INNOVATION DIFFUSION IN COASTAL AGGLOMERATIONS OF WESTERN RUSSIA

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Abstract

The article identifies the innovation development features of coastal agglomerations and their role in innovation import substitution in the conditions of geo-economic changes. While maintaining the cross-border communication function, the western coastal regions accumulate tacit knowledge for performing innovation development and secure their innovation potential. The study traces the processes associated with innovation diffusion in the coastal regions of Western Russia via both analysis of regional statistics and the qualitative data acquired from expert surveys. The empirical data cover the cases on the Rostov agglomeration – the largest coastal center of the South-West Russia, and the Kaliningrad – the North-West exclave region, which is highly integrated into the European space. It is shown that the education and science centers of the coastal regions become the leading accumulators of innovations in the conditions of the lack of external technological development resource. The innovation diffusion in the regional production system demonstrates various trends depending on the support of regional authorities, the volume of internal demand for technologies and innovation products, the interdependence and technological exchange between civil and military sectors, etc. The findings are to be implemented in regional management and decision-making.

Key words: diffusion of innovations, innovation metabolism, coastal regions, coastal agglomerations, Western Russia

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Introduction

The processes of spatial distribution of new technologies, innovation goods and services are in focus of regional economic development and regional management as they are the basis for the innovation and economic growth of a region, that can be both the accumulator of innovations coming from abroad (or other regions of a country) and the generator of ones. It

means that the regional possibilities for high conductivity for innovations become one of the main conditions to reach the global competitiveness for a national economy.

These world trends are urgent for the modern Russia, as in the conditions of economic sanctions and geo-economic turbulence the additional resources are needed to maintain and develop the global positions, as well as to provide the import substitution. So, there are important issues to be addressed: a) to trace the diffusion of innovation processes in the western coastal regions of Russia, b) to evaluate their internal demand for innovations, c) to find out whether they have accumulated the innovational potential and tacit knowledge enough for the further development and substituting previously exported production, d) to point out the role of the coastal cities in the process of innovation distribution into the space of their hinterlands, and e) to indicate the proportion between generation and adsorption of innovations in the coastal territories of Russia during the recent years. The study includes the cases on the developed export-oriented region of the South-West (Rostov region) and exclave Kaliningrad region with the deeply integrated economy into European market.

1 Theoretic basis of research

1.1 Innovation diffusion concept: approaches, models and regional application

The importance of innovation development for both economy and society accented in early studies of Schumpeter, who identified the special role of time dimension of this processes embodied into the concept of innovation origins of trade cycle. The time factor is of increasing value nowadays. Rooting in the works of Gabriel Tarde, the ideas on spatial dimension of innovation are being revised with regard to the mass integration of information and communication technology (ICT) in all economic sectors (Pradhan et al. 2019). The main categories and elements of the innovation process are specified within the open innovation paradigm (Chang, Chen, 2015). During the last four decades, the research interest within this approach evolved from the mechanisms of technology transfer and its implementation to the general the issues of transnational innovation transmission (Andergassen et al., 2017; Caiazza, Volpe, 2017) and the issues of developing the diffusion policy mechanisms (Caiazza, 2016; Schuster, Rueck, 2017; Stoneman, Battisti, 2010). One of the most developed concepts of innovation diffusion within the economic and geographic research is elaborated Hägerstrand (1953), followed by Deves et al. (1983) and other scholars developing the particular models, including one within the concept of ‘long waves’ (Van Dain, 1976). Within this concept, the

diffusion of technologies performs spatial waves of four stages: occurrence, distribution, accumulation and saturation, being spatially distributed within the center-periphery system.

This concept already was implemented within the studies of Russian regions. During the recent period, the studies of Baburin and Zemtsov are noticeable as the attempt to construct the geographical full-scale picture of innovation processes in Russia (Baburin, Zemtsov, 2013). They evaluate the speed of innovation diffusion and classify the roles of regions of the national innovation system: the innovators – mostly the central regions of Russia, the early adopters – mostly concentrated among the innovators or in the centers of scientific development in European part and Siberia, the early majority – most regions, as well as the later majority and the lagging regions – mostly located in remote regions of Siberia, Far East and also the North Caucasus. However, there are no specialized studies focused on the coastal areas of Russia, despite their special contact-barrier function in spatial economy.

1.2 Specefics of coastal zones as the consumers of innovations

Coastal regions perform the advanced pace of economic development due to their location at the cross-roads of information, resources and financial flows. Using the possibilities of maritime and intermodal transport, they are the area of open space for exchange of both goods and services and innovation ideas. The largest coastal cities and agglomeration become the leading centers of regional and world innovation development, playing the role of growth poles for their regional hinterlands and neighboring territories due to cross-border diffusion of innovations (and also cross-border clustering). Along with the role of accumulators and generators of innovations at the cross of informational and resource flows, the coastal regions perform the high-scaled demand for innovations. They become the market pools for innovators, as they tend to implement innovations easier and faster than inland territories (except the highly developed capital cities due to their status and population destiny).

2 Research methodology

The object of the study is the innovation diffusion within two coastal regions – the Kaliningrad region and the Rostov region. The parameters evaluated are: the innovation inflow to the region (including patents, technologies, equipment, etc.); the domestic demand for innovation; the generation of innovations by regional educational and scientific centers; the level of technological and knowledge dependence; the marine economic specifics of

innovation activities; the institutional support for innovation; the main possible obstacles to the development of an innovative economy in the region and the diffusion of innovations.

The three-year study period is used (2015-2017 compared to 2010). Both quantitative (e.g. Rossat, Kaliningradstat, Rostovstat databases, the Federal Customs Service) and qualitative data (sites of regional authorities, innovative companies, specialized supporting infrastructure) are analyzed. A survey of experts is conducted to identify the main obstacles and threats to the innovative development. In the Kaliningrad region, 26 scientific experts are asked to evaluate the likelihood of a threat and the degree of its negative impact on the innovative economy of the Kaliningrad region in points from 1 to 3 in ascending order. All threats are divided into four groups: 1) violations of migration of human resources, carriers of explicit and implicit knowledge – 8 factors; 2) violation of the transport communication between the Kaliningrad region and the Russian Federation, which will prevent the diffusion of innovations concluded in the form of goods – 6 factors; 3) increased dependence on foreign technologies due to their excessive influx – 8 factors; 4) deterioration of interactions with the border countries separating the Kaliningrad region from the Russian Federation – 10 factors. The estimates for each group are summarized by calculating the arithmetic average. The empirical evidence on Rostov region includes the data on the activities by local firms presented in official resources of the organization, mass media information and the interviews with the representatives of the local administration and academic society (15 interviews with open questionnaire).

3 Innovation metabolism in Rostov region

Despite the Rostov region has the much greater potential in both economic and human resources than Kaliningrad region, the processes of innovation diffusion in the region are less in speed and intensity. According to the classification of Baburin and SZemtsov, the region takes the middle positions of ‘later majority’, while the Kaliningrad region belongs to the ‘early majority’ in the process of innovation diffusion (Baburin, Zemtsov, 2013).

The innovation dynamics in Rostov region performs contradictory trends. On the one hand, since 2012 the range position of the region in the Russian regional innovation index (RRII) has risen from 38 to 26 of the 85 regions of Russia; the position in the range of socio-economic facilities for innovation activity ranking from 38 to 17 and in the range of scientific-technological potential – from 28 to 23. On the other hand, the quality of the innovation policy during the recent years ranks below the average for Russian regions: 50-46 positions

(Isaeva, 2018). The same picture of uneven innovation development of the region is obvious while comparing the dynamics of the key statistic indicators on innovations (Tab. 1).

Tab. 1: Dynamics of the main indicators of innovations in Rostov region, 2010-2017

Indicator	2010	2015	2016	2017
number of personnel involved in innovation generation	16,402	12,556	12,102	11,846
number of organizations providing R&D works	100	100	86	89
volume of goods and services produced with the use of innovation technologies, mln. RUR	19,185	108,526.9	133,792.6	104,538.5
innovation goods and services in regional production, %	4.8	14.3	14.5	10.6
innovation tecknologies produced	9	22	25	15
innovation technologies used	2,664	3,047	3,314	3,368
total expenditure on technological innovations, mln. RUR	6,668.4	13,682.2	13,663.8	13,102.3

Source: Rosstat, 2018

Thus, the most of technologies used and innovation production consumed are imported from abroad (mostly from European countries, China and the USA), that was also proved by the expert interviews: the geographic area for the export of regional generated technologies and production with the use of innovation is presented by Turkey, China, Middle Eastern and some African countries. But, despite there are both foreign and domestic markets for technologies, the share of innovative regional production does not suit the world level and the national strategic plan (about 50% of all the production), and the most of enterprises do not invest into internal R&D, nor one by external scientific organizations. The main reasons meant within the expert interviews are: lack of internal resources for investments (in the conditions of debts, taxation system and other institutional problems, and high prices at the credit market), high risks of innovation activities, the lack of experience in the R&D activities, and especially high costs of innovating in comparison with the profitability of rough materials that does not motivate the suppliers to create additional levels of the added value. In the profile for the agricultural Rostov region in grain farming the profitability of exporting can reach 50-60%, for wheat – 60-80%, sunflower and sugar beet 100-120%. But there are attempts to overcome the situation, e.g. via clustering, as the common cluster resources to cover the risks, using foreign technologies while developing domestic ones and improving human capital (clusters “Amilco”, “Yug Rusi”, “Aston”, “Eurodon” and other).

The agricultural sector and hi-tech machinery become the main regional industries for developing and implementing new technologies due to both stable competitive advantages and the current geo-economic situation (need for import substitution). This additional impetus gave the birth to the innovative clusters “Southern Constellation” (specializing in a wide range of hi-tech machineries), “Marine Systems” (echolocation fishing equipment, previously

imported) and some other ones. The system of education and science represented by big regional universities and institutes became the additional core for the innovative integration.

The process of stimulation innovative activities and clustering helps to overcome the peripherysation of the regional space. Agricultural clustering brings new technologies into rural areas both from the Rostov agglomeration as the leading regional center and from abroad. Innovative machinery had been developing mostly in Rostov but after the start of clustering it has been joining more cities of the agglomeration and also neighbor centers, due to both production links and education systems with its subsidiaries. So there is real potential for innovation development within the region, both developed internal demand for innovations and productive conditions, while the problem of external dependence exists only in some sectors (for example the region critically depends on the import of planting material of high quality: for sugar beet – 98%, corn – 70%). But the main leverage to improve the regional innovational metabolism is one of motivation and creating institutional facilities.

Another problem meant in the expert interviews is associated with the synchronization of innovation waves in the various sectors of the regional production and logistics, especially between the local agricultural and machinery production – and the maritime transport and port industry (that is also not highly motivated to implement innovations, and it causes the lag for the regional producers and consumers). The attempts to overcome this trend are mostly via creating alternative port organizations as the result of diversification of agribusiness. So the region (especially Rostov agglomeration) does not use effectively the coastal factor as it is.

4. Case of the Kaliningrad region

The Kaliningrad region is characterized by a strong imbalance between the development and implementation of advanced production technologies. The figures indicate that the region is primarily a consumer of technology, and the supply in the domestic market cannot satisfy the existing demand. Total for the three years analyzed, 4 technologies are developed while the average volume of technologies used annually in the same period exceeded 830 with the dominance of the fields of design and engineering; production, processing and assembly; communication and management. The level of organizations' innovation activity is not high. On average in 2015–2017, the share of organizations engaged in technological, marketing and organizational innovations fluctuated at the level of 4%, with dominance of technological type. The expenditure on new technologies over the period was unstable with a peak in 2016 (3.9 billion RUR). The main cost was the purchase of machinery and equipment (over 70%).

The share of costs for the direct purchase of new technologies, including patents, licenses for inventions, industrial designs, utility models, amounted to less than 1%, which is extremely low (Tab. 2).

Tab. 2. Cost structure for technological innovations of the organizations of the Kaliningrad region by innovation activity types, mln RUR.

Indicator	2010	2015	2017
total expenditure on technological (product, process) innovations, including:	176.6	1,066.4	1,464.6
research and development of new products, services and methods	3.0	140.2	89.7
design (change in shape, appearance or usability of products or services)	1.8	2.8	-
acquisition of machinery and equipment related to technological innovation	160.8	175.6	1,122.8
acquisition of new technologies, *including:*	-	0.1	0.2
rights to patents, licenses for inventions, industrial designs, utility models	-	-	0.2
software acquisition	9.7	27.2	176.6
engineering	1.1	11.6	8.6
innovation education and training	-	1.8	1.2
marketing research	-	-	0.9
other technological innovation expenditure	0.1	707.1	64.4

Source: Rosstat

According to the Kaliningrad Regional Customs (General results..., 2017), almost half of the total imports of the region are machinery and equipment: 53.4% in 2015 and 49% in 2017. The largest share is occupied by transportation vehicles, their parts and accessories, which is due to the development of automobile production in the region. In 2017, they accounted for 2.09 billion USD, and the leading trading partners were foreign countries: the Republic of Korea (43.6%), Slovakia (24.4%), the USA (11.2), Germany (10.3%), and Czech Republic (7.4%). Total imports from neighboring countries of the Kaliningrad region is less than 10%. Taking the strategic perspective, the automotive industry and mechanical engineering, shipbuilding and ship repair, agriculture and food production, tourism, fishing industry and fish processing, amber jewelry production are considered as promising industries for the Kaliningrad region. Their successful development is due to the coastal factor: synthesis of natural-geographical, resource, infrastructural, personnel, transport, and other features caused by the territorial proximity of the region's production to the sea. The main mechanism for encouraging investment in fixed assets and, as a result, the influx of innovations into the Kaliningrad region is the Special Economic Zone (SEZ). In 2017, important amendments are made to the law, the main purpose of which is to increase the investment attractiveness of the exclave region in the current economic conditions. By 2018, the territory of the SEZ regime expanded to include internal marine areas, which should give additional impetus to the development of regional marine sector; also, a differentiated minimum investment threshold for potential residents (the smallest for companies in IT and medicine) is introduced. The

limited capacity to develop labor-intensive and energy-intensive industries stimulates regional authorities to assist in the high-tech innovative activities, including innovative services.

However, the expert interviews showed that there are a number of threats to the innovative development of the Kaliningrad region and the implementation of its functions as a corridor for the diffusion of technologies. First of all, the experts indicated the high degree of threat associated with the violation of the transport link between the Kaliningrad region and the Russian Federation (Tab. 3). The main concerns are the worsening of air traffic due to the winding down of the Federal airline subsidy and airline departure programs and the growth of additional transaction costs for business, caused by the exclave position of the Kaliningrad region. The second threat in terms of the impact on the innovation system of the region is technological dependence, primarily on the foreign innovation infrastructure, foreign technologies expressed in machines and equipment, and foreign intellectual property. The least significant factor is cooperation with the border countries in the innovation sphere, since the region's innovation system is very poorly integrated with the innovation systems of the border regions of Poland and Lithuania.

Tab. 3. Top-3 threats to innovation for Kaliningrad region by groups of factors

Group	Key events / factors	Probability	Impact
I	Large influx of to low-skilled labor migrants from CIS countries	2.12	1.96
	Strong migration outflow of qualified specialists to other regions of Russia	1.77	2.00
	– : to other EU countries (except neighboring ones)	1.58	1.92
II	Growth of additional transaction costs caused by the exclave location	2.19	2.54
	The need to develop air and sea transport to maintain ties with the mainland	2.42	1.96
	Deterioration of air traffic due to folding of Federal airline subsidies program	1.81	2.46
III	Dependence of key economy sectors on foreign technologies (incl. machines)	2.31	2.38
	Dependence of key economy sectors on intellectual property	1.96	2.15
	High dependence of innovative entities on foreign innovation infrastructure	1.81	2.04
IV	Decline in initiatives aimed at sharing experiences, knowledge and information between the region, Lithuania, Poland: in the political sphere	2.38	2.00
	Distortion of the image of the region in the Polish and Lithuanian media	2.27	2.08
	Decline in initiatives aimed at sharing experiences, knowledge and information between the region, Lithuania, Poland: in the business sphere	2.19	2.08

Source: expert survey results

Conclusion

As the study has shown, the coastal regions of Russia mostly act as the consumers of innovations. Being deeply integrated into the system of world division of labor and becoming the contact zones in the Russia-West system, they tend to use the foreign innovation and (in the less extant) transmit it further to inland territories from the coastal agglomeration centers to the periphery. In this regard the exclave Kaliningrad region is one of high conductivity,

developing the open space for innovations and information flows, but problematically dependent on the imported innovation products. It means that its metabolism needs to concentrate at accumulating tacit knowledge, developing internal technologies for the regional demand and improving the social and business environment via investing into human capital. In the situation of the lack of internal resources, this vector of development faces the problems of increasing transport isolation from other Russian regions.

Less dependent due to internal potential and quickly reacting to provide import substitution, the Rostov region is conductive for both production and consumption of innovations. The region uses the logistic advantages mostly for the production and sales strategies, fairly followed by the innovative initiatives. In this regard, the most far-reaching consequences can be caused by the lack of motivation and insufficient institutional environment. It is partly compensated by the clustering with the integrating role of the science and education system.

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References

1 Andergassen, R., Nardini, F., & Ricottilli, M. (2017). Innovation diffusion, general purpose technologies and economic growth. *Structural Change and Economic Dynamics, 40*, 72-80.

2 Baburin, V. L., & Zemtsov, S. P. (2013). Geography of innovation processes in Russia. *Moscow University Proceedings. Vol. 5. Geography, 5*, 25-32.

3 Caiazza, R. (2016). A cross-national analysis of policies affecting innovation diffusion. *Journal of Technology Transfer, 41*(6), 1406-1419.

4 Caiazza, R., & Volpe, T. (2017). Innovation and its diffusion: Process, actors and actions. *Technology Analysis and Strategic Management, 29*(2), 181-189.

5 Deves, S., Mensfild, E., & Romeo, A. (1983). *The models of Diffusions of Technical Innovation*. New York.

6 General results of foreign trade of the Kaliningrad region in the 4th quarter of 2017. *FCS in the Kaliningrad region.* URL: http://koblt.customs.ru/index.php

7 Hägerstrand, T. (1953). *Innovation diffusion as a spatial process.* Postscript and translation by A. Pred; Chicago: University of Chicago Press.

8 Chang, S. & Chen, C. M. (2015). A new approach to assess the changing growth model of open national innovation systems. *International Journal of Innovation Science, 7*(3), 183-197.

9 Innovation Cities Indexes 2016–2017. URL:https://www.innovation-cities.com/indexes

10 Isaeva, E. (2018) *On the innovation development of the Rostov region.* Rostov-on-Don, Rostovstat.

11 Pradhan, R. P., Arvin, M. B., Nair, M., Bennett, S. E., & Hall, J. H. (2019). The information revolution, innovation diffusion and economic growth: An examination of causal links in european countries. *Quality and Quantity, 53*(3), 1529-1563.

12 Scientific and technical potential of the Kaliningrad region: statistical collection. *Territorial body of the Federal state statistics service for the Kaliningrad region (Kaliningrad state Statistics service)*. Kaliningrad, 2018.

13 Schuster, G., & Rueck, P. (2017). Innovation diffusion, licensing and corporate entrepreneurship – A conceptual review. *International Journal of Entrepreneurship and Innovation Management, 21*(1-2), 119-142.

14 Stoneman, P., & Battisti, G. (2010). *The diffusion of new technology, 2*(1), 733-760.

15 Van Daijn J. *The Long Wave in Economic Life.* New York, 1976.

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