

Coastal regions as innovation gateways: the new industrialization development trajectory

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Abstract—Coastal regions are conceived as innovation gateways. Being open to the world the territories adjacent to marine and ocean coasts absorb latest trends in technologies, techniques, business models, and other advancements. The full spectrum of innovative solutions are transmitted upcountry after being assimilated with respect to regional and national legislation, business culture, available resources, market expectations and other particularities of the territorial community. Exclave position of a region imposes restrictions to the process of knowledge and innovation diffusion, resulting from both its spatial isolation and differences in properties of the regional innovation system from the national innovation system domain. The study focuses on new industrialization of the Kaliningrad region, which by the end of 1991 during perestroika became an isolated part of Russia – the enclave on the Baltic Sea. The paper provides an in-depth case study on regional innovation system dynamics of the Kaliningrad region. The study concludes with policy implications on resetting the innovation gateway role of the region

Keywords—*innovation; coastal region; coastalization; exclave region; Kaliningrad region*

I. INTRODUCTION

National innovation system constitutes of a mosaic of territorial innovation ecosystems, each featuring a unique set of competences and an individual profile that has formed over time. Their roles within the general open innovation process differ as regional actors are subjected to distinct contextual factors affecting their development trajectories. Geoeconomic position of a region largely predefines its status, ranging from a core to periphery. Whereas attribution of a region to a certain type is rather subjective and depends on the assessment methodology being used, the general worldwide pattern suggests that coastal regions exhibit higher values in socio-economic and innovative development [1; 2].

The coastalization effect that has been present for centuries resulted in hyper-concentration of human activity along the coast. According to [3] the settlements of the coastal zone exceed the global average numbers threefold and are expected to increase. Researchers estimate that before 2040 over three-quarter of world population will live within 100 km of a coast [4-6]. Along with population, the coastal zone features an exponential increase in infrastructure density [7]. The urban sprawl within 200 km wide coastal lowlands is observed worldwide [8; 9]. Similar trend is found in southern Europe [10].

Reverse dynamics is often registered in outlying border regions, especially those developing under the alienation or co-existence scenarios [11]. Borderlands are characterized as economic outskirts dominated by low-tech production facilities [12]. Despite numerous opportunities that emerge from neighboring location (e.g. customs-related activities), many frontier areas suffer from volatile geopolitics, limited access to resources, missing or underdeveloped infrastructure, largely due to predomination of a barrier function of the border [13]. Coastal borderland regions can be seen as areas of opportunities and insecurity featuring the potential for cooperation and conflict.

The objective of this study is to determine the new (post)industrialization dynamics of a coastal border region. The study is grounded on evaluating the innovation activity of a coastal enclave – the territory that would display the external influence over the local innovation environment at its extreme. The study case is the Kaliningrad region – the territory that became part of the Soviet Union after World War II and found itself in the position of the Russian exclave on the Baltic Sea in the 1991. The resource limitations of the region’s economy against the background of its isolation from the Russia’s mainland and strained geopolitical relations force the Kaliningrad region to seek new approaches to self-development, perforce, balancing between the roles of ‘development corridor’ and ‘double periphery’, with an ever

clearer understanding of the need to protect its innovation security.

In the next section, we review background studies on Kaliningrad region with a focus on its strategic development. Section 3 provides an in-depth case study on the evolution of the regional innovation system of the Kaliningrad region. Section 4 closes the paper with some discussion and conclusions.

II. LITERATURE REVIEW

The Kaliningrad region is often described as ‘double periphery’ [14] or ‘double borderland’ [15]. Exclave position of the region implies geographical isolation from the main territory of the country and emphasizes the importance of cross-border cooperation and integration for overcoming bilateral alienation (e.g. socio-cultural, economic, scientific and technological). The breakthrough in the intensification of cross-border activity was the implementation of the agreement on Small Border Traffic (SBT) zone between the Republic of Poland and the Kaliningrad region of the Russian Federation in 2012. This agreement allowed residents of the borderland to undertake visa-free multiple border crossings in order to maintain public, cultural or family contacts for a period of a one-time stay for no longer than 30 days. It changed the blockade function of the border and reduced the social and functional distance between Poland and Kaliningrad [16]. At present, this regime has ceased to exist, but along with other measures it enabled promote entrepreneurship and cross-border activity, and to recreate a network of new socio-economic links in place of those lost in the 1990s.

Another perspective on the Kaliningrad region is from defining it as semi-enclave, focusing on the competitive advantage of the Baltic Sea and the marine infrastructure. Kaliningrad has the only ice-free port in Russia on the Baltic Sea. This provides an excellent opportunity for fishing and trade. The most important institutional decision in utilizing the marine advantage was the implementation of the Free Economic Zone (FEZ) regime in 1991, which by 1996 transformed into the status of Special Economic Zone (SEZ). At present, the special legal regime for conducting economic, industrial, investment and other activities in the Kaliningrad region has been extended until April 1, 2031. The basic idea behind SEZ regime is to provide a limited added value to the products shipped (reimported) to the Russia’s mainland. To certain extend it enables to use the ice-free port facilities, but most importantly to attract investments to the Kaliningrad region and to form the core of the manufacturing industry of the strategically important westernmost territory of Russia.

Being reliant on international trade and investments, as well as being entirely pegged to international logistics services (incl. inland cargo), the region is highly vulnerable to geopolitics. Trade wars, sanctions, tightening of the visa regime, turbulence in the currency exchange rate, and other non-market factors threaten the regional security (social, economic, even innovation). The seemingly perfect strategy of using the marine capital by introducing SEZ is often described as an institutional trap [17]. The territorial economic system of the region formed under the SEZ conditions is fragile [18]. This fact limits innovation activity as it requires long-term

planning and the overall stability of the regional innovation system, thus, hampering post-industrialization.

III. RESEARCH METHODOLOGY

The study is based on an in-depth analysis of the regional innovation system of the Kaliningrad region. The official data of the Statistical Office of the Kaliningrad region (Kaliningradstat) and the Federal State Statistics Service of the Russian Federation (Rosstat) are used. The research period is 2000-2015, with individual indicators focusing on 2006-2015 period.

Indicators used are: The share of enterprises engaged in innovation activity, The volume of private expenditure on technological innovations (million rubles), The volume of innovative products, works and services registered (million rubles), The share of innovative products, works and services in the total production volume, The share of high-tech and knowledge-intensive industries in the gross regional product (GRP), The volume of commercial exchange of technologies with foreign counterparts.

A comparative assessment is undertaken threefold: firstly, by type of innovation activity: new product development; industrial design; acquisition of machinery and equipment related to technological innovation; acquisition of new technologies; acquisition of software; other preproduction activities; training of innovation related staff; marketing research; other expenditure on technological innovation; secondly, by economy sector: industrial production; services; thirdly, by national and federal district average values.

IV. THE CASE OF KALININGRAD REGION

The market and geographical conditions force the companies of the Kaliningrad region to be in competitive relations not only between themselves but also with companies from other Russian regions and from abroad, mainly the Baltic States and Poland. The most important factor for long-term competitiveness is innovation, the introduction and generation of which creates the basis for increasing the companies’ comparative advantage in competition. Evaluation of innovation activity of economic entities in the Kaliningrad region in the last decade has demonstrated a decline in the interest of regional businesses in innovation. While in 2006 14.1% of all organizations in the region could be attributed to innovative organizations, by 2015 this figure dropped to just 4.1% (Figure 1).

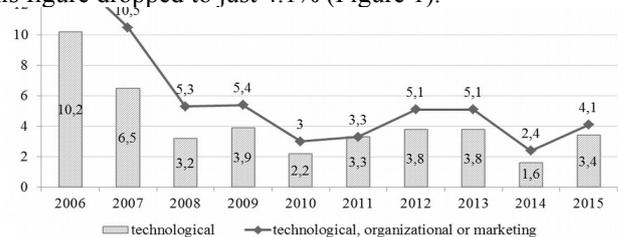


Fig. 1. Innovation activity engagement dynamics by enterprises of the Kaliningrad region, %

Source: based on Kaliningradstat data

Technological innovation has the overwhelming share in the innovation activity structure, being implemented

by more than half of innovative companies in the region. However, its share in the ten years period also reduced from 10.2 to 3.4%. Notable that about 2.6% of small companies were engaged in technological innovation, which is less than the average for the full range of enterprises in the same period (3.5%). The proportion of organizations implementing environmental innovations is small and fluctuates at the level of 1%. Reduction of the innovation activity had a negative impact on the amount of innovation expenditure, both in general and with respect to figures per enterprise (Table 1).

TABLE I. EXPENDITURE ON TECHNOLOGICAL INNOVATION PER ORGANIZATION, MILLION RUBLES

year	Total	by type of innovation activity:								
		1	2	3	4	5	6	7	8	9
2006	93.0	263.2	1.0	19.3	0.3	1.9	5.9	0.3	0.0	0.0
2007	26.0	0.3	40.4	24.1	0.7	2.2	0.0	0.0	30.0	0.0
2008	85.8	1.3	26.1	79.6	387.0	0.0	0.0	0.5	9.9	0.0
2009	35.9	0.1	0.0	44.7	1.0	0.2	0.0	0.0	0.0	0.0
2010	20.5	0.0	0.9	32.1	0.0	0.1	1.1	0.0	0.0	0.1
2011	13.5	11.6	97.3	5.6	0.4	3.4	0.1	0.5	0.0	1.6
2012	26.7	1.6	51.7	39.4	1.8	1.8	0.0	0.0	0.0	2.7
2013	22.1	11.0	2.3	40.4	1.4	1.6	0.0	0.2	0.6	0.0
2014	35.6	65.4	0.0	8.1	0.0	6.4	0.0	0.1	0.0	0.0
2015	71.1	46.7	1.4	25.1	0.1	5.4	11.6	0.4	0.0	707.1

Legend: 1 – new product development; 2 – industrial design; 3 – acquisition of machinery and equipment related to technological innovation; 4 – acquisition of new technologies; 5 – acquisition of software; 6 – other preproduction activities; 7 – training of innovation related staff; 8 – marketing research; 9 – other expenditure on technological innovation

Source: based on Kaliningradstat data

The total amount of expenditure on technological innovation has decreased by 55% from 2417.6 to 1066.4 million rubles, or by 1.3 times per organization engaged in technological innovation – from 93.0 to 71.1 million rubles. The average annual investment volume per company in technological innovation is 31.2 million rubles. The cost structure for technological innovation is unstable at the given period. In total for 10 years, the largest amount of investments was invested in research and development (R&D) of new products, services and methods of their manufacturing (2,529.4 billion rubles), the acquisition of machinery and equipment (2,310.8 million rubles); in the second place – the industrial design (427.7 million rubles) and the acquisition of new technologies (396.2 million rubles); in third – the purchase of software (97.2 million rubles) and market research (40.5 million rubles). The smallest amount of the costs associated with personnel training (3.7 million rubles).

According to survey held by the Ministry of the economy of the Kaliningrad region (Ministry of Economy of the Kaliningrad Region, 2016), an innovative approach to improving competitiveness was implemented by less than half of all companies in the region in the period of 2013-2015: 42% trained their staff; 26% – purchased new machinery and processing equipment; 16% – developed new modifications of their products; 8% – purchased technologies, patents, licenses, know-how; 6% – conducted research. The most common solution, resorted by more than 40% of businesses, was costs reduction without reducing the volume of production, which actually means reducing the quality of the products by

replacing expensive raw materials and components with cheaper ones and using cheaper labor.

The consequence of a sharp decrease in the number of innovative companies and downsizing of investment in innovation activity was the reduction of the volume of created innovative products in the region in 2009 and partial reorientation from production of new or significantly changed to the technologically advanced products (Fig. 2).

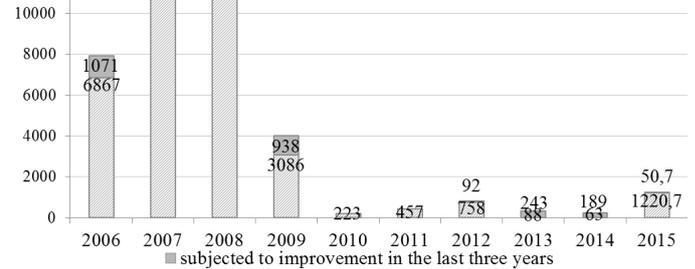


Fig. 2. Dynamics in the volume of innovative products, works and services in the Kaliningrad region in current prices, mln.rub

Source: based on Kaliningradstat data

The share of innovative products produced by organizations of the Kaliningrad region is below average for the Russian Federation and the Northwestern Federal District and ranged from 0.1 to 0.4%. Service sector has higher rates than the industry (Table 2). In terms of small business the share of innovative products in the total volume of production is highly unstable: from 0.54% to 2.5% with a peak in 2013 – 2.5%.

TABLE II. THE SHARE OF INNOVATIVE PRODUCTS, WORKS AND SERVICES IN THE TOTAL PRODUCTION VOLUME, %

Region	2009	2010	2011	2012	2013	2014	2015
	total						
Russian Federation	4.5	4.8	6.3	8.0	9.2	8.7	8.4
North-western Federal District	3.1	4.1	5.2	7.3	9.3	8.1	6.3
Kaliningrad region	2.8	0.1	0.2	0.3	0.1	0.1	0.4
industrial production							
Russian Federation	4.6	4.9	6.1	7.8	8.9	8.2	7.9
North-western Federal District	3.2	4.3	4.8	6.9	8.9	7.8	6.0
Kaliningrad region	2.6	0.1	0.2	0.3	0.1	0.1	0.3
service sector							
Russian Federation	3.2	4.0	8.3	9.6	11.2	12.8	12.9
North-western Federal District	2.7	2.3	9.5	10.5	13.1	10.8	8.9
Kaliningrad region	8.4	-	0.7	0.5	1.4	2.1	3.3

Source: based on Rosstat Interactive window URL: <http://cbsd.gks.ru>

Despite the existing intraregional problems, the contribution of high-tech and knowledge-intensive industries in the Kaliningrad region’s GRP has a positive trend (Fig. 3).

Due to the annual increase in the region's economy, by 2013-2014 it was possible to showcase the best structural indicators in comparison with both the national average and the Northwest Federal District.

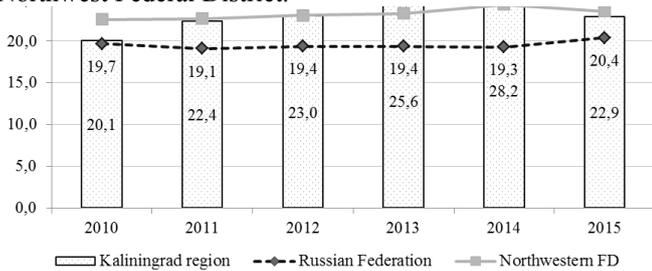


Fig. 3. The share of high-tech and knowledge-intensive industries in the gross regional product of the Kaliningrad region, %
Source: Rosstat Interactive window URL: <http://cbsd.gks.ru>

Industrial enterprises of the region are characterized by strong technological dependence on external input. The amount of advanced manufacturing technologies (AMT) used annually is hundreds of times greater than the number being created in the Kaliningrad region (Fig. 4), which is a threat to long-term sustainability of the regional innovation system.

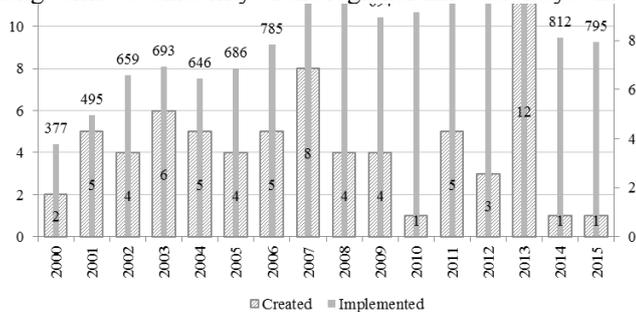


Fig. 4. The share of high-tech and knowledge-intensive industries in the gross regional product of the Kaliningrad region, %
Source: Rosstat Interactive window URL: <http://cbsd.gks.ru>

Of the highest demand by local companies are AMTs in the fields of 'Design and Engineering', 'Production, processing and assembly' and 'Communication and control'. These areas are also in the lead by the number of AMTs created. However, demand for them significantly exceeds supply volumes generated in the region. Analysis of age composition for the AMTs used demonstrates the growing share of technologies introduced six or more years ago (in 2015 – 58%), indicating the gradual technological obsolescence of production processes in the Kaliningrad region, and, consequently, a decrease in innovativeness and sustainability. Low receptiveness of the regional market to locally generated innovations creates the conditions for the outflow of regional technologies abroad (Table 3).

Matters of export are patent licenses on inventions, industrial designs, engineering services, research and development. The main areas by the field of appliance of the

subject matter of the agreement on the export of technologies are: textile production; wood processing and products of wood and cork, except furniture; research and development; education. Import of technology is characteristic for production of non-metallic mineral products; production of medical devices, equipment for measurement, monitoring, control and testing; construction; research and development.

TABLE III. INFORMATION ON THE COMMERCIAL EXCHANGE OF TECHNOLOGIES OF KALININGRAD REGION WITH FOREIGN COUNTERPARTS

year	Export			Import		
	Number of agreements	Volume		Number of agreements	Volume	
		million Rubles	thousand US dollars		million Rubles	thousand US dollars
2010	40	896	29857	18	187	7076
2011	26	2840	61154	24	119	3984
2012	33	2884	90552	29	290	9442
2013	41	2656	82175	22	315	9846
2014	34	113102	105129	19	7832	7786
2015	30	-	89167	17	-	3083

Source: based on Kaliningradstat

Major constraints to innovation activity in the region are the high cost of implementing innovations combined with large economic risks and the lack of financial support of the state against the backdrop of limited companies' own funds. These results are obtained during a series of surveys of regional innovation companies held in 2008-2010 by the Kaliningrad statistical office on request of the Immanuel Kant Baltic Federal University. An important role in smoothing out the negative impact of these factors and ensuring favorable institutional conditions for innovation, as an important component of the innovative milieu, is played by innovative policies, whose effectiveness increasingly depends on the active involvement of regional authorities in its implementation.

The regional level of innovation policy in the Kaliningrad region is represented by the Laws of the Kaliningrad region and other regional normative-legal acts in the sphere of science, education, innovation, investment, and entrepreneurship. The basic document is the Act of the Kaliningrad region "On science and innovation policy in the Kaliningrad region" N. 229 from July 27, 2000, which determines the foundations of science, technology and innovation policy in the region and is being mainly of a framework nature. The Act stipulates the definition of the state science and technology policy as an integral part of socio-economic policy, which involves consideration of the innovation system as part of the territorial socio-economic system of the region. Among the main objectives of the innovation policies of the region are: improving the efficiency of utilization and increasing of scientific and technological capacity; strengthening links between science and education; increase the contribution of the research sector in the socio-economic development; progressive structural transformation of the economy and increase in the competitiveness of goods produced in the region; increase in the environmental, informational, personal and public security.

The Kaliningrad region does not have an independent holistic strategy of innovation development, which would be a

result of political dialogue among participants in the innovation process. Innovative block is reflected in the long-term strategy of socio-economic development of the region (The government of the Kaliningrad region, 2012). The strategy sets out the basic task of regional science and technology policy, which is the concentration of resources in priority areas and the creation of favorable framework conditions for interregional cooperation and the establishment of close strategic cooperation between business, government and public institutions.

Priority areas include materials and nano-systems; information and telecommunications systems; transportation and logistics; recreational technologies; medical biotechnology; rational use of natural resources, biological resources and biotechnology; energy efficiency and energy security; technologies on development of the urban environment; social change; social and humanitarian technologies. In their allocation the Government of the Kaliningrad region was guided by national priorities and objectives of socio-economic development challenges facing the region in the context of the Northwestern Federal District. With that, the authorities have understanding that the Kaliningrad is not a large competitive center of scientific and technological development nor it is an independent distribution center of the country or the macro-region, but it has the ability to act as a new site for outsourcing (The government of the Kaliningrad region, 2012). Among the priority areas of economic activities for the region marked the production of food, shipbuilding and ship repair, manufacture of machinery and equipment, TV and other consumer electronics, automobiles, products from amber, which corresponds to the structural features of the economy.

Regional level tools on innovation policy are limited and scattered by individual laws and by-legal acts. The region has adopted individual laws on state support of information technology, organizations undertaking investments in the form of capital investments, small and medium-sized enterprises. There are laws on education, industrial policy, public-private partnership. In 2006 a special award "Eureka" on achievements in the field of science, technology and innovation was established. The Decree of the Government of the Kaliningrad region approved the territorial planning scheme of the region with the allocation of manufacturing and industrial zones; establishes the procedure for expenditure of the regional budget on applied research; established a permanent collegial consultative body under the Government of the Kaliningrad region in the sphere of science, education and youth policy – the Council of young scientists and specialists, and defined the procedure for the annual competition of creative innovation projects and non-profit initiatives. Since 2010 the award of scholarships for gifted and talented youth in the field of education and science is being held. In general, among the main tools of innovation policy implemented in the Kaliningrad region are: government purchases, loans, guarantees, subsidies, grants, budgetary allocations and investments, public services, measures of material and moral incentives and other.

In general, state purchases, credits and loans, guarantees and sureties, subsidies, grants, budgetary allocations and investments, public services, measures of

material and moral incentives were identified among the main instruments of innovation policy implementation in the Kaliningrad region. However, despite a fairly wide range of instruments, there are a number of factors that impede effective interaction between business and government, and, consequently, the implementation of innovation policy (Ministry of Economy of the Kaliningrad Region, 2016): instability of entrepreneurial legislation (48.1% of respondents); high tax burden (42.6%); corruption (31.0%); the complexity of the procedure for obtaining land plots (24.0%); complexity and slowness of the licensing process (17.1%); limited access of the companies with state-ownership and the entities of natural monopolies to public procurement (13.2%); the need to establish partnerships with representatives of public authorities (10.9%); access barriers to the public procurement scheme (9.3%); pressure from the public authorities, preventing the entrepreneurship or market entry of new business entities (9.3%); restrictions imposed by the authorities on joint economic initiatives of small businesses (7.0%); strong pressure from law enforcement agencies (2.3%).

V. DISCUSSION AND CONCLUSION

The Kaliningrad region is a strategically important area on a national scale and ensuring its innovation sustainability is on a federal agenda. The innovation system is in the stage of its formation. A number of steps have been taken to formalize innovation activities. However, a full-fledged strategy for innovative development of the region has not yet been developed, the principles of complexity and consistency in building a regional innovation policy and creating an innovation infrastructure are not observed. There is disunity in the interests of key actors of the innovation process: business entities, representatives of state authorities and education and science, which does not allow forming cooperative relations based on trust, which form the basis of the relational capital of the region. The shortcomings of the innovation milieu on the background of a relatively small scale of the innovation system and its isolation from the national innovation system adversely affect the innovation activity of local companies.

Increase in openness of the regional economy has ambiguous consequences for its innovation milieu. On the one hand, it is accompanied by the influx of new ideas, technologies, cultural traditions and innovations from the neighboring countries of Europe and the formation of new network connections for the region; on the other, regional companies are faced by increased competition, to which they are not ready neither in organizational nor technological terms. At present, the companies of the Kaliningrad region are mainly oriented to the Russian market, competing by price and foreign technologies, a significant proportion of which are implemented in production before 2010.

Strong technological dependence on foreign actors makes the real sector of the regional economy vulnerable in case of strong geopolitical changes, and a limited influx of new technologies leads to technological obsolescence. The lack of investment in intellectual property and staff training, a low innovative culture, a weak business interest in the results of research and development of regional scientific

organizations against the backdrop of the inability of the latter to fully meet the knowledge and technological needs of the region are direct threats to the innovation security of the Kaliningrad region. Their leveling requires a systemic reaction of regional government bodies through an active innovation policy for the long-term development of the region, taking into account the dynamism of the needs and interests of participants in the innovation process in the ever-changing geospace and respecting the general line of development of Russia's national innovation system.

All recent development strategies of Kaliningrad region are excessively focused on land borders while overseeing the maritime economy and the capacity of the coastal zone. Being the open gates to the global economy the Baltic Sea coast can provide linkages to the global production and innovation networks. The increased diversity of partners around the globe will ensure sustainability of the regional economy, make it "seismic resistance" to the geoeconomic turbulences. The possibility of long-term forecasts will balance out the share of advanced manufacturing technologies being created and implemented, as well as facilitate industrial R&D

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