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COMPARATIVE ANALYSIS OF THE TERRITORIAL SUPPORT FRAME OF SETTLEMENT IN COASTAL AREAS: THE CASE OF ST. PETERSBURG AND KALININGRAD REGIONS

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As a scientific method, comparative studies respond to the needs of society. However, the logic of globalisation has reduced the demand for comparative analysis in international and national (regional) studies. Nevertheless, old, settled coastal areas — which European urban science considers as evidence of the decisive effect of coastal position on spatial development and urbanisation — remain valid research objects. Achieving corresponding theoretical and practical goals requires qualitative and quantitative analysis of urbanisation in coastal areas. This article aims to determine whether the territorial support frameworks of settlement in the St. Petersburg and Kaliningrad regions meet the modern conditions of settlement system development. A cartographic modelling of the settlement structures of the two Russian regions was carried out using Golden Software Surfer 20. The models obtained were supplemented with isolines reflecting the fields of the spatial structure of urban settlement. The settlement systems were analysed from the standpoint of transport communications, using the Engel and Goltz coefficients. The coefficient values show that road transport is the most developed in the study regions, while river transport is the least developed. It is concluded that spatial development is leading to urbanisation and reinforcing the monocentric model of spatial structure. However, the economic effects of monocentricity are almost exhausted, and the limits of polarisation and effective growth attainable with the model are nearly reached. This calls for a transition to a polycentric urbanisation model through developing local centres and enhancing transport connectivity between them. It seems that, in the new economic and political conditions, Russia's two coastal border regions will benefit the most from the linear-nodal settlement. The study identified the local cores that can lay the foundation for the transition to the new settlement model.

Keywords:
urbanisation, transport systems, Kaliningrad region, Leningrad region, St. Petersburg, coastal position, spatial structure, territorial support frame

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Introduction and problem setting

Coastal regions have a critical role in the development of nations, regardless of whether it is considered in a socioeconomic or political context. According to Aleksandr Druzhinin, the "gravitation to the sea" phenomenon, which encompasses the economic and population trends, along with related institutional, economic, socio-cultural, and spatial planning factors and impacts, serves as the primary indicator and fundamental characteristic of coastal zones or regions [1, p. 28]. He writes that, in Russia, only 23 regions have an outlet to the sea, accounting for 60 % of the country's territory and 24.2 % of the population. Seventeen of these sites can be classified as 'encouraging coastalisation', meaning they have a strong presence of maritime industries and their most populated and economically developed centres are disproportionately located in the coastal zone [1, p. 29]. In Russia, the regions of this kind include the coastal regions of the Baltic Sea: Russia's semi-exclave of the Kaliningrad region and the St. Petersburg metropolitan area comprising two administrative units, St. Petersburg and the Leningrad region. The role and significance of these territories in the current geopolitical situation, has markedly increased in the current geopolitical situation. Both territories, sharing a similar position in terms of physical, economic and political geography, have a distinctly coastal settlement system and a maritime economy. Although there are many geographical commonalities between the two areas and they both have attracted intense interest from the research community, this is the first study to conduct a comparative analysis of the territorial support frames of settlement characteristic of the St. Petersburg metropolitan area and the Kaliningrad region.

The article *aims* to quantify the correspondence between the territorial support frames of settlement in the two regions and the current conditions of settlement system development.

To this end, the following *objectives* are attained:

— to examine theoretical approaches to the core-periphery analysis of cities and describe the role of coastal regions;

— to carry out a comparative analysis of the established elements of territorial support frames of settlement in the St. Petersburg metropolitan agglomeration and the Kaliningrad region;

— to analyse the settlement systems in the study regions from the perspective of transport communications.

Theoretical framework

Modern approaches to urbanisation are anchored in the recognition of the special role of cities. This is where economics not only does not contradict but strongly agrees with political science and sociological theories. An interdisci-

plinary approach presupposes a geographical component, the extent of whose influence becomes particularly apparent in the coastal zones specializing in maritime industries. This happens because the urban core controls the vast bulk of interactions among local resource holders, i. e., a share that by far exceeds its own. It is capable of dominating the area in economic and economic geographical terms [2].

Regional development of complex coastal and capital regions, which is often constrained by some ancillary factors, has been considered within agglomeration studies [3—5] and works focusing on agglomeration-based metropolitan areas [6]. Some observations on American agglomerations prove the effect of a coastal position [7; 8].

For a long time, international academic science saw the theory as a 'growth machine'. This interpretation was based on the belief that the highest level of a city's socioeconomic development is reached through extensive exploitation of its economic, demographic, and spatial potential [9]. The Soviet cities of Leningrad (today, St. Petersburg) and Kaliningrad followed this model as well. The strength of this approach is that it linked the process of agglomeration as linked to globalisation and the development of international trade. These approaches were employed by Paul Krugman [10]. Yet, his new economic geography, which won him a Nobel Prize, has at its core economic effects produced without continuous extensive spatial growth.

The tenets of new economic geography may be considered the theoretical framework of this study. Current approaches subsumed under this concept draw on the thesis about the principal role of cooperation, neighbourhood effects, spillover events and economic growth spreading from cities to adjacent territories. This assumption holds true for not only large cities but also neighbouring countries and states. For example, periphery regions may experience agglomeration effects in large cities only if the country is involved in international economic integration.

The key problems of modern settlement systems in urbanised districts are well-known: growing cities devour landscapes, literally spreading over hundreds of square miles in all directions [see 11]. Although natural limitations do exist, there is some debate in the literature whether it is possible 'to prod an agglomeration whose growth is not restricted by the sea or mountains into a better, desired direction' [12, p. 19]. Further questions that require investigation include how this can be achieved without turning the entire area into a continuous urban sprawl and how spillover effects can be initiated. The answer, which is particularly important for coastal regions, is broader participation in global trade. For instance, Carl Gaigné and Jacques-François Thisse write that the 'main contribution' of new economic geography was the idea that '[u]nder constant returns, firms find it profitable to disperse their production to bring it

closer to customers, as this will reduce transport costs without lowering productive efficiency. Such a space economy is the quintessence of self-sufficiency: if the distribution of factor endowments is uniform, the economy reduces to a Robinson Crusoe-type economy where each person produces for his or her own consumption. Under these circumstances, only differences in endowments of immobile production factors can explain the marked differences in the spatial distribution of activities, and hence the need for interregional and international trade [13]. The Russian scholars Svetlana Rastvortseva and Lyudmila Snitko arrive at a similar conclusion: 'agglomeration effects help regions save their assets and, having a specialisation, distribute them more effectively' [14, p. 46]. In other words, no matter what consideration we are motivated by, abandoning agglomeration effects is neither possible nor prudent.

Let us consider in this context some fundamental elements of the European experience of urbanisation. It is worth noting that the process of agglomeration took place in European coastal regions in a very similar manner [15].

A natural result of the development of society, coastal urban agglomerations are associated with certain economic consequences. An economist sees the city as a tool to increase the competitiveness of the economy, a mechanism ensuring an inflow of resources for the development of the whole settlement system. Moreover, it is traditionally perceived as the site where conditions emerge for social development at an entirely new level [16]. An efficiently organised network of cities, towns and settlements comprising an agglomeration can generate economic profits that would not be made otherwise. Yet, the periphery is losing economic and demographic opportunities, and these losses cannot be compensated for within either a command or market economy.

The concept of periphery first appeared in the international literature on economics and economic geography in the mid-20th century. A classic of the core-periphery concept is John Friedmann. His model holds that uneven economic growth and spatial polarisation inevitably lead to disproportions between the core and the periphery. Throughout the lifespan of the core-periphery system, the core continuously dominates over the periphery, which is particularly conspicuous in the areas influenced by large agglomerations [17].

The city is a symbol of global and regional socio-political inequality. The primary factor behind the appearance of global cities is the skewed distribution of resources between the global core and the periphery [18], which translates into inequality between states and cities. This type of inequality has been extensively investigated by international researchers [19—24]. In Russia, it has been explored by Olga Gritsai, Grigory Ioffe and Andrey Treyvish [25], Natalya Zubarevich [26], Oleg Golubchikov and Alla Makhrova [27], Tatyana Nefedova and Andrey Treyvish[28], Inna Manaeva [29] and others.

In the case of Russia, inequality means that some processes develop there asynchronously with Western and even Eastern Europe, albeit their general direction in Europe and Russia coincide. This also holds for coastal agglomerations underpinning settlement systems, for instance, those of St. Petersburg and Kaliningrad.

The spatial configuration of coastal regions extends beyond their "marine façade," as these territories are characterized by vibrant economic activity, a concentration of towns, and population growth through migration. The development of such towns and cities would be impossible without exploiting the advantages of coastal agglomerations. A product of similar combinations of factors, these advantages have similar results when it comes to the economic effects of spatial planning structures manifested in the territorial support frame of settlement (TSFS) [30—32]. The TSFS is the location and combination of its elements — settlements (nodes) and transport links (lines) — and the interaction between them. Each TSFS has a main city, which is the core that performs the function of political administration, concentrates people, industries, and resources. Additionally, there are linear elements comprising thoroughfares, with roads and railways being the most important ones. As Pavel Polyan wrote in 1988, 'economic and social development is increasingly displaying tendencies of gravitation towards areas and lines. These tendencies manifest themselves in population agglomeration and the emergence of multimodal routes, i. e., processes converging at the level of the support frame of settlement' [33, p. 37—38].

Coastal regions in general and the St. Petersburg metropolitan area and the Kaliningrad region in particular have been studied extensively by human geographers and regional economists. For instance, the sustainable development of coastal regions has been examined by Aleksandr Druzhinin [1; 34], Pytor Baklanov [35], Göran Roos, Natalya Kubina and Yulia Farafonova [36]. Gennady Fedorov and Valentin Korneevets [37].

The St. Petersburg metropolitan area has been placed in the context of the 'coastal factor' in several studies by Stanislav Lachininsky and colleagues [38—40]. The effect of coastal position on the Kaliningrad region has been addressed by Gennady Fedorov, Tatyana Kuznetsova and Vladimir Razumovsky [41], as well as Ivan Gumenyuk, Lidiya Gumenyuk and Nikolai Belov [42].

Selected aspects of the territorial support frame of the St. Petersburg metropolitan agglomeration and urban agglomerations have been investigated by Viktor Solodilov [43; 44] and Leonid Losin [44], Marina Sviridenko [45], Stanislav Lachininsky and Ivan Sorokin [46], Mikhail Kalmykov [47] and other. Ivan Gumenyuk, Veronika Yustratova [48] and Anna Belova have looked at the features of settlement in the Kaliningrad region [49].

Materials and methods

This study uses statistics from Petrostat, the St. Petersburg and Leningrad regional branch of the Federal State Statistics Service (FSSS), and Kaliningradstat, the Kaliningrad regional branch of the agency.[1] Particularly, it looks at data on the total population from 2005 to 2022 as of January 2 of the corresponding years, the number of settlements and size of urban population as of 1 January 2022, the length of federal, regional and municipal public roads,[2] the length of public railways[3] and the length of inland waterways.[4] The information was retrieved from the FSSS website.

The Yandex.Maps service was used when examining the established TSFS in the study regions; the analytical, statistical and geostructural methods were employed in the study, along with cartographic modelling.

The cartographic modelling of the TSFS structures in the St. Petersburg metropolitan agglomeration and the Kaliningrad region was carried out using Golden Software Surfer 20. Particularly, the software was used to digitalise city coordinates and the outlines of the study regions. Based on the obtained absolute population size for towns as of 1 January 2022, cartographic models were constructed, incorporating isolines to delineate the spatial structure of urban settlement fields.

Results

The St. Petersburg metropolitan area is Russia's third largest region, after Moscow and the Moscow region. As of 1 January 2022, 7,289,100 people lived there, and the area's population density reached 84.8 people/km^2. The city of St. Petersburg is home to 5,377,500 people (73.8 %), and the Leningrad region has a population of 1,911,600 (26.2 %), with a population density of 3,737 people/km^2 and 22.6 people/km^2 respectively. With a population of 1,027,800 people, the Kaliningrad region has the 50th largest area in the country and a population density of 68.1 people/km^2. The residents of the city of Kaliningrad

[1] Kaliningrad region in numbers. 2009. A book of statistics. Kaliningradstat. Kaliningrad, 2009; Kaliningrad region in numbers. 2022. A summary of statistics. Kaliningradstat. Kaliningrad, 2022.

[2] Length and characteristics of public roads (since 2006), 2022, *Rosstat,* URL: https://rosstat.gov.ru/search?q=Протяженность+автомобильных+дорог+общего+пользования+по+субъектам+Российской+Федерации&date_from=&content=on&date_to=&search_by=all&sort=relevance (accessed 15.10.2022).

[3] Length and density of public railways (since 2000), 2022, *Rosstat,* URL: https://rosstat.gov.ru/search?q=протяженность+Железнодорожных+путей+общего+пользования&date_from=&content=on&date_to=&search_by=all&sort=relevance (accessed 15.10.2022).

[4] Transport in Russia 2020, 2022, *Rosstat,* URL: https://rosstat.gov.ru/search?q=протяженность+судоходных+путей&date_from=&content=on&date_to=&search_by=all&sort=relevance (accessed 15.10.2022).

account for 48.5 % of the region's population with 498,300 people, while the rest of the territory accounts for 51.5 % with 529,400 people. The population density in the city is 2,317.5 people/km², while in the rest of the territory it is 35.6 people/km².

In the past 17 years, the population of the two regions has been increasing. In the St. Petersburg metropolitan area, the 2022 population growth rate reached 12.9 %, compared with 2005; in the Kaliningrad region, 9.1 %.

Moreover, the two regions differ substantially in the number of towns and urban-type settlements (UTSs): 70 (34 towns and 36 UTSs) over the 85,939 km² of the St. Petersburg metropolitan area and 23 (22 and 1 respectively) over the 15,100 km² of the Kaliningrad region. Figures 1 and 2 show the fields of the spatial structure of urban settlement in the St. Petersburg metropolitan area and the Kaliningrad region, based on the absolute population size values.

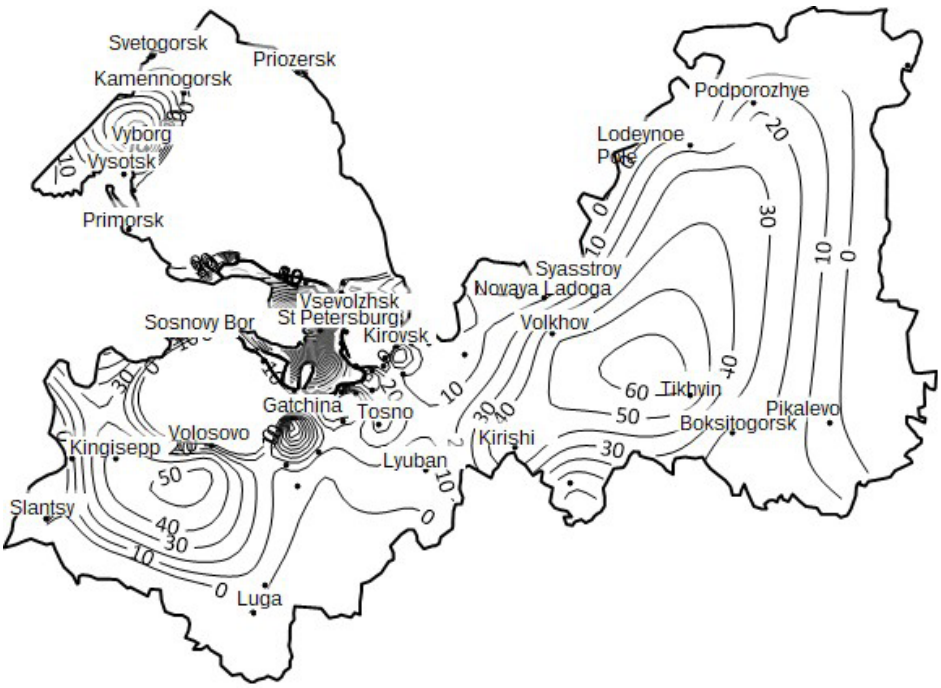

Fig. 1. Fields of the spatial structure of urban settlement in the St. Petersburg metropolitan area

Source: prepared by the authors based on Petrostat data[1].

[1] St. Petersburg 2021. A summary of statistics. Petrostat. St. Petersburg, 2022; Permanent population of Leningrad region municiaplities as of 1 January 2002, *Petrostat,* URL: https://petrostat.gks.ru/storage/mediabank/%D0%A7%D0%B8%D1%81%D0%BB.%D0%9B%D0%9E%20%D0%BD%D0%B0%2001.01.2022.pdf (accessed 15.10.2022).

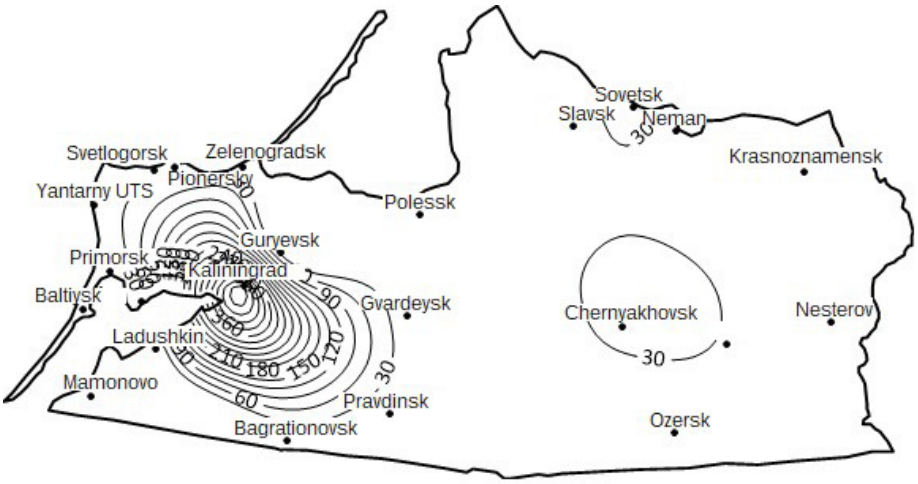

Fig. 2. Fields of the spatial structure of urban settlement in the Kaliningrad region

Source: prepared by the authors based on Federal State Statistics Service data on the Kaliningrad region[1].

As Figs. 1 and 2 show, the study regions exhibit a monocentric, concentric model of the spatial settlement structure, which grew around their respective administrative-political and socio-economic cores — St. Petersburg and Kaliningrad. The transport systems of the regions are also oriented to these two cities. Yet, St. Petersburg is more monocentric than Kaliningrad. St. Petersburg has a population 60 times as large as that of the region's second most populated town, Gatchina, whilst Kaliningrad's population is only 13 that of its satellite town of Sovetsk.

The two regions also have local cores, which attract people from nearby areas. In the St. Petersburg metropolitan area, these are Vyborg, Gatchina, Kingisepp, Tosno and Tikhvin; in the Kaliningrad region, Sovetsk and Cherenyakhovsk. These cores are of local significance due to their administrative status, which is true of Gatchina and Tosno, and the distance to the main cores (Vyborg, Kingisepp, Tikhvin, Sovetsk, Chernyakhovsk). Nevertheless, all of them are situated in the same 'coastal' space behind the 'marine façade'.

The St. Petersburg metropolitan area has the following planning axes of the territorial support frame, which are linked together by roads:

— northwestern, passing from Vyborg;

— northern, from Priozersk;

[1] Kaliningrad region in numbers. 2022. A summary of statistics. Kaliningradstat. Kaliningrad, 2022.

— northeastern, from Kirovsk. Volkhov, Lodeynoe Pole, Podporozheyv (a railway axis);

— southeastern, from Tikhvin;

— southern, from Tosno;

— southwestern, from Gatchina and Luga;

— western, from Kingisepp and Ivangorod;

— St. Petersburg Southern half-ring A-120 (motorway).

The planning axes of the territorial support frame of the Kaliningrad regions are as follows:

— Kaliningrad — Mamonovo;

— Kaliningrad — Chernyakhovsk;

— the ring road connecting the resort towns.

The spatial structures of the St. Petersburg metropolitan agglomeration and the Kaliningrad region have large coastal belts: the coastal belt proper and the land-coast belt. The configuration of the coastal shorelines in the two regions and their settlement structure allows for the identification of coastal zones within the coastal belts. In the St. Petersburg metropolitan area, the coastal belt consists of three distinct coastal zones:

1. The northwestern zone stretching along the central part of the Karelian Isthmus from Svetogorsk in the north to Kamennogorsk to the administrative border of St. Petersburg in the Sertolovo district in the south. The zone includes six towns (Vyborg, Sertolovo, Svetogorsk, Kamennogorsk, Primorsk, Vysotsk) and three urban-type settlements (Roshchino, Sovetsky and Lesogrosky), their urban population totalling 184,700 people.

2. The central zone comprising the main core of St. Petersburg within its administrative borders and the adjacent settlements of the Leningrad region: ten towns (Murino, Vsevolozhsk, Kudrovo, Gatchina, Otradnoe, Nikolskoe, Kommunar, Tosno, Kirovsk and Shlisselburg) and sixteen urban-type settlements (Yanino-1, Kuzmolovskiy, Novoselye, Sverdlova settlement, Toksovo, Villozi, Taitsy, Fedorovskoe, Rakhya, Krasnyi Bor, Dubrovka, Pavlovo, Ulyanovka, Fornosovo, Morozova settlement and Bolshaya Izhora). Its total population is 5,926,200 people with St. Petersburg accounting for 90.7 % or 5,377,500 people. The northernmost point of this zone is the Sertolovo district (the town itself is not part of it). Then, it goes southeastward, reaching the shore of Lake Ladoga via Toksovo, Rakhya, and Morozov settlement, Shlisselburg. Having passed Kirovsk, it coincides with route A-120. The zone also includes Tosno, which is 13 km away from the route, and finally reaches the southern coast of the Gulf of Finland at the village of Bolshaya Izhora.

3. The southwestern zone, whose eastern border runs along most of route A-120, from the village of Bolshaya Izhora in the north until the road crosses the Gatchina motorway in the south at the village of Voiskovitsy in the Gatchina district. From there it follows the Gatchina motorway westward via Volosovo and then route 41A-002 towards the adjoining road of A-180 'Narva' (including Kingisepp) and Narva. The zone includes four towns (Sosnovyi Bor, Volosovo, Kingisepp, Ivangorod) and one UTS (Lebyazhye), its urban population totalling 136,700 people.

The coastal belt of the Kaliningrad region has two zones:

1. The central zone, which skirts Kaliningrad, is composed of 13 towns (Kaliningrad, Baltiysk, Primorsk, Ladushkin, Mamonovo, Pionerskiy, Svetlyi, Svetlogorsk, Bagrationovsk, Gvardeisk, Guryevsk, Zelenogradsk and Pravdinsk) and one urban-type settlement UTS (Yantarny), with a population of 665,300 people. The city of Kaliningrad with 498,300 residents comprises 74.9 % of the zone's urban population. The zone stretches from Zelenogradsk in the north southeastward to Guryevsk to Gvardeysk, where it turns southwest, running via Pravdinsk to reach Bagrationovsk.

2. The northern zone, which borders on the west the central zone until it reaches Gvardeysk (albeit it does not include the town). Then the border turns east, following European route E-28 until it reaches the village of Talpaki where it turns northeast and runs along route A-216 to Sovetsk and Neman. The zone comprises four towns (Sovetsk, Neman, Polessk and Slavsk) with a total urban population of 60,100 people.

The coastal belt of the St. Petersburg metropolitan agglomeration includes three coastal zones, within which 21 towns and 21 UTSs are situated, whose total population is 6,247600 people or 93.9 % of the territory's urban population. The Kaliningrad coastal bet has two coastal zones with 17 towns and 1 UTS, their urban population totalling 725,400 people or 90.8 % of the total population of the region's towns.

The other territories of the St. Petersburg metropolitan agglomeration and the Kaliningrad region are part of the land-coast belt.

Let us determine the level of development of linear TSFS elements, i. e., the transport links, by calculating the Engel and Goltz coefficients. The Engel coefficient is computed according to the formula:

$$d = \frac{\mathrm{L}}{\sqrt{SN}}, \quad (1)$$

where L is the total length of routes, km; S is the total area of the region, km^2; P is the population, 1,000 people.

The Goltz coefficient is calculated as follows:

$$d = \frac{\mathrm{L}}{\sqrt{SP}}, \quad (2)$$

where N is the number of settlements.

The difference between the two coefficients is that the former includes the total population and the latter the number of settlements. Thus, their values can differ dramatically. The Goltz coefficient provides a more accurate picture of transport development since the same route may link settlements with incommensurable populations.

The table shows the values of statistical indicators, as well as of the Engel and Goltz coefficients, for the principal modes of transport: road, rail and river.

The calculation of the Engel and Goltz coefficients demonstrates that, in the two study regions, the highest values are associated with road transport and the lowest with river communications. The transport (linear) elements of the TSFS seem to be more developed in the Kaliningrad region than in the St. Petersburg metropolitan area. This conclusion holds for all the transport modes, except for railway, and only as long as the Goltz coefficient is considered. The Engel coefficient indicates that the Kaliningrad region is 2.17 times more developed than the St. Petersburg metropolitan area in terms of road transport, 1.42 times in railway transport, and 1.77 times in river transport. On the other hand, according to the Goltz coefficient, the Kaliningrad region is 1.42 times more developed than the St. Petersburg metropolitan area in road transport and 1.16 times more developed in river transport. However, the St. Petersburg metropolitan area has 1.08 times more developed railway transport compared to the Kaliningrad region.

The transport networks of the Leningrad and Kaliningrad regions may be conducive in overcoming monocentricity, which might be expected in the case of long-settled areas. Moreover, the transport-geographical factors hint at the possibility of a common methodology for the development of settlement systems in the Leningrad and Kaliningrad regions.

Statistical indicator, the Engel and Goltz coefficients for road, rail and river transport in the St. Petersburg metropolitan area and the Kaliningrad region

Region	Total road/railway/waterway length, km			Area, km²	Number of towns and UTSs	Population, 1,000 people	Road transport		Railway transport		River transport	
	Public roads	Public railways	Inland waterways				Coefficient					
							Engel	Goltz	Engel	Goltz	Engel	Goltz
St. Petersburg metropolitan area	26 741.219	2 981.3	1 907.7	85 300	70*	7 289.1	1.07	10.94	0.12	1.22	0.08	0.78
Kaliningrad region	9173.5	667.6	534	15 100	23	1 027.8	2.33	15.57	0.17	1.13	0.13	0.91

Source: calculated by the authors based on data from the Federal State Statistics Service[1].

Comment:* expect for the settlements comprising the administrative region of St. Petersburg.

[1] Length and characteristics of public roads (since 2006), 2022, *Rosstat,* URL: https://rosstat.gov.ru/search?q=Протяженность+автомобильных+дорог+общего+пользования+по+субъектам+Российской+Федерации&date_from=&content=on&date_to=&search_by=all&sort=relevance (accessed 15.10.2022) ; Length and denity of public railways (since 2000), 2022, *Rosstat,* URL: https://rosstat.gov.ru/search?q=протяженность+Железнодорожных+путей+общего+пользования&date_from=&content=on&date_to=&search_by=all&sort=relevance (accessed 15.10.2022) ; Transport in Russia 2020, 2022, *Rosstat,* URL: https://rosstat.gov.ru/search?q=протяженность+судоходных+путей&date_from=&content=on&date_to=&search_by=all&sort=relevance (accessed 15.10.2022).

Conclusions

The above analysis of the settlement systems of the St. Petersburg metropolitan agglomeration and the Kaliningrad region points to a high degree of similarity, which is due to both geographical and historical factors. Yet, the two systems are not identical. The spatial limitation of the 'marine façade' is present in the regions. Their main polarised cores, St. Petersburg and Kaliningrad, while being economically successful and enjoying a population growth, exert a 'coercive' effect on the nearby areas and contribute to the development of corresponding planning structures, i. e., the territorial support frames of settlement. Therefore, this study drew on two popular concepts: the core-periphery model and new economic geography.

A comparative spatial analysis of the structural elements of the territorial support frames of settlement showed that both regions have an established monocentric model of concentric type, monocentricity being particularly pronounced in St. Petersburg. The study also identified the local cores that attract population in the territories and described the directions of the planning axes of the territorial support frames. In the St. Petersburg metropolitan area, the local cores are Vyborg, Gatchina, Kingisepp, Tosno and Tikhvin; in the Kaliningrad region, Sovetsk and Chernyakhovsk. The former has seven planning axes; the latter, three.

The spatial structures of the two regions include large coastal belts: a coastal belt proper and a land-coast belt. Coastal belts are composed of coastal zones: three in the St. Petersburg metropolitan area (northwestern, central and southwestern) and two in the Kaliningrad region (central and northern).

The Engel and Goltz coefficients were computed to define the level of development of the linear elements, i. e., transport routes. The calculation showed that road transport outstrips other modes in both regions, whilst river transport is the least advanced. The Kaliningrad region performs better than the St. Petersburg metropolitan area across all modes of transport with the exception of railway transport as assessed based on the Goltz coefficient.

Therefore, the similar socioeconomic conditions observed in the country, the Baltic area, and the world cause the two regions to develop in the same direction, compensating for some tendencies of recent years. In the years to come, the maritime component will not play the same decisive role. Consequently, spatial planning carried out in the study regions should embrace the transition from a monocentric to polycentric spatial structure model, a transition bolstered by the emergence and development of local satellites and their linear relationships (a linear-nodal model). Given the current values, growing monocentricity will no longer produce positive economic effects, such as those associated with agglomeration. On the contrary, it will have mounting negative consequences.

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