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# COASTAL COUNTRYSIDE INNOVATION DYNAMICS IN NORTH-WESTERN RUSSIA

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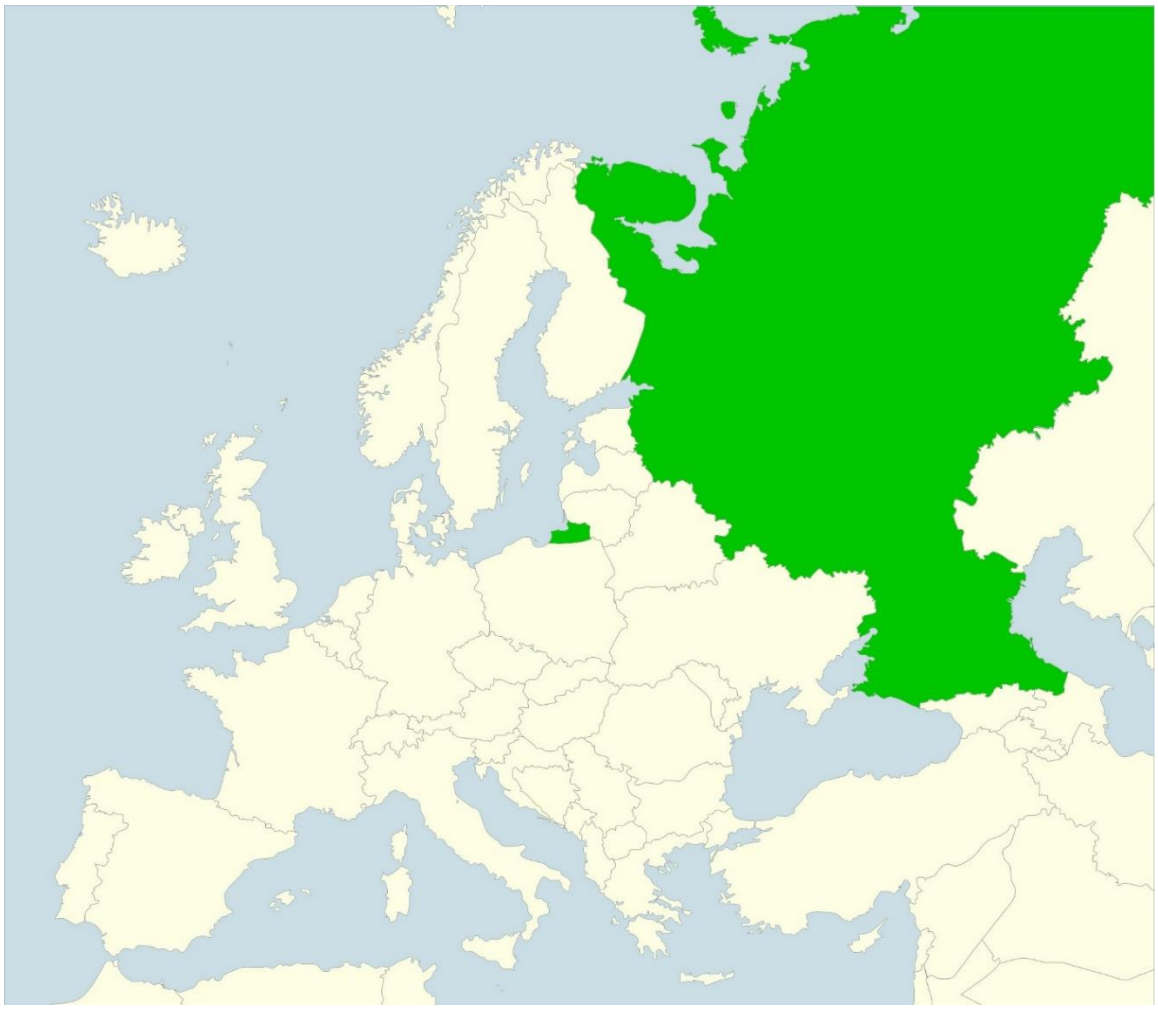

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**Abstract:** Coastal regions are generally conceived as highly advanced in terms of socio-economic and innovative development. Acting as international contact zones, coastal agglomerations are described as gateways for absorbing new knowledge, technologies, business cultures, etc. Yet, this perception is based on studies of large coastal cities and agglomerations. In our study, we focus on coastalization effects manifested in rural settlements and evaluate the innovation capability of the economies of coastal rural areas. The research scope covers 13 municipalities of the Leningrad region, including 134 rural settlements. The research methodology is structured into three main blocks: the evaluation of the human capital, assessment of the favorability of the entrepreneurial environment, and analysis of susceptibility of local economies to innovations. The list of analyzed innovation dynamics parameters includes the geospatial data for the distribution of population, companies and individual entrepreneurs, localization of specialized support and innovation infrastructure, sectoral analysis of the economic structure, digitalization aspects, et cetera. The data coverage period is 2010–2019 with variations depending on the availability of individual indicators. The research findings reveal particular features of the countryside as compared to urban settlements. Strong asymmetries are observed between the development of rural settlements cross-influenced by coastalization, near-metropolitan location, and national border proximity.

**Keywords:** innovation dynamics, coastal countryside, suburbanization, coastal region, Leningrad region, Russia

## 1. Introduction

Coastal sprawl is the contemporary phenomenon that outlines an all-embracing shift to marine coasts. Studies suggest that people all over the globe tend to settle down in coastal cities and peri-urban coastal zones contributing to de-structuring of traditional rural economies and communities (Barragán and de Andrés, 2015; Beach, 2002; Leontidou and Marmaras, 2001; Sayas, 2006). Today, coastal zone occupies two-thirds of world cities and an average population density of coastal regions is over twice the values of inland territories (Cracknell, 1999; Emerton, 2006; Mee, 2012; Small and Nicholls, 2003). As noted by Bell et al. (2013), over half of the southern coasts of Europe are already heavily urbanized. Being favorable to the concentration of population, coastal areas are overcrowded, overdeveloped, and overexploited (Barragán and de Andrés, 2015; Hinrichsen, 1996). Such facts supporting the hypothesis on the global coastalization trend foster the development of specific policies on integrated coastal zone management. The logic behind it is to withstand an excessive population density and anthropogenic pressure on the coastal ecosystem, as well as to secure the lifestyle of local societies. With that, spatial delimitation is usually held on a rather conditional basis by outlining a 50–150 km-wide band of horizontal distance from the nearest point of coastline on to the edge of major coastal agglomerations (e.g. according to Small et al. 2000, the highest values of population density are found within 20 km of coast that starts to diminish beyond 100 km).

Despite the ‘coastal rush’ (McFadden, 2007) being registered, coastal areas should not be considered as homogeneous space, as it is extremely variable by social, economic, cultural and environmental profile (Balaguer et al., 2008). Numerous coastal territories remain almost pristine or underdeveloped peripheral communities (Mee, 2012; Morrissey, 2015). Our recent study reveals a considerable difference between the types of coastal regions found in Europe. For instance, coastal border regions defined as administrative-territorial units corresponding to the second level of a common classification of state territorial units for statistics (NUTS 2) with a state border over land, lake or river surface, are characterized by reduced labor productivity, lower level of population density, decreased gross regional product (GRP) in purchasing power parity (PPP) growth rate (Mikhaylov et al., 2018). Regional disparities in the socio-economic development are particularly distinctive on a NUTS 3 scale and between local administrative units (LAU) due to an interplay of objective (e.g., environmental, demographic) and subjective (e.g.,

institutional) factors (e.g., see Pomianek and Chrzanowska, 2016). However, results on the evaluation of the regional divergence dynamics in the Baltic region argue for increased returns on public investment in infrastructure and industrial support of peripheral territories as compared to major agglomerations (Fedorov and Mikhaylov, 2018). Thus, additional support given to periphery might unlock regional potential, contribute industry clustering, attract investment and ensure positive externalities.

The purpose of this article is to identify the features in the innovation development and the penetration of innovations into coastal rural areas in comparison with other landlocked rural areas. The hypothesis of the study is that, due to its economic and geographical position near marine ports as transport and logistics hubs, coastal rural areas are more predisposed to attract and implement innovations than inland rural areas. The focus is on assessing the human, infrastructural and technological potential of the economy of coastal rural areas in comparison with other rural areas, reflecting its susceptibility to innovation.

## 2. Literature review

The conventional perception of rural territories as being dominated by agricultural activity is no longer valid. Countryside has transformed into a multifunctional space that is particularly attractive to small and medium-sized enterprises (SMEs) of creative economy sectors – advertising, architecture, arts and antique markets, crafts, design, designer fashion, film, video and photography, software, computer games and electronic publishing, music and the visual and performing arts, publishing, television and radio, etc. (Roberts and Townsend, 2016; Šťastná et al., 2018; Townsend et al., 2017). Anderson et al. (2016) and Ross (2008) suggest that businesses engaged in creative industries are an opportunity for rural areas to ease the transformation from agricultural domain and smoothen the existing inequalities in the level of socio-economic development, while daily work commutes to adjacent urban areas wash away the urban-rural delimitation (Stonawská and Vaishar, 2018). Similar structural transformations occur in small towns that were established at mineral deposits, historical trade routes, large public industrial complexes, etc. (Vaishar et al., 2015). Modern information communication technologies (ICT), broadband connectivity in particular, compensate the remoteness of rural communities by fostering shrinkage of time and space between the collaborating stakeholders and reinforce the importance of a-spatial proximities (such as cognitive, organizational, technological, etc.) in connecting people from the core and the periphery (Boschma, 2005; Salemink et al., 2017; Townsend et al., 2017).

As it is mentioned by Hart et al. (2005), the scale of “peripherality” and “rurality” is difficult to define. Such a distinction does not necessarily coincide with geographical remoteness, as proven in the case of coastal regions. Studies indicate numerous classifications of rural settlements since significant variations are visible within rural economies (Blacksell, 2010; Lang, 2015; Naldi et al., 2015; Pomianek and Chrzanowska, 2016; Šťastná et al., 2013). Townsend et al. (2013) suggest using two broad categories: geographical locality and social representation, which would encompass a wide range of indicators used (e.g. remoteness from major urban centers, population density, availability of infrastructure). An extensive literature review on different approached to define rural areas or countryside is given by Stonawská and Vaishar (2018). They concluded with the proposition of the following typology: progressive countryside, deficit countryside and suburban countryside. The defining principles behind the aforementioned classification are the general factors (natural conditions, accessibility being measured as distance and transport conditions from regional centers, and path dependency) and individual factors (population number, human and social capital, the factor of urban planning and construction).

Numerous recent studies conclude for pronounced differences in socio-economic and innovative development level of rural areas with an advanced position of those located within the coastal zone. Salemink et al. (2017) hypnotized that territories within the coastal zone are at the forefront of human activity, thus, are expected to be less affected by greater distance and lower density factors that discourage the market from investing in new technologies, such as digital subscriber line (DSL), fiber optics, or mobile broadband. Coastal rural areas of Poland (gminas) are found to be as developed as the major semi-urban areas adjacent to major cities – Warsaw, Szczecin,

Poznań, Wrocław and Kraków (Pomianek and Chrzanowska, 2016). Similar divergence between the development of rural areas located in coastal and interior areas are found in a recent study held in the UK grounded on the figures of self-employment (excluding freelancers, subcontractors and agency workers) as an indication of innovative entrepreneurship – a crucial 'ingredient' in regional growth (Faggio and Silva, 2014). Results suggest that regions located at immediate proximity to the sea have double the figures on the share of self-employed and business ownership. Sánchez-Zamora et al. (2014) noted that coastal rural territories of Spain located in close proximity to provincial capitals show particularly strong economic dynamism, sufficient level of infrastructure development, and high demographic potential. Although, they still experience the development gaps typical of rural areas – high unemployment rate, minimum availability of facilities, and tourism specialization.

Numerous studies have considered individual aspects of the socio-economic and innovative development of urban settlements in the Leningrad region of Russia and the city of St. Petersburg as coastal areas with metropolitan status (Druzhinin et al., 2017; Druzhinin et al., 2018; Kuznetsov et al., 2017; Lachininskii and Semenova, 2015). In particular, it is noted that the Leningrad region is one of the few regions of Russia with a prolonged and large-scale impact of the marine factor on the settlement system. In the last quarter of the century, historically inherent manifestations of coastalization gained new impetus, contributing to the development and expansion of the coastal zone, and its structuring, stratification into separate segments with specific socio-economic, demographic and existential dynamics. However, these studies lack individual attention to coastal rural settlements.

## 3. Methodology

The scope of the study is the territory of the Leningrad region of the Russian Federation, covering a total of 13 municipalities, of which 1 urban district and 12 municipal districts, consisting of 134 rural settlements. The administrative-territorial structure of the Leningrad region was approved by the regional law No. 32-oz dated June 15, 2010 "On the Administrative-Territorial Structure of the Leningrad region and the Procedure for Changing It". The Sosnovy Bor urban district and 3 municipal districts (Kingiseppskiy, Vyborgskiyskiy, Lomonosovskiy) with a total number of 25 rural settlements fall within the limits of the coastal zone. The subject of the research is the peculiarities of the innovative development of coastal rural areas of the Leningrad region with respect to other rural areas. Due to the limited variety of available statistical indicators of innovative development for individual urban and rural settlements of municipal districts, data were used that characterize the potential and readiness of the economy of coastal rural areas to intensify innovative processes. All data used in the analysis can be grouped into three blocks:

- data characterizing the human capital of rural areas – the vital resource of the innovation economy;
- data characterizing the favorability of the entrepreneurial environment in rural areas through an assessment of the support service system for business and innovation processes, including the availability of specialized infrastructure to support small and medium enterprises (SMEs), the provision of banking, financial, information and other specialized services in the field of entrepreneurship, as well as assistance to innovation activity;
- data characterizing the susceptibility of rural economies to innovations, in particular in the information and communication sphere through the spread of mobile communications and the Internet as the main factor of economy digitization, and in traditional industries (primarily in agriculture and the maritime economy as the leading activities for coastal rural areas) through technological modernization and the introduction of new equipment and technology.

The human capital of rural areas is analyzed on the basis of an assessment of the distribution of the population with higher and postgraduate (tertiary) education between the municipalities of the Leningrad region. Women and men aged 15 and over are counted[5]. The next census will be

[5] Source of data – the All-Russian population census of 2010.

held in 2020. In the operational statistical reports, this information in the context of rural areas is not collected; therefore, the restriction to monitoring the process of accumulating human capital is a large time period between the collection and representation of data. The involvement of human capital in the economy is estimated through the ratio of the number of business entities to the population. Among the business entities large, medium, small and micro companies are taken into account, as well as individual entrepreneurs – individuals registered in accordance with the law and engaged in entrepreneurial activities without forming a legal entity. It can be argued that the higher the density and diversity of companies per 1000 inhabitants, the greater the opportunity to use human capital within the municipal area. Special attention was paid to the distribution and dynamics of small, micro-companies and individual entrepreneurs in the context of the municipalities of the Leningrad region, since the increase in their number is an indicator of the growth of entrepreneurial activity of the population. The available period of data coverage on the number of business entities is 2013–2017.

Favorability of a business environment is assessed using a number of indicators. Firstly, the location of objects of specialized support and innovation infrastructure, promoting the development of entrepreneurship and innovation. The supporting infrastructure includes: microfinance organizations, multifunctional public service centers “MFC” for business, which provide on-site state and municipal services to citizens and legal entities on the basis of publicly available online services of the Russian Federation “State Services – Gosuslugi”, business support centers, agricultural advisory centers. The innovation infrastructure includes: private and state business incubators, industrial parks, engineering centers, technology parks (technopoles), centers of certification, standardization and testing (collective use). Secondly, the spatial distribution of ATMs of the largest Russian banks: Sberbank, Gazprombank, Pochta Bank, VTB, VTB Bank of Moscow, Rosselkhozbank, Ural Bank RiR, Bank Saint-Petersburg, Vostochny Express Bank, Baltinvestbank, Alfa-Bank, Raiffeisenbank, Promsvyazbank, Mosoblbank, Bank Zenith, Binbank, Surgutneftegazbank, FC Otkritie, Tavrichesky, Ak Bars Bank, Bank Vozrozhdenie, Bank Yugra, Sovcombank. On-site access to specialized support and innovation infrastructure services is a factor that improves the institutional context and basic conditions for doing business, eliminates bureaucracy and corruption, and reduces the time and effort to obtain information, analysis, financial and other types of services. The data is presented as of the 1st half of 2019. The main limitation to the study is the impossibility of building a dynamic data series to establishment of individual support infrastructure and ATM facilities in each time period due to the absence of such data in official statistics. Therefore, the current (latest) time period is used taking into account all existing specialized organizations and ATMs available according to their address in the Leningrad region.

The susceptibility of the municipal economy to innovation is estimated based on the following indicators: firstly, the sectoral distribution of economic entities with the identification of activities with a greater potential for generating and introducing innovations; secondly, the technological equipment of the traditional economy sectors for coastal rural areas (distribution of agricultural machinery and equipment, including those under 4 years old, across the municipalities of the Leningrad region; technological modernization and infrastructure investments of four seaports in Ust-Luga, Primorsk, Vysotsk and Vyborgskiy). thirdly, the ICT development (location of base stations and coverage of 3G and 4G mobile communications provided by the five largest mobile operators – Beeline, MegaFon, MTS, Tele2, Skylink).

The choice of these indicators is based on several assumptions:

- different economic activities have different potential for generation and absorption of innovations;
- Internet access contributes to the development of human capital in rural areas, has a positive effect on the dissemination of knowledge and technology products through outsourcing and remote work, facilitates interregional communication, etc.;
- technologization of agriculture reflects the level of introduction and demand for technological innovations in rural economies;

- development of port activities reflects the coastal specifics of the absorption of innovations by rural areas, including through inclusion in communication flows and direct technologization of enterprises in this type of activity.

The data on the sectoral structure of the distribution of economic entities is presented for 2013–2017. The activities with high capacity to generate innovations are: information and communication technologies (ICT), including software development; research and development (R&D). The activities high capacity to consume (implement) innovation are manufacturing industries, including the production of motor vehicles; paper and paper products; computers, electronics and optics; electrical equipment; leather and leather goods; clothes; textiles; coke and oil products; drugs and medical supplies; machinery and equipment; furniture; metal products; metallurgy; mineral products; food and beverages; tobacco products; rubber and plastic products; chemicals and products; other finished products. Individual consideration is given to services for business: financial services; law and accounting; insurance; administrative and ancillary services for business; supporting activities in the field of finance and insurance; postal and courier services. The group of traditional industries includes significant activities for coastal rural areas that reflect the coastal and rural specifics of the economy of these territories: agriculture and hunting; fishing and fish farming; water transport, warehouses and logistics. The sectoral composition of companies and individual entrepreneurs is considered in the context of municipalities of the Leningrad region.

The dynamics of mobile telephony coverage in rural areas is estimated based on a comparison of data made for two time slices of 2010 and 2019. The dynamics of the creation of mobile base stations from 2004 to 2019 is also analyzed. The limitation to the study of the dynamics of the digitalization process is that the information on the exact location of the base stations is inaccessible due to its confidentiality. It is gathered by private initiative and is accumulated on a specialized website, which is continuously updated. The data is complete and reliable featuring exact addresses and photos, but, perhaps, not exhaustive. The source of data on the technological equipment of agricultural enterprises is the All-Russian Agricultural Census 2016. The previous one was held in 2006. The main types of agricultural machinery and equipment are: tractors, combine harvesters and forage harvesters, plows, planters, potato planters, organic fertilizer spreaders, machines for plant protection, mineral fertilizers and limes plant, mowers, balers, agricultural loaders, harrows of all kinds, postharvest machines for processing of grain, postharvest dryers, grain drying prior to storage on the mortgage, milking machines, milk coolers, cattle feeders, trucks. The source of data on the development of port complexes in the Leningrad region in 2016 – 2018 and plans for subsequent periods are open materials, analytical reports and the research of the Transport Department of the Leningrad region.

All of the selected indicators correspond to the innovation development dimensions found in the Global Innovation Index (URL: www.globalinnovationindex.org) co-published by Cornell University, INSEAD, and the World Intellectual Property Organization (United Nations) and the Innovation Development Rating of the subjects of the Russian Federation (URL: www.issek.hse.ru/rir) developed by the Institute for Statistical Studies and Economics of Knowledge of the Higher School of Economic, however, taking into account the agricultural and coastal specifics of rural areas. The general methodological approach to studying the countryside specifics of innovation entrepreneurship is adopted from the study of Voloshenko and Mikhailova (2012).

A general limiting factor to the study of coastal rural areas is the impossibility of building complete series of statistical data on all selected indicators for a single period, since the collection of data in the context of municipalities and individual rural settlements of the Leningrad region is carried out in separate surveys and is not part of the annual monitoring.

## 4. Research results

### 4.1 Human capital of coastal rural areas

As of January 1, 2019, over 1.8 million people lived in the Leningrad region. The average population density was 25 people per sq.km. The distribution of the population between

the 13 municipalities of the Leningrad region is not homogenous. More than half of the population of the region is concentrated in 4 districts: Vsevolozhskiy (398.9 thousand people or 21.6%), Gatchinskiy (243.2 thousand people or 13.2%), Vyborgskiy (199.6 thousand people or 10.8%), Tosnenskiy (128.3 thousand people or 6.9%), which are located in close proximity to St. Petersburg – the second largest city of Russia with a population of 5.4 million people. The smallest population lives in areas distant from the northern capital – Lodeinopol'skiy and Podporozhskiy – 28 thousand people each or 1.5%. A total of 417.6 thousand people or 22.6% of the total population of the Leningrad region live in the coastal zone of 12 thousand square kilometers. The average population density in coastal areas is higher than in other municipalities with no direct access to the sea – 34 vs 23 people per sq.km.

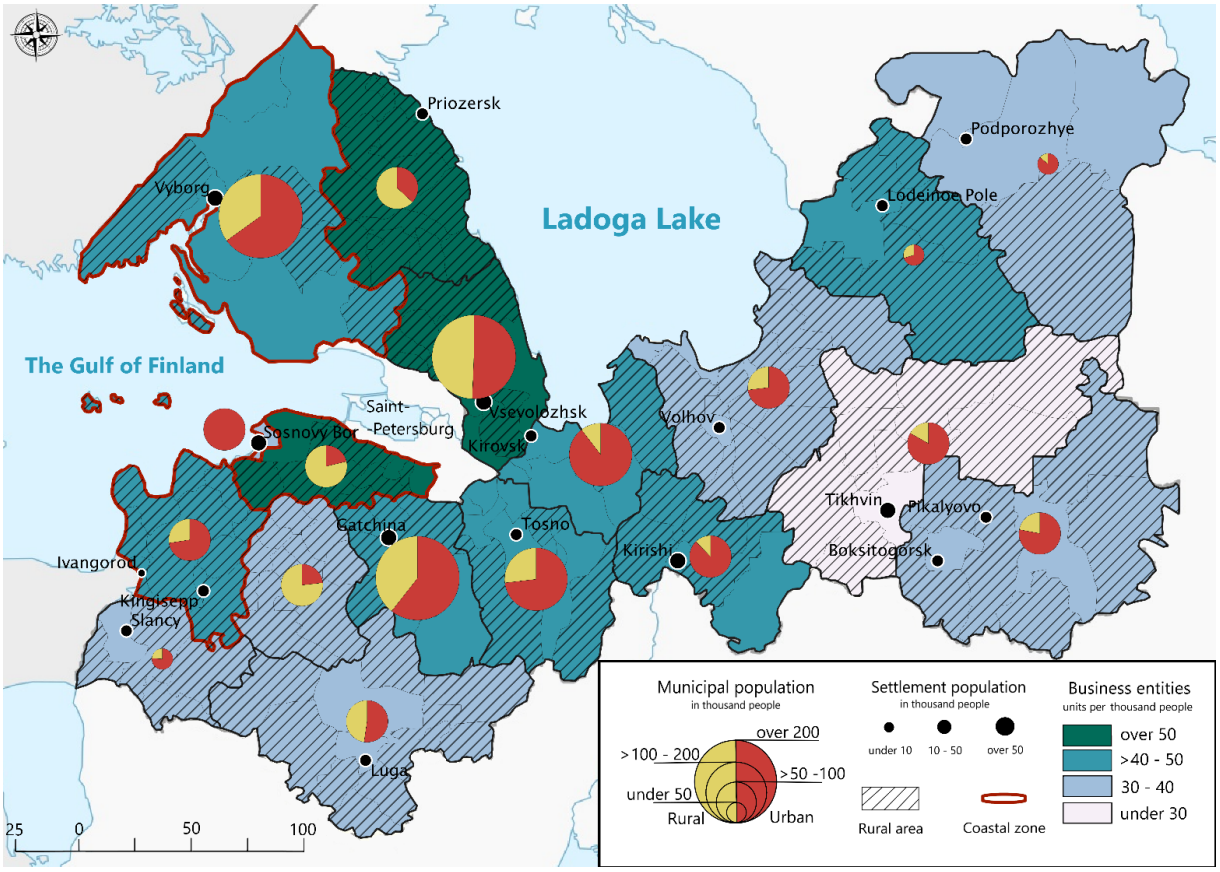


*Fig 1. Distribution of population and business entities by municipal districts of the Leningrad region. Source: Petrostat, Rosstat[6], Spark database[7]*

The Leningrad region has an extensive system of 134 rural settlements in which more than 659 thousand people live or 35.6% of the population of the Leningrad region. The proportion of the rural population in municipal areas in relation to urban ranges from 10.3 to 78.6% (Fig. 1). Municipal districts with the prevalence of the rural population (more than 50%) are Lomonosovskiy, Volosovskiy, Priozerskiyiy. The largest rural settlements are located in the Vsevolozhskiy, Vyborgskiy (coastal), Gatchinskiy, Tosnenskiy, Lomonosovskiy (coastal) districts: on average, 1 settlement of these districts accounted for 18.1; 14.0; 8.7; 6.8 and 5.2 thousand inhabitants, respectively. Up to 22.5% of the entire rural population of the Leningrad region is concentrated in the coastal zone, including Vyborgskiy municipal district with 70.0 thousand people, Lomonosovskiy – 57.7 thousand people, Kingiseppskiy – 20.5 thousand people.

[6] Office of the Federal State Statistics Service for St. Petersburg and the Leningrad region (Petrostat). Russian Federal State Statistics Service (Rosstat).

[7] Spark database. Legal entities and individual entrepreneurs of the Leningrad region.

For 10 years from 2010 to 2018 the population in the Leningrad region grew by 7.9%, incl. rural population – by 13.1%. Population growth accounted for 6 municipal districts: Vsevolozhskiy (52.3%), Volosovskiy (5.4%), Gatchinskiy (4.8%), Kirovskiy (3.9%), Lomonosovskiy and Tosnenskiy (3.5% each), and Sosnovy Bor urban district (3.6%). The growth of the rural population in some areas underwent at a faster pace (in Vsevolozhskiy – by 75.7%, Gatchinskiy – by 7.2%, Volosovskiy – by 6%) or proceeded against the background of a reduction in the urban population (in Vyborgskiy by 3.5% Kingiseppskiy – by 2.5%, Priozerskiy – by 1.3%). In the coastal areas in 2010–2018, the population grew slightly – by 0.6%, while the rural population decreased by 0.9%. The share of the coastal rural population in the total rural population also decreased from 25.7 to 22.5%. The main source of population growth in the Leningrad region is migration growth, which has a positive trend against the background of the average annual natural population loss in 2013–2017 – 9.1 thousand people per year. The steady trend in reducing the natural population decline in the last 5 years was characteristic only for the near-metropolitan Vsevolozhskiy municipal district, which in 2017 was the only one to demonstrate a small natural increase in the number of inhabitants by 48 people.

In the coastal areas in 2013–2017, the average total annual reduction of the population due to natural loss is 1.6 thousand people per year, which is about 17% of the total natural loss in the Leningrad region as a whole. The highest absolute loss of population from the excess of mortality over birth rate among the coastal municipal areas is found in Vyborgskiy and Lomonosovskiy. The main migration flow in the Leningrad region (in 2017, 85.6% of the migration increase) was directed to rural areas, including the move from town to village. Interregional migration dominates in the structure of migration growth, i.e., the Leningrad region and, to a large extent, its rural settlements attract people from other regions of Russia. Primarily, this refers to the near-metropolitan municipal districts, which are close to St. Petersburg. In 2016–2017, the annual influx of migrants from the CIS countries more than doubled, reaching 22.9% of the total migration and 15.7% of the migration to rural areas. A similar trend is observed for migrants from other countries, but in absolute terms, their volume remains insignificant (1% of all migrants) [8].

The share of the population with higher and postgraduate (tertiary) education varies between the municipal districts of Leningrad region from 12.4 to 31% (Fig. 2). The level of education above the regional average (21.3%) is noted in 5 municipalities: Sosnovy Bor urban district (31%), Vsevolozhskiy municipal district (29.9%), Gatchinskiy municipal district (24.4%), Vyborgskiy municipal district (21.8%) and Kirovskiy municipal district (21.5%). Two of these top-5 municipalities are coastal and all are adjacent to St. Petersburg. The remaining two coastal municipal districts (Lomonosovskiy and Kingiseppskiy) also have a fairly high rate of education of the population – over 19%. In general, in the coastal regions, 25% of all residents with higher and postgraduate education are concentrated, including 27.7% of all persons with tertiary education. The two municipal districts with the largest share of the rural population demonstrate different levels of education among residents. While the coastal near-metropolitan Lomonosovskiy municipal district has a fairly high rate – close to the average in the Leningrad region, the Volosovskiy municipal district with no access to the sea and somewhat remote from St. Petersburg takes the last place among all the regions according to the indicator under consideration. In general, municipal districts remote from St. Petersburg demonstrate a lower proportion of the population with higher and postgraduate education.

[8] Office of the Federal State Statistics Service for St. Petersburg and the Leningrad region (Petrostat). Osnovnyye pokazateli demograficheskikh protsessov Leningradskoy oblasti v 2017 [Key indicators of demographic processes in the Leningrad region in 2017]. Petrostat: St. Petersburg, 2018.

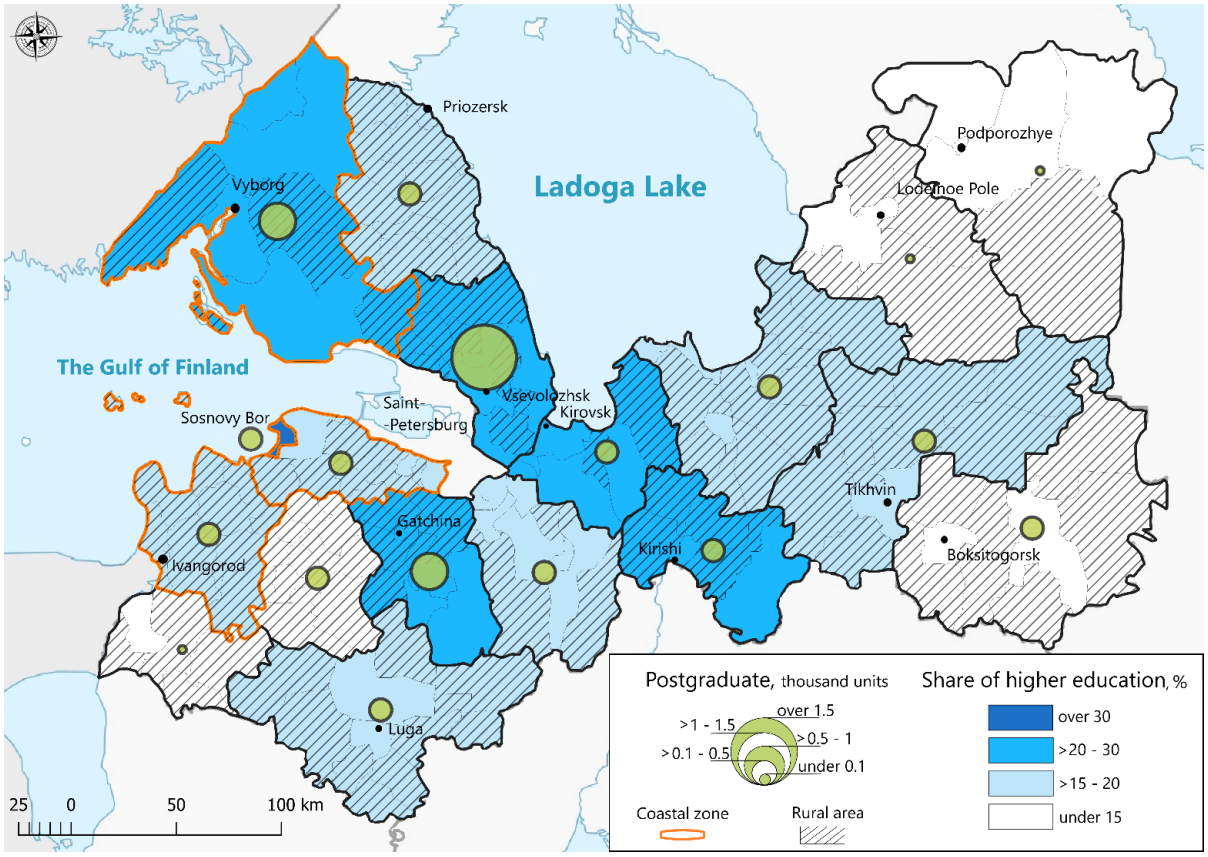


*Fig 2. Distribution of the population with higher and postgraduate education among the municipalities of the Leningrad region. Source: according to the 2010 All-Russian Population Census*

The use of human capital in the municipal economies is estimated through the dynamics of existing business entities per 1000 people (Fig. 1). It is calculated that the higher the ratio of business entities relative to the number of inhabitants, the more widely the existing human potential of the area is used. In 2017, more than 50 companies and entrepreneurs per 1000 residents were registered in the Lomonosovskiy, Priozerskiy and Vsevolozhskiy municipal districts with a large share of the rural population; from 40.5 to 48.5 – in the municipal areas of the external belt of the St. Petersburg agglomeration: Kingiseppskiy, Vyborgskiy, Gatchinskiy, Kirovskiy, Tosnenskiy and Kirishskiy, as well as in Lodeinopol'skiy. In the rest of the municipal districts – less than 40, which is below the regional average indicator (43 economic entities per 1000 population). In the period 2013–2017, all municipal districts (excluding the Sosnovy Bor urban district) had a positive trend in the number of companies (legal entities) and individual entrepreneurs relative to the population. The largest increase (above the regional average) was observed in 9 municipal districts, incl. in 2 coastal (Slantsevskiy – by 14.1 business entity per 1000 people; Kingiseppskiy – by 13.0; Lodeinopol'skiy – by 12.9; Kirishskiy – by 12.4; Podporozhskiy and Vsevolozhskiyy – by 11.8; Luzhskiy – by 11.5; Tosnenskiy – by 11.1; Vyborgskiy – by 10.2). Note that more than half of all business entities in the Leningrad region are individual entrepreneurs. On average, in the region, their share for 2013–2017 increased by 7.5% from 50.7 to 58.2%, and in some areas growth was over 10% (Boksitogorskiy, Vsevolozhskiy, Lomonosovskiy), which indicates growth of entrepreneurial activity of the population. The largest share of individual entrepreneurs in the number of business entities (over 65%) is registered in remote areas: Slantsevskiy, Volosovskiy, Boksitogorskiy and Lodeinopol'skiy. In the structure of legal entities, the leading role belongs to small and micro enterprises, they account for more than 90% of all companies in the Leningrad region. In the period 2013–2017, most municipalities (with the exception of the Volkhovskiy, Volosovskiy and Kirishskiy districts) were characterized by positive dynamics in the share of small and micro enterprises. Nearly 30% of all companies and 24% of individual entrepreneurs of the Leningrad region are concentrated in coastal areas. However, despite the increase in the absolute number

of business entities in 2013–2017 (legal entities by 5% to 9221 units and individual entrepreneurs by 43% to 10547 units), their share in the total volume in the Leningrad region decreases.

### 4.2 Favorability of business environment in coastal rural areas

Favorable business environment of the area is largely determined by the presence of a variety of organizations that contribute to business development, including by providing information, analytical, investment and other specialized services. In the Leningrad region, as of 2019, there are 62 supporting infrastructure facilities that foster the development of entrepreneurship (Fig. 3).

Each municipality has business support organizations, but their distribution between districts is uneven. Most of the support organizations are concentrated in the two near-metropolitan areas – Vsevolozhskiy and Gatchinskiy municipal districts (per 7 pcs.), in Boksitogorskiy, Vyborgskiy and Kirovskiy municipal districts – per 5 pcs.; in Priozerskiy – 4 pcs.; Kingiseppskiy, Kirishskiy, Lodeinopol'skiy, Podporozhskiy and Tosnenskiy – per 3 pcs. each; other municipalities have 2 organization each. The structural ratio analysis suggests that Multifunctional centers (MFC) for business occupy 51.6%; business support centers – 35.5%; microfinancial organizations – 8.1%; agricultural advisory centers – 4.8%. More than 88% of all organizations supporting business development are located in cities. In rural areas, the availability of business support services is low: 6 MFCs (in Vyborgskiyskiy, Vsevolozhskiyy, Priozerskiyiy and Gatchinskiy municipal districts) and 1 business support center in the Volosovskiy municipal district. In the coastal areas, there are 12 supporting infrastructure facilities: 7 MFC for business, incl. 1 – in the countryside; 4 business support centers; 1 agricultural advisory center.

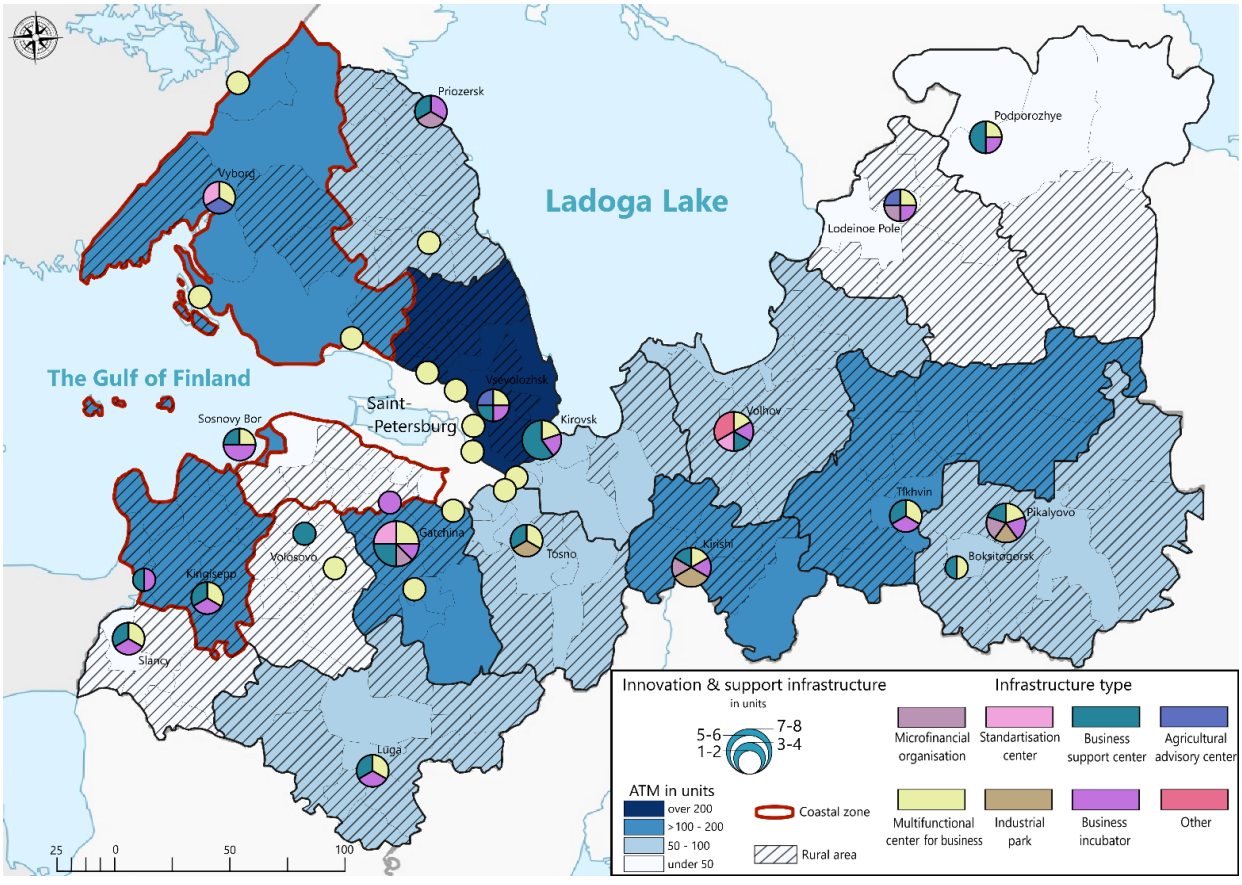


*Fig 3. Distribution of support and innovation infrastructure between municipalities of the Leningrad region, 2019. Source: INGURU[9], MSP Business Navigator[10]*

[9] INGURU. Database on ATMs in the Leningrad region.

[10] MSP Business Navigator. URL: https://navigator.smbn.ru/support/2/filters/1/3

Note that the multifunctional centers of public services “Gosuslugi” for individuals, by contrast, are more accessible to rural residents than to urban ones. On average, in rural areas there are 4545 people per 1 MFC for individuals, while in urban settlements there are 6833 people. MFCs have denser coverage in rural areas with the greatest availability in the areas of the outer belt of the St. Petersburg agglomeration (120 km from St. Petersburg). First of all, these are Volkhovskiy, Kirishskiy, Tihvinskiy, Podporozhskiy, Slantsevskiy, Luzhskiy and Volosovskiy municipal districts. The largest districts with the maximum rural population located in the zone of influence or included in the St. Petersburg agglomeration – Vsevolozhskiy, Gatchinskiy, Vyborgskiy and Tosnenskiy have a large load on the MFC for individuals per population (Table 1). The total load on the MFC for individuals in coastal areas is higher than in inland areas, which is true for both urban and rural areas.

In the Leningrad region, 28 innovation infrastructure facilities are concentrated (Fig. 3). In a structural ratio, 60.1% is accounted for business incubators, 17.9% – industrial parks, 10.7% – standardization centers, 10.7% – other (engineering center, technopark, center for certification, standardization and testing). Business incubators are available in 14 of 18 municipalities. The overwhelming number of innovation infrastructure facilities is concentrated in cities, with the exception of 2 industrial parks (the village of Pushnoye, the Vyborgskiy district and the village of Taitsy, the Gatchinskiy district) and 1 business incubator (the village of Telman of the Tosnenskiy district). In two municipal districts with the largest share of the rural population – coastal Lomonosovskiy and Volosovskiy, there are no objects of innovation infrastructure. In general, in the coastal zone there are only 6 innovation infrastructure facilities (4 business incubators, 1 industrial park, 1 standardization center), including 1 in the countryside.

*Tab 1. The spatial distribution of the MFC for individuals in the Leningrad region, 2019. Source: Committee for Communications and Informatization of the Leningrad region. List of Multifunctional centers of public services in the Leningrad region*

| Municipality | MFC | | | Load, people per 1 MFC | |
|---|---|---|---|---|---|
| | total | Incl. in rural areas | | | |
| | | pcs. | % | total | Incl. in rural areas |
| Volkhovskiy | 19 | 13 | 68.4 | 4688 | 1847 |
| Kirishskiy | 15 | 4 | 26.7 | 4138 | 1892 |
| Tihvinskiy | 14 | 6 | 42.9 | 4969 | 1917 |
| Podporozhskiy | 10 | 2 | 20.0 | 2826 | 1918 |
| Slantsevskiy | 11 | 5 | 45.5 | 3863 | 2031 |
| Luzhskiy | 21 | 14 | 66.7 | 3430 | 2445 |
| Volosovskiy | 21 | 16 | 76.2 | 2460 | 2485 |
| Kingiseppskiy | 18 | 8 | 44.4 | 4232 | 2564 |
| Boksitogorskiy | 14 | 4 | 28.6 | 3518 | 2687 |
| Kirovskiy | 20 | 4 | 20.0 | 5297 | 2726 |
| Lodeinopol’skiy | 8 | 3 | 37.5 | 3566 | 2795 |
| Priozerskiy | 17 | 11 | 64.7 | 3590 | 3516 |
| Lomonosovskiy | 18 | 14 | 77.8 | 4082 | 4123 |
| Tosnenskiy | 20 | 6 | 30.0 | 6416 | 5672 |
| Vyborgskiy | 27 | 10 | 37.0 | 7392 | 7006 |
| Sosnovy Bor | 8 | 0 | 0.0 | 8543 | - |
| Gatchinskiy | 25 | 10 | 40.0 | 9726 | 9582 |
| Vsevolozhskiy | 33 | 15 | 45.5 | 12088 | 12074 |
| Total | 319 | 145 | 45.5 | 5793 | 4545 |

The calculation of the institutional density indicator for all municipalities of the Leningrad region as the ratio of the sum of supporting and innovative infrastructure organizations to the total number of companies and individual entrepreneurs showed the greatest infrastructure provision of the municipalities distant from St. Petersburg: Boksitogorskiy, Podporozhskiy and Lodeinopol'skiy municipal districts, featuring 4.5, 3.7 and 3.0 facilities of supporting infrastructure per 1000 business entities. Another 8 districts (Kirishskiy, Volkhovskiy, Slantsevskiy, Tihvinskiy, Priozerskiy, Sosnovy Bor, Kirovskiy, Kingiseppskiy) are provided with organizations supporting business and innovation at a higher level than the average in the Leningrad region (1.2 organizations per 1000 business entities). The smallest institutional density is of the remaining 7 municipal districts (Volosovskiy, Gatchinskiy, Luzhskiy, Vyborgskiy, Tosnenskiy, Lomonosovskiy, Vsevolozhskiy), in which, with a similar number of supporting and innovative infrastructure, the number of business entities is much higher. The differences between the first (Boksitogorskiy) and the last (Vsevolozhskiy) municipal districts by the number of companies and individual entrepreneurs is almost 11 times (with the dominance of the latter), meanwhile, the number of support infrastructure facilities is similar – 7 and 8.

The availability of financial services in coastal rural settlements of the Leningrad region was estimated based on the distribution of ATMs of the largest banks (Fig. 3). The sample was 1,671 ATMs, the major share of which falls on Sberbank. In absolute terms, the leaders in the concentration of ATMs are the near-metropolitan districts: Vsevolozhskiy (214 units), Vyborgskiyskiy (179 units), Gatchinskiy (169 units), while outsiders are areas with a prevalence of the rural population (Volosovskiy with 18 units and Lomonosovskiy with 26 units) and remote from St. Petersburg (Podporozhskiy with 32 units and Lodeinopol'skiy with 33 units). 26.8% of all ATMs of the Leningrad region with a density of 1.1 ATM per 1000 inhabitants are concentrated in coastal areas, which is higher than for the inland regions (0.9 ATM per 1000 people). In general, the most affluent by the number of ATMs are Kirishskiy (2.2 ATM per 1000 people), Tihvinskiy (1.6 ATM per 1000 people), the coastal municipalities Sosnovy Bor (1.9 ATM per 1000 people) and Kingiseppskiy (1.5 ATM per 1000 people), which prevail by the urban population (over 75%). Provision of rural residents of the region, including in the coastal zone, with banking services is significantly lower than urban ones. The highest availability of ATMs per rural residents is observed in the following areas: Kingiseppskiy (note that 28% account for rural areas of the port of Ust-Luga), Podporozhskiy (only Vinnitsa village), Kirishskiy (only Glazhevo village and Pcheva village, located on the Kirishi-Volkhov highway), Luzhskiy district and Tosnenskiy district, part of the St. Petersburg metropolitan area. The lowest share is typical not only for remote areas where the presence of banks is relatively small (Boksitogorskiy, Slantsevskiy, Volosovskiy – 3.5, 2.9 and 1.1% of all ATMs), but also closest to St. Petersburg, experiencing agglomeration effect and pressure of the so-called "summer residents" (Gatchinskiy, Kirovskiy).

### 4.3 Susceptibility to innovation by coastal rural areas

Table 2 presents data on changes in the distribution of legal entities and individual entrepreneurs of the Leningrad region in the context of selected groups of industries: with increased potential for generating innovations; with increased potential for implementing innovations; business services and entrepreneurship support; traditional industries.

For all municipalities of the Leningrad region in 2013–2017, there was a growth in the number of business entities in industries with high potential for generating innovations: in some districts (primarily, in the near-metropolitan Vsevolozhskiy, Kirovskiy, Tosnenskiy) – more than twice. Also during this period, the share of business entities in these industries increased in relation to the total for all municipalities. In the least degree, the concentration of business entities in sectors with high potential for generating innovations was observed in remote areas (Volkhovskiy, Podporozhskiy, Boksitogorskiy) and areas with the prevalence of the rural population (Lomonosovskiy, Volosovskiy). Traditional industries continue to play a prominent role in the economic structure of municipalities of the Leningrad region, but the number of companies and individual entrepreneurs is actively decreasing, which is noted for all districts. In the coastal Sosnovy Bor urban district, by 2017 the number of companies in traditional and innovative industries had equalized. The number of business entities in the processing industries, which are potential consumers of innovations (primarily technological), is growing at a somewhat less rapid

rate. On average, in 2017 the share of these business entities ranged from 3.5 to 6.6%. A positive trend is demonstrated by business entities that provide business services and support for entrepreneurship, such companies and individual entrepreneurs are particularly active in distant Boksitogorskiy and Slantsevskiy districts, which indicates a revival of entrepreneurial activity in these areas.

*Tab 2. Distribution of economic entities of the Leningrad region by industry groups, 2013–2017. Source: Spark database*

| Municipalities | Share of business entities by industry groups of all business entities, % | | | | | | | | Growth of business entities over five years, % | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2013 | | | | 2017 | | | | | | | |
| | G | C | S | T | G | C | S | T | G | C | S | T |
| Boksitogorskiy | 1.1 | 4.0 | 0.8 | 8.2 | 1.6 | 4.5 | 2.0 | 7.8 | 108.3 | 55.6 | 244.4 | -24.0 |
| Volosovskiy | 0.8 | 3.6 | 2.0 | 7.0 | 1.5 | 4.6 | 2.9 | 9.7 | 107.7 | 45.6 | 71.0 | -37.1 |
| Volkhovskiy | 1.3 | 4.1 | 1.8 | 7.4 | 1.9 | 4.3 | 2.3 | 7.5 | 69.7 | 30.0 | 60.5 | -20.3 |
| Vsevolozhskiy | 2.3 | 4.5 | 3.4 | 5.3 | 3.3 | 4.9 | 4.1 | 4.9 | 126.0 | 67.5 | 86.6 | -29.9 |
| Vyborgskiy | 1.7 | 3.7 | 2.8 | 7.1 | 2.1 | 4.1 | 3.4 | 7.1 | 55.6 | 42.0 | 50.7 | -20.7 |
| Gatchinskiy | 1.9 | 6.0 | 3.2 | 6.0 | 2.9 | 6.1 | 3.5 | 5.9 | 98.7 | 32.9 | 39.7 | -22.7 |
| Kingiseppskiy | 1.5 | 4.8 | 3.0 | 9.8 | 2.0 | 4.6 | 3.4 | 9.4 | 81.4 | 30.6 | 51.8 | -23.0 |
| Kirishskiy | 1.6 | 3.3 | 2.7 | 9.1 | 2.0 | 4.3 | 3.2 | 7.2 | 73.3 | 83.3 | 64.0 | -10.2 |
| Kirovskiy | 1.6 | 4.5 | 2.0 | 5.5 | 2.9 | 5.1 | 2.2 | 5.6 | 126.8 | 41.7 | 40.6 | -20.3 |
| Lodeinopol'skiy | 1.8 | 3.1 | 1.7 | 6.5 | 2.2 | 3.1 | 2.2 | 6.3 | 70.6 | 36.7 | 81.3 | -23.2 |
| Lomonosovskiy | 1.5 | 6.5 | 2.6 | 10.3 | 1.7 | 6.4 | 3.0 | 9.1 | 37.3 | 16.8 | 38.2 | -5.3 |
| Luzhskiy | 1.8 | 3.5 | 2.2 | 8.0 | 2.2 | 3.4 | 2.9 | 7.1 | 69.2 | 31.6 | 80.9 | -16.3 |
| Podporozhskiy | 1.8 | 3.0 | 1.9 | 8.5 | 1.8 | 3.8 | 1.8 | 8.0 | 42.9 | 82.6 | 33.3 | -24.1 |
| Priozerskiy | 1.5 | 3.1 | 2.3 | 12.4 | 2.0 | 3.5 | 2.8 | 11.5 | 52.4 | 33.3 | 43.5 | -8.6 |
| Slantsevskiy | 2.1 | 5.7 | 1.7 | 6.0 | 2.3 | 6.2 | 2.7 | 5.3 | 65.2 | 70.5 | 150.0 | -27.0 |
| Sosnovy Bor | 3.3 | 5.9 | 3.4 | 3.5 | 4.3 | 5.0 | 3.9 | 4.3 | 30.3 | -15.1 | 13.0 | -17.2 |
| Tihvinskiy | 2.4 | 6.1 | 1.8 | 10.1 | 2.3 | 6.6 | 2.1 | 8.7 | 10.5 | 25.0 | 35.7 | 0.0 |
| Tosnenskiy | 1.1 | 5.3 | 2.2 | 5.9 | 2.0 | 5.7 | 2.7 | 5.6 | 138.6 | 46.1 | 67.9 | -24.0 |

Note: G – generation, C – consumption, S – support, T – traditional.

Comparative analysis of the territorial distribution of business entities in the context of the marine and agricultural sectors resulted in the division of the municipalities of the Leningrad region into predominantly agricultural, marine or mixed ones. The group of 9 municipal districts – Volosovskiy, Volkhovskiy, Tihvinskiy, Lodeinopol'skiy, Lomonosovskiy, Luzhskiy, Podporozhskiy, Priozerskiy, is dominated by agricultural sector, having the number of companies and entrepreneurs engaged in agriculture and hunting higher than the total for the sectors "fishing and fish farming", "water transport", "warehouses and logistics". Vsevolozhskiy, Gatchinskiy, Kingiseppskiy, Slantsevskiy municipal districts and Sosnovy Bor urban district are included in the group dominated by marine enterprises. The mixed-type group includes Boksitogorskiy, Vyborgskiy, Kirovskiy, Tosnenskiy districts, including due to the significant number of logistics organizations.

An important characteristic of the innovation susceptibility of the economy is the degree of technological modernization. Figure 4 shows the territorial distribution of modern agricultural machinery, machines and equipment in the context of the districts of the Leningrad region.

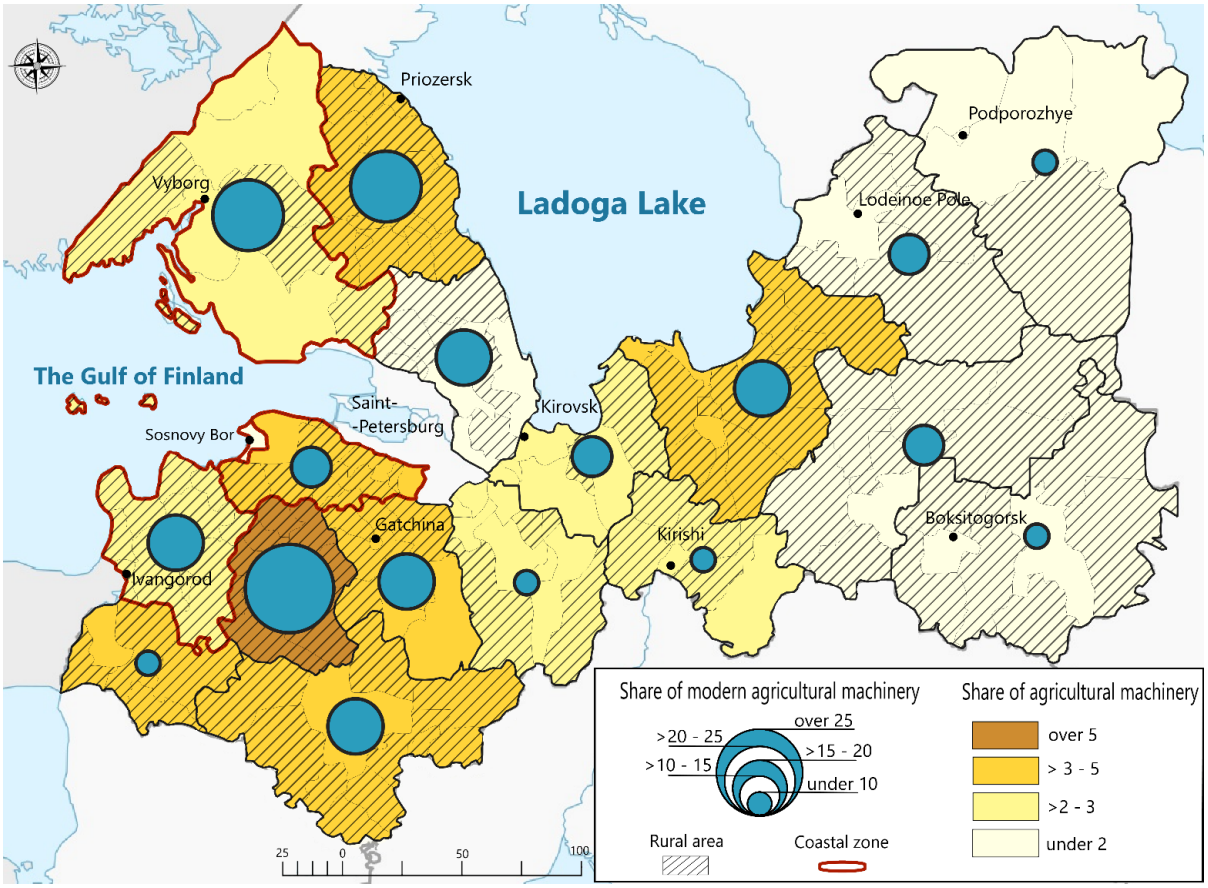


*Fig 4. Technological modernization of agriculture in municipalities of the Leningrad region, 2016. Source: compiled on the basis of the data of the All-Russian Agricultural Census, 2016*

In 2016, in absolute terms, the largest share (59.4%) of agricultural machinery, machines and equipment was concentrated in 3 municipal districts of the Leningrad region: Volosovskiy, Gatchinskiy and Priozerskiy. They contained 49.7% of combine harvesters, 43.9% of forage harvesters and 37.2% of tractors. The Volosovskiy municipal district is the leader in terms of technological equipment, accounting for 9.5 units of various agricultural machinery, machinery and equipment per 1 business entity in the field of agriculture. Another 4 municipalities (Luzhskiy, Volkhovskiy, Gatchinskiy, Slantsevskiy) are having this indicator value at the range of 4.3 to 4.8 units; two municipalities (Priozerskiy, Lomonosovskiy) – from 3.3 to 3.9. A number of municipal districts included in the predominantly agricultural group have very low technological equipment with agricultural machinery – lower than the regional average level, namely Tihvinskiy, Lodeinopol'skiy, Podporozhskiy. The top 5 municipal districts with the highest share of modern (under 4 years old) agricultural machinery (tractors and combines) are: Volosovskiy (26.8%), Priozerskiy (24.8%), Vyborgskiy (22.9%), Kingiseppskiy (18, 7%), Luzhskiy (18.5%). The Gatchinskiy municipal district has 16.5%. In general, a third of all agricultural machinery, machines and equipment of the Leningrad region in 2016 was concentrated in the coastal areas, including 22% of all modern tractors and combine-harvesters. As of January 1, 2019, the total number of agricultural machinery, machines and equipment in the Leningrad region decreased (for example, the number of seeders by 20.3%, tractors by 10.2%, plows by 15.4%, mowers by 3.3 %, harrows by 3.1%, etc.), however, their structural and territorial distribution remained practically unchanged[11].

An important reflection of the maritime specifics of the economy of coastal regions is port activity. In the Leningrad region there are four seaports in 2 coastal municipalities: Kingiseppskiy (Ust-

[11] Office of the Federal State Statistics Service for St. Petersburg and the Leningrad region (Petrostat). Nalichiye sel'skokhozyaystvennoy tekhniki v sel'skokhozyaystvennykh organizatsiyakh Leningradskoy oblasti na 1 yanvarya 2019 goda [The availability of agricultural machinery in agricultural organizations of the Leningrad Region on January 1, 2019]. Statistical Bulletin. St. Petersburg: Petrostat, 2019

Luga) and Vyborgskiy (Vyborg, Primorsk, Vysotsk) – table 3. All 4 ports play an important role in ensuring the international logistics of Russia. Combined, they account for over 20% of the cargo turnover of the country's ports. The new port complexes in the transport and logistics system of the region are the large multifunctional port of Ust-Luga and specialized port of Primorsk, the construction of which began in the 1990s. At the same time, the ports of Vyborg and Vysotsk were reconstructed in accordance with modern requirements.

*Tab 3. Characteristics of the ports of the Leningrad region.*

| Port | Cargo specialization | The average number of employees | Cargo turnover, million tons | | | |
|---|---|---|---|---|---|---|
| | | | 2012 | 2016 | 2017 | 2018 |
| Vyborg | general; bulk (chemical) | 310 | 1.5 | 1.4 | 1.5 | 3.7 |
| Vysotsk | bulk (coal); liquid (oil products) | 872 | 13.6 | 17.1 | 17.6 | 32.5 |
| Primorsk | liquid (oil, diesel fuel) | 1024 | 74.8 | 64.4 | 57.6 | 49.0 |
| Total for Vyborgskiy municipal district | – | 2206 | 89.9 | 82.9 | 76.7 | 85.2 |
| Ust-Luga | bulk (coal, coke, mineral fertilizers, sulfur, ore, etc.); liquid (oil and oil products, liquefied gas); general (forest); containers; ferry cargo | 1830* | 46.8 | 93.4 | 103.3 | 98.7 |
| Total for Leningrad region | – | 4036 | 136.7 | 176.3 | 180.0 | 183.9 |
| Russia | – | n/a | 567.0 | 722.0 | 786.4 | 816.7 |
| The share of ports of the Leningrad region from the Russian Federation, % | – | – | 24.1 | 24.4 | 22.9 | 22.5 |

Note: * jobs created from 2007 to 2015 are taken into account. Source: Petrostat, Leningrad Region Transport Association[12], Sea Trade Port Association[13], Investment portal Leningrad Region[14]

The estimated average number of people employed in the ports of the Leningrad region is over 4 thousand people. Based on the estimations of Druzhinin and Lachininskii (2015), there are 7–8 related jobs per 1 employed person in the port, thus, the total number of employment can be estimated at 28–32 thousand people, which is as much as 10–12% of the total population of Vyborgskiy and Kingiseppskiy districts. Port complexes of the Leningrad region are dynamically developing infrastructure facilities that attract a significant share of investment in fixed assets. The main driver is the port complex of Ust-Luga, whose development is carried out in a cluster scheme, which terminal infrastructure is developed along with the adjacent facilities, including a large industrial park, a city for port workers and related organizations, a transport and logistics hub combining rail, road, inland sea transport and others. Improving the innovativeness of port complexes of the Leningrad region is set as a priority task of the concept of regional transport development[15], which is associated with the use of innovative production technologies in the reconstruction (modernization) and construction of new port facilities, the improvement of

[12] Leningrad Region Transport Administration. O deyatel'nosti i razvitii morskikh portov v Leningradskoy oblasti

[13] Sea Trade Ports Association. Statistics.

[14] Investment portal Leningrad region. Investment passport of the Kingiseppsky district, 2018.

[15] Government of the Leningrad region, Committee on Transport and Transport Infrastructure, Order of September 14, 2011 N 01-07 / 11 "On approval of the Concept of innovative development of the transport complex of the Leningrad region for 2012–2020".

business processes, the application of marine innovative technologies. At the same time, a significant number of unresolved problems remain in the development and technologization of the associated infrastructure with the aim of building an integrated intelligent transport system operating on-line, which impedes the growth of throughput and port turnover, and the reduction of cargo handling time [16].

Along with the importance of developing transport and logistics infrastructure for the economy of the Leningrad region, information and communication infrastructure plays a significant role. Figure 5 shows the coverage of the territory of municipalities with 3G and 4G connection provided by the leading mobile operators of Russia – MTS, MegaFon, Beeline, Tele-2, Skylink.

Sustainable mobile communication covers areas of the Leningrad region that are directly adjacent to St. Petersburg and are included in the St. Petersburg agglomeration. 4G zones cover the agglomeration space and urban areas of Vyborg, Gatchina, Sosnovy Bor, Kirishi, Volkhov, Luga and some other regional centers. Only the extreme eastern territories of the region do not have access to mobile Internet. The distribution of base stations across the territory of the Leningrad region is uneven (Fig. 5). The least affluent are the remote municipal areas: Podporozhskiy, Tihvinskiy, Lodeinopol'skiy, Kirishskiy, Boksitogorskiy, in which 1 base station is located per 550, 540, 327, 305, 288 sq.km of the territory. The highest density of base stations is found in the Sosnovy Bor urban district (1 station per 10 sq.km), Vsevolozhskiy (1 per 24 sq.km), Vyborg (1 per 59 sq.km) and Lomonosovskiy (1 per 62 sq.km) municipal districts, 3 of these municipalities are coastal. In general, coastal municipalities account for 29.4% of all base stations in the Leningrad region, including 27.7% being located in rural areas. A comparison of the distribution of base stations over the territory of coastal and inland districts demonstrates the twofold superiority of the former – 1 base station per 67 sq.km versus 139 sq.km.

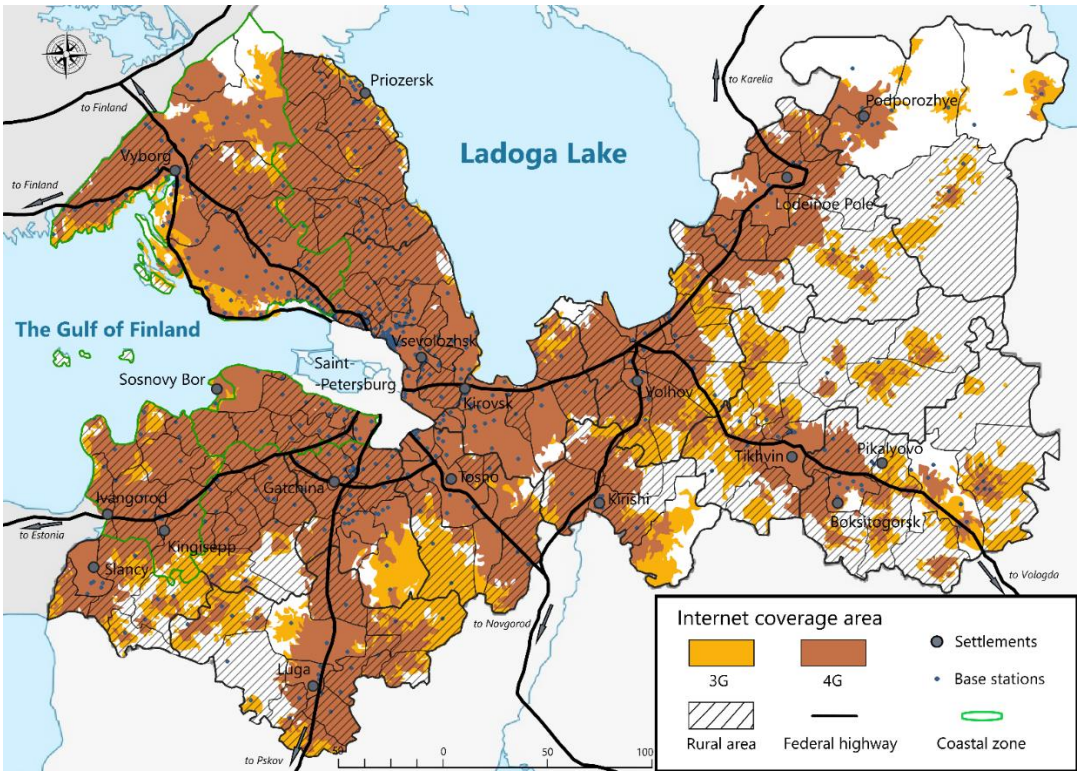


*Fig. 5. 3G and 4G coverage areas for the Leningrad region, 2019.*

[16] Kommersant. Po vodnomu puti: infrastruktura [By waterway: infrastructure]. Leningrad region. Appendix No. 53, March 29, 2017, p. 20. URL: https://www.kommersant.ru/doc/3254570

## 5. Discussion

In the process of researching the features of the innovative development of coastal regions in comparison with other territories of the Leningrad region, a wide range of indicators were evaluated that characterize the dynamics of their human capital, the favorableness of the innovation environment and susceptibility to innovation. In general, the coastal territories of the Leningrad region account for 17% of the total area and 22.6% of the population, including 22.5% rural; 25% of the population have higher and postgraduate education; 25.3% of business entities (including 28.3% of legal entities and 23.2% of entrepreneurs) with 35.3% of the total turnover; 20% of all organizations promoting entrepreneurship (21.4% of innovation and 19.4% of supporting infrastructure) and 26.8% of all ATMs; 29.4% of all base stations; 33% of all agricultural machinery, machines and equipment, including 22% of modern tractors and combine-harvesters. Coastal municipalities (Vyborgskiy, Kingiseppskiy, Lomonosovskiy districts and Sosnovy Bor urban district), which were the objects of research, demonstrated the distinctive features of their innovative trajectories, which allowed them to be typified with respect to inland districts.

The density and level of education of the population, the concentration of business entities relative to residents, and the provision of banking and Internet services (higher densities of ATMs and base stations) acted as common to the coastal territories of the Leningrad region. The obtained result indicates more favorable conditions in the coastal zone for the activation of innovative activity. However, the heterogeneity of the coastal territories of the Leningrad region themselves in terms of their economic and geographical location (primarily with respect to St. Petersburg and the main transport routes), population and economy structure, involvement in the marine economy, institutional density and other indicators makes the development of a unified approach to their innovative development impossible. Each of the four coastal municipalities has its own specifics, which is reflected in the development of their rural territories.

Sosnovy Bor urban district is a small municipality in terms of population and area, located 80 km south-west of St. Petersburg. Only the urban population is concentrated here, including 85% in the city of Sosnovy Bor. Sosnovy Bor urban district has the highest population density (949 people per sq.km) and the level of education of the population (31%) among other municipalities. The population change is characterized by a positive trend (population growth of 3.6% for 2010–2019). The population growth creates a higher load of the MFC for citizens than in the outlying areas. In the structure of the economy, the economic entities engaged in activities with a greater potential for generating innovations by 2017 was equal to traditional industries – 4.3% of the total. The overall provision of the Sosnovy Bor urban district with organizations supporting entrepreneurship and innovation, financial services (1.9 ATMs per 1000 people), as well as information and communication infrastructure (1 base station per 10 sq.km) is significantly higher than the average level in the Leningrad region. The industry specialization of the municipality is nuclear energy; the Leningrad Nuclear Power Plant (LNPP) is located here. This type of activity accounts for up to 50% of the total turnover of large and medium enterprises. It is the energy complex that attracts the bulk of investments in the urban district related to the modernization of the existing LNPP and the construction of replacement capacities, and is the driver of innovative processes. The region has large specialized scientific organizations involved in research and development in the field of energy, which explains the high level of the population with postgraduate education. Maritime activity acts as supporting (complementary) for energy: in the urban district, marinas for small vessels are operating, being used to deliver large-sized equipment by sea.

Lomonosovskiy municipal district is one of the smallest municipalities in the Leningrad region, characterized by both a coastal and a near-metropolitan position. This area is characterized by the highest share of the rural population among other municipalities – 78.6%. However, while the overall population of the district is growing, it is decreasing in rural areas, with the natural decline being the main reason. The Lomonosovskiy municipal district is characterized by relatively high indicators of population education (over 19%), entrepreneurship (over 50 companies and individual entrepreneurs per 1000 inhabitants) and company profitability (average profit of 12.2 million rubles per company) as compared to other municipalities. Active dynamics of

the share of individual entrepreneurs is registered. Important factors for the favorable business environment in the municipal district are the full coverage of the district with a 4G network and the availability of a developed road and railway network. At the same time, the institutional density indicator is one of the lowest in the Leningrad region: 2 objects of supporting infrastructure are located in the city of Lomonosov, and there is no innovative infrastructure.

The availability of financial services is also low – 0.4 ATMs per 1000 people. Agriculture is a significant activity for the Lomonosovskiy municipal region, including poultry, meat and dairy farming, crop production, fish farming. However, this industry is a weak attractor of innovation. The district demonstrates the average level of equipment in the Leningrad region with agricultural machinery, machines and equipment. In general, in the municipal economy, the number of business entities – potential generators of innovation, is one of the lowest (1.7%). The potential of using the coastal position of the district according to the Concept of socio-economic development of the Leningrad region for the period until 2025 is primarily associated with the development of the industrial and logistics zone near St. Petersburg.

Kingiseppskiy and Vyborgskiy municipal districts are the two coastal municipalities of the Leningrad region, in which port complexes are actively developing being the drivers of their economies. Both districts have the same population density (26 people per sq.km) with a difference in area of 2.6 times: the near-metropolitan Vyborgskiy district is larger. Also, for these two areas a slight decrease in the population (about 1%) is registered in 2010–2019 against the background of an increase in the number of rural residents by 2.5 – 3.5%. In total, less than a third of the population of these municipalities is concentrated in rural settlements. The level of education of the population in these areas is relatively high as compared to other municipalities: Vyborgskiy district in 4th place – 21.8%, Kingiseppskiy district in 8th place – 19.6%, with an average value of the Leningrad region being 21.3%. Kingiseppskiy and Vyborgskiy municipal districts demonstrate high rates of economic activity, with 58.8 and 52.1 business entities per 1000 people. These municipalities occupy leading positions (top-5) in terms of revenue and profit generated by companies, both aggregate and average values per legal entity. Despite the equally high level of economic development, the entrepreneurial environment in Kingiseppskiy and Vyborgskiy regions is characterized by varying degrees of favorableness. Kingiseppskiy district has more organizations supporting entrepreneurship and innovation, the MFC for citizens, and ATMs. Moreover, both in Kingiseppskiy and in the Vyborgskiy district, they are mainly located in cities. In the municipal economy structure, the share of business entities in industries with the potential for consuming innovations is higher than generation for both districts. An important role is played by the so-called traditional types of activities for coastal rural areas: fishing and fish farming, agriculture, warehouses and logistics, water transport. Kingiseppskiy and Vyborgskiy districts have a relatively high susceptibility to innovation relative to other municipalities of the Leningrad region. The results of the study showed that these areas have a higher share of modern agricultural equipment, as well as developed port infrastructure. The largest and most dynamically developing is the port of Ust-Luga in Kingiseppskiy district, which is being built from scratch as a transport and logistics cluster with an industrial zone. The provision of information and communication infrastructure in the Vyborgskiy district is slightly higher than in Kingiseppskiy district, due to its closer location to St. Petersburg.

## 6. Conclusion

The study shows that the rural territories of the Leningrad region have unequal development and susceptibility to innovation, which corresponds the spatial distribution pattern of innovations in the Leningrad region identified earlier by Zubarevich (2010) and Puzanov (2012) at a general level. The assumption on the great importance of the economic and geographical position is confirmed, including the proximity to the growth pole – the city of St. Petersburg in case of the Leningrad region, the navigable sea, the state border, the main transportation routes, etc. We have analyzed a variety of indicators characterizing the human capital, the favorability of entrepreneurial environment and susceptibility to innovation of four coastal municipalities of the Leningrad region (three municipal districts with rural settlements – Kingiseppskiy, Vyborgskiy, Lomonosovskiy, and one urban district – Sosnovy Bor) and compared their performance with other municipalities having intraregional position. A large degree of heterogeneity between

the rural settlements is revealed, which is the result of the cross-influence of several factors at once: near-metropolitan location, coastalization (thalasso-attractiveness), and national border proximity.

The Vyborgskiy and Lomonosovskiy coastal districts are near-metropolitan, entering the St. Petersburg city agglomeration. The proximity of a large center enables them to use the benefits of a more developed information and communication and transport infrastructure in stimulating their own economic growth, which is manifested, inter alia, in high rates of entrepreneurial activity. However, the proximity of St. Petersburg with a rich service sector to some extent inhibits the development of infrastructure to support entrepreneurship and innovation, as well as financial services “on the ground”. Vyborgskiy and Lomonosovskiy districts have relatively lower values of institutional density and concentration of ATMs. In addition, the rural areas of these regions are characterized by the so-called “summer residents effect” – seasonal migration from St. Petersburg to the suburbs.

The Vyborgskiy and Kingiseppskiy districts are bordering on land with the EU countries (the first with Finland, the second with Estonia) and have favorable natural, economic and institutional conditions for the development of seaports and shipping. This allowed them to become large transport and logistics hubs, attracting industrial companies generating significant aggregate turnover to the neighboring location. However, despite the similarities in socio-economic trajectories, there are differences between regions, for example, in 4G network coverage. In the metropolitan Vyborgskiy municipality, coverage is higher, incl. in rural areas, compared with Kingiseppskiy district.

In general, the rural territories of coastal municipalities have more developed infrastructure than the remote inland areas, but may be inferior to rural settlements located in close proximity to St. Petersburg. The heterogeneity between the coastal regions themselves in the development of rural territories is also high, which does not allow to draw a direct conclusion over the importance of the coastal factor. The small and medium-sized cities remain to be the innovation centers for municipalities, concentrating the main industrial, scientific, human, investment, financial and institutional resources. Thus, as previously found by Vaishar et al. (2015), they remain as a driving force behind spatial development of local milieu of the countryside as large cities are for the national innovation system. The role of traditional place-specific types of activity (primarily agriculture and the maritime sectors) still remains significant in the structure of the municipal economies of the Leningrad region, however, there has been a trend towards a reduction in the number of business entities in these sectors.

The undoubtedly dominant sub-urbanization factor of the “northern capital” of Russia is well complemented by the coastalization phenomenon. The coastal municipalities located at a distance from St. Petersburg and next to the border with Estonia and Finland are in the need of spatially-adaptive solutions aimed at promoting rural entrepreneurial activity of cross-border and maritime specifics (Lang et al., 2014). As it is previously noted by Naldi et al. (2015), place-specific policies are a natural response to the differences in the territorial capital of rural areas. These policies should acknowledge specificity of local economies, dominated by either “rural entrepreneurship” with a particular embeddedness in the countryside and its environment, or “entrepreneurship in the rural” – entities that could be easily relocated without any significant loss of functions or identity (Korsgaard and Müller, 2015). Moreover, these ‘customized policies’ (Salemink et l., 2017) should address the issues of digital connectivity that hamper functional integration of rural communities into entrepreneurial networks beyond the local milieu.

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[1] Anderson, A. R., Wallace, C. & Townsend, L. (2016). Great Expectations or Small Country Living? Enabling Small Rural Creative Businesses with ICT. *Sociologia Ruralis* 56(3), 450–468. DOI: 10.1111/soru.12104.

[2] Balaguer, P., Sarda, R., Ruiz, M., Diedrich, A., Vizoso, G. & Tintor E, J., (2008). A proposal for boundary delimitation for integrated coastal zone management initiatives. *Ocean and Coastal Management* 51, 806–814. DOI: 10.1016/j.ocecoaman.2008.08.003.

[3] Barragán, J. M. & de Andrés, M. (2015). Analysis and trends of the world's coastal cities and agglomerations. *Ocean and Coastal Management*, 114, 11–20. DOI: 10.1016/j.ocecoaman.2015.06.004.

[4] Beach, D. (2002). *Coastal Sprawl: the effects of urban design on aquatic ecosystems in the United States*. Arlington, VA. Pew Oceans Commission.

[5] Bell, S., Peña, A. C. & Prem, M. (2013). Imagine coastal sustainability. *Ocean and Coastal Management*, 83, 39–51. DOI: 10.1016/j.ocecoaman.2013.02.016.

[6] Blacksell, M. (2010). Agriculture and Landscape in 21st Century Europe: The Post-Communist Transition. *European Countryside*, 2(1), 13–24. DOI: 10.2478/v10091-010-0002-8.

[7] Boschma, R. A. (2005). Proximity and innovation: A critical assessment. *Regional Studies* 39 (1), 61–74. DOI: 10.1080/0034340052000320887.

[8] Cracknell, A. P. (1999). Remote sensing techniques in estuaries and coastal zones – An update. *International Journal of Remote Sensing* 20(3), 485–496. DOI: 10.1080/014311699213280.

[9] Druzhinin, A. G. & Lachininskii, S. S. (2015). The place of the St. Petersburg coastal region in system of the leading coastal regions of Europe. *Economy of the North-West: Issues and Prospects of Development*. 4(49), 127–138. https://elibrary.ru/item.asp?id=25805440/

[10] Druzhinin, A. G., Gorochnya, V. V., Gontar, N. V., Dets, I. A., Lachininskii, S. S. & Mikhailov, A. S. (2017). Transboundary clusters in the coastal zones of the European part of Russia: inventory, typology, factors, and prospects. *Baltic Region* 9(4), 21–32. DOI: 10.5922/2079-8555-2017-4-2.

[11] Druzhinin, A. G., Lachininskii, S. S. & Shendrik, A. V. (2018). The economic and residential dynamics of settlements of the Leningrad region: influence of factors of a cross-border clustering. Proceedings of the Russian Geographical Society, 150(3), 12–27.

[12] Emerton, L. (2006). *Counting coastal ecosystems as an economic part of development infrastructure, Ecosystems and Livelihoods Group Asia*. Colombo: World Conservation Union (IUCN).

[13] Faggio, G. & Silva, O. (2014). Self-employment and entrepreneurship in urban and rural labour markets. *Journal of Urban Economics*, 84 67–85. DOI: 10.1016/j.jue.2014.09.001.

[14] Fedorov, G. M. & Mikhaylov, A. S. (2018). Regional divergence dynamics in the Baltic region: towards polarisation or equalization? *Geographia Polonica* 91(4), 399–411. DOI: 10.7163/GPol.0127.

[15] Hart, L. G., Larson, E. H. & Lishner, D. M. (2005). Rural definitions for health policy and research. *American Journal of Public Health* 95(7), 1149–1155. DOI: 10.2105/AJPH.2004.042432.

[16] Hinrichsen, D. (1996). Coasts in Crisis. *Issues in Science and Technology* 12(4), 39–47.

[17] Korsgaard, S. & Müller, S. (2015). Rural entrepreneurship or entrepreneurship in the rural – between place and space. *International Journal of Entrepreneurial Behaviour and Research* 21(1), 5–26. DOI: 10.1108/IJEBR-11-2013-0205.

[18] Kuznetsov, S. V., Lachininskii, S. S. & Shendrik, A. V. (2017). The economic dynamics of urban settlements in the Leningrad region in 2011–2016 years. *Economy of the North-West: Issues and Prospects of Development*, 3–4 (56–57), pp. 76–85. https://elibrary.ru/title_profile.asp?id=10506/

[19] Lachininskii, S. S. & Semenova, I. V. (2015). *The St.-Petersburg coastal region: geoeconomic transformation of the territories*. SPb, Lema Print.

[20] Lang, R., Fink, M. & Kibler, E. (2014). Understanding place-based entrepreneurship in rural Central Europe: A comparative institutional analysis. *International Small Business Journal* 32(2), 204–227. DOI: 10.1177/0266242613488614.

[21] Lang, T. (2015). Socio-economic and political responses to regional polarisation and socio-spatial peripheralisation in central and Eastern Europe: A research agenda. *Hungarian Geographical Bulletin*, 64(3), 171–185. DOI: 10.15201/hungeobull.64.3.2.

[22] Leontidou, L. & Marmaras, E. (2001). From tourists to migrants: Residential tourism and 'littoralisation'. In Apostolopoulos, Y., Loukissas, P. & Leontidou, L., eds., *Mediterranean tourism: Facets of socioeconomic development and cultural change* (pp. 257–267). New York, NY: Routledge.

[23] McFadden, L. (2007). Governing Coastal Spaces: The Case of Disappearing Science in Integrated Coastal Zone Management, *Coastal Management* 35(4), 429–443. DOI: 10.1080/08920750701525768.

[24] Mee, L. (2012). Between the devil and the deep blue sea: the coastal zone in an era of globalisation. *Estuarine Coast and Shelf Science* 96, 1–8. DOI: 10.1016/j.ecss.2010.02.013.

[25] Mikhaylov, A. S., Mikhaylova, A. A. & Kuznetsova, T. Yu. (2018). Coastalization effect and spatial divergence: segregation of European regions. *Ocean and Coastal Management* 161, 57–65. DOI: 10.1016/j.ocecoaman.2018.04.024.

[26] Morrissey, K. (2015). An inter and intra-regional exploration of the marine sector employment and deprivation in England. *The Geographical Journal*, 181, 295–303. DOI: 10.1111/geoj.12099.

[27] Naldi, L., Nilsson, P., Westlund, H. & Wixe, S. (2015). What is smart rural development? *Journal of Rural Studies* 40, 90–101. DOI: 10.1016/j.jrurstud.2015.06.006.

[28] Pomianek, I. & Chrzanowska, M. (2016). A spatial comparison of semi-urban and rural gminas in Poland in terms of their level of socio-economic development using Hellwig's method. *Bulletin of Geography* 33, 103–117. DOI: 10.1515/bog-2016-0028.

[29] Puzanov, K. A. (2012). Modern models of the spread of innovation: a critical analysis. *Sociology of Power*, 6–7 (1), 82–99. https://socofpower.ranepa.ru/en/

[30] Roberts, E. & Townsend, L. (2016). The Contribution of the Creative Economy to the Resilience of Rural Communities: Exploring Cultural and Digital Capital. *Sociologia Ruralis* 56(2), 197–219. DOI: 10.1111/soru.12075.

[31] Ross, A. (2008). The New Geography of Work: Power to the Precarious? *Theory, Culture and Society* 25(8), 31–49. DOI: 10.1177/0263276408097795.

[32] Salemink, K., Strijker, D. & Bosworth, G. (2017). Rural development in the digital age: A systematic literature review on unequal ICT availability, adoption, and use in rural areas. *Journal of Rural Studies*, 54, 360–371. DOI:10.1016/j.jrurstud.2015.09.001.

[33] Sánchez-Zamora, P., Gallardo-Cobos, R. & Ceña-Delgado, F. (2014). Rural areas face the economic crisis: Analyzing the determinants of successful territorial dynamics. *Journal of Rural Studies*, 35, 11–25. DOI: 10.1016/j.jrurstud.2014.03.007.

[34] Sayas, J. P. (2000). Urban sprawl in the periurban coastal zones of Athens. *The Greek Review of Social Research* 121, 71–104.

[35] Small, C., Gornitz, V. & Cohen, J. E. (2000). Coastal hazards and the global distribution of human population. *Environmental Geosciences* 7(1), 3–12. DOI: 10.1046/j.1526-0984.2000.71005.x.

[36] Small, C. & Nicholls, R. J. (2003). A global analysis of human settlement in coastal zones. *Journal of Coastal Research* 19(3), 584–599.

[37] Šťastná, M., Toman, F., Vaishar, A., Woods, M. & Vavrouchová, H. (2013). European rural regions in the era of globalization: The South Moravia case study. *Innovation*, 26(4), 354–364. DOI: 10.1080/13511610.2013.849860.

[38] Šťastná, M., Vaishar, A., Vavrouchová, H., Mašíček, T. & Peřinková, V. (2018). Values of a suburban landscape: Case study of Podolí u Brna (Moravia), The Czech Republic. *Sustainable Cities and Society* 40, 383–393. DOI: 10.1016/j.scs.2018.01.034.

[39] Stonawská, K. & Vaishar, A. (2018). Differentiation and typology of the Moravian countryside. *European Countryside* 10(1), 127–140. DOI: 10.2478/euco-2018-0008.

[40] Townsend, L., Sathiaseelan, A., Fairhurst, G. & Wallace, C. (2013). Enhanced broadband access as a solution to the social and economic problems of the rural digital divide. *Local Economy* 28(6), 580–595. DOI: 10.1177/0269094213496974.

[41] Townsend, L., Wallace, C., Fairhurst, G. & Anderson, A. (2017). Broadband and the creative industries in rural Scotland. *Journal of Rural Studies* 54, 451–458. DOI: 10.1016/j.jrurstud.2016.09.001.

[42] Vaishar, A., Štastná, M. & Stonawská, K. (2015). Small towns – Engines of rural development in the South-Moravian region (Czechia): An analysis of the demographic development. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis* 63(4), 1395–1405. DOI: 10.11118/actaun201563041395.

[43] Voloshenko, K. Yu. & Mikhailova, A. A. (2012). Innovative factors and conditions of sustainable development of rural territories. Baltic Region, 3(13), 79–87. DOI: 10.5922/2079-8555-2012-3-7.

[44] Zubarevich, N. V. (2010). Cities as centers of modernization of the economy and human capital. *Social Sciences and Modernity* 51(4), 3–27. DOI: 10.2753/SOR1061-0154510401.