms: innovation center, techno-park, techno-polis, techno-region. All these forms share some basic characteristics: integration of research and production, and incubating and support for small innovation firms.

The analysis has also revealed some problems. First, the SFD’s techno-parks do not clusterize innovations and do not form interdependent enterprisers within a cluster. Second, innovation-technology centers do not define the technological boundaries for the usage of innovations. Third, the SFD technology transfer centers do not define the commercial boundaries for innovation application in the process of innovation diffusion.

Therefore, it is highly advisable to create interrelated enterprises within a cluster, to create new knowledge-intensive firms within a techno-park, to provide technical, information and consulting support for innovation business within innovation-technology centers, and to ‘push’ technologies by means of technology transfer centers – all of this in order to intensify the SFD innovation capacities.

References

- [1] Agkatseva I.E., Boyko S.V., Guzhov V.V., Fedorova T.N. An analysis of the current state and development prospects of the innovation sector of the Russian economy. – Moscow, 2006.
- [2] Antonenko I.V. Innovation development sectoral trajectories of the South Russian regions // *Regional and Sectoral Economic Studies*. Spain. Vol. 14-2 (2014). pp. 31-38.
- [3] Antonenko I.V., Lisovskaya N.V. The innovation climate rating of the regions of the South Federal District // *Regional Economics: Theory and Practice Journal*. Vol. 2 (377), 2015, pp.48-55.

- [4] Boudeville, J. Problems of regional economic planning, 1966.
- [5] Glaziev S. Yu. The theory of long-term techno-economic development. – Moscow, 1993.
- [6] Inshakov O.V. Production factors theory in the context of Development Economics: Scientific report (Moscow, the 29th November, 2002). – The Publishing House of Volgograd State University, 2002.
- [7] The strategy of innovative development of the Russian Federation for the period up to 2020. Ministry of Economic Development. – Moscow, 2010. pp. 17-18.
- [8] Mensch H. Stalemate in technology: innovation overcome the depression. Cambridge (Mass.), 1979.
- [9] The Central Statistics database [Electronic resource]. Key performance indicators of some sectors / Science and innovation / Data on innovative activity of organizations / The share of enterprisers that implement technological innovations // Access mode: <http://www.gks.ru/dbscripts/Cbsd/DBInet.cgi>