MONITORING STUDIES

SPATIAL DEVELOPMENT MONITORING

Trends in the Spatial Development of Regions in the Northwest of Russia in the 21st Century

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Abstract. Russia, being the largest country in the world in terms of territory, attaches great importance to the effective use of its vast space. The paper considers findings of a monitoring of the current situation and key trends regarding spatial development of the Northwestern Federal District and the RF constituent entities included in it. Spatial development of the macro region is studied from the position of center-peripheral and frame approaches; spatial organization is considered taking into account the transformation of the settlement, production, economic and infrastructural frames. The conclusion is made about the increasing nature of the centripetal vector of development and peripherization at the macro and intraregional levels (this is especially acute in the regions of the North). In addition, the paper presents current estimates (2020–2023) of the ranks of Northwestern regions among RF constituent entities on key indicators of spatial development, which can be used by federal and regional authorities as part of monitoring and revising their policies. We prove that an important task is to create conditions conducive to the development of the spatial frame of the macro region by unlocking the potential of various kinds of localities (cities and agglomerations of various levels of hierarchy, rural, industrial periphery). We substantiate a set of measures to increase the connectivity of the macro region's space, which are in line with the priorities of the new Concept and draft Strategy for Spatial Development of the Russian Federation until 2036.

Key words: spatial frame, agglomeration processes, locational compression, strategic priorities, connectivity of space, Northwest of Russia.

Introduction

An important task is to increase the efficiency of the use of internal (endogenous) factors of development, which includes a huge *spatial potential*[1] in the context of Russia's growing geopolitical confrontation with the countries of the Collective West, expressed in the Special Military Operation (SMO) and increased sanctions pressure (Ilyin, Morev, 2022); however, it is currently used not fully and effectively enough to ensure national security of the country.

These circumstances determine the importance of scientific-methodological and information-analytical support of the activities of public authorities in the development and implementation of spatial development policy priorities. At the same time, we should agree with the researchers (Lazhentsev, 2020; Kryukov et al., 2020) that it is advisable to implement such a policy not only within the boundaries of the RF constituent entities, but also at a higher level of hierarchy (macro region). This will help to form a strategic approach to Russia's spatial development, which allows consolidating and using the potential of interregional integration.

The purpose of the study is to monitor the state and key trends in the spatial development of the Northwestern Federal District (NWFD) regions at the current stage.

The presented materials[2] can serve as a *scientific, analytical and methodological basis* for the deve-

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[1] In the most general form, the spatial potential of a country, macro region, region is characterized by the degree of economic, settlement development and livability, the actual level of cohesion (integrity) of the territory and, in practice, synthesizes all other components of the aggregate potential (Kuznetsova, Nikiforov, 2013).

[2] A monitoring system is currently being formed for various aspects related to the development of Northwestern Federal District regions (demography, economy, space, scientific and technological development, etc.). This is done under the leadership of Vladimir A. Ilyin, RAS Corresponding Member, Doctor of Sciences (Economics), Professor. The presented work is devoted to monitoring the spatial development of the Northwest of Russia.

lopment and implementation of spatial development policy at the macro and regional levels in the light of the aggravation of geopolitical challenges and the development of a new Concept[3] and Strategy for Spatial Development of Russia until 2036[4], which are focused on the development of the supply economy in the country, creation of conditions for ensuring the sustainability of the settlement system (reduction of population outflow from the regions of Siberia, the Arctic and the Far East; development of strategic settlements, small and medium-sized cities, rural areas), provision of infrastructural development and growth of transport accessibility of territories.

**Methodology and information base of the research**

The methodological basis of the study is the provisions of the *"center – periphery"* theory (Friedmann, 1966; Demyanenko, Isaev, 2015; Castells, 2020; Nefedova, Treivish, 2020; etc.), the concept of the supporting spatial frame[5] (Lazhentsev, 2011; Yakovleva, 2013; Lazhentsev,

2018; Dmitrieva, 2016; Dmitrieva, 2023; Gainanov et al., 2021; etc.). The spatial frame as an integral category of multidimensional socio-economic space (Kurushina, 2019) includes settlement, production-economic, infrastructural frameworks (*Fig. 1*).

The spatial frame development of a macro region is a mechanism of territorial and economic integration (Luchnikov, Nikolaev, 2017). In addition, as noted by the famous Russian geographer G.M. Lappo (Lappo, 1983), the use of the spatial frame concept stimulates the development of "frame thinking", which allows thinking strategically, seeing large problems, operating over vast territories (zones, macro regions, countries).

To study and characterize individual frames, taking into account the methodological approach of Academician A.G. Granberg[6], we formed a list of indicators characterizing the *quality of economic space* from the perspective of *density* parameters (density of population, economic activity, e.g. GRP,

Figure 1. Spatial frame components of the macro region

Spatial frame

1. Settlement framework

2. Production-economic framework

3. Infrastructural framework
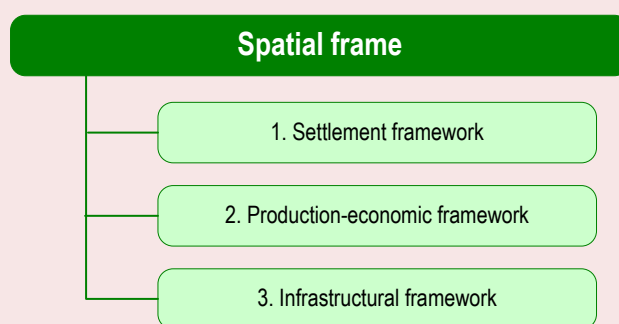
Source: own compilation.

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[3] Concept of the Strategy for Spatial Development of the Russian Federation until 2030 with a forecast up to 2036. Ministry of Economic Development of the Russian Federation. Available at: https://www.economy.gov.ru/material/file/85fb48440f79df7 78539e0b215af5345/koncepciya_strategii_prostranstvennogo_razvitiya_rf_na_period_do_2030_goda.pdf

[4] On the main provisions of the projected strategy for spatial development of the Russian Federation until 2030. Federation Council of the Federal Assembly of the Russian Federation. Available at: http://council.gov.ru/activity/activities/ parliamentary/160906/

[5] In the classic works of the Soviet period, there were references to the "territorial framework" (Baransky, 1956), "settlement frame", "supporting frame of settlement" (Khorev, 1975), "supporting frame of the national economy" (Lappo, 1983). The focus was on nodes (large cities and urban agglomerations) and linear elements (roads, trunk roads) that connect these nodes with each other, thus "stitching together" the socio-economic space.

[6] Granberg A.G. (2000). *Fundamentals of Regional Economics: Textbook for Higher Education Institutions.* Moscow: GU VSHE.

number of organizations per capita, communication routes, etc.), *connectivity* (connectivity between parts and elements of space, development of transport and communication networks), *location* (determined through the presence of economically developed and undeveloped territories indicators of evenness, concentration of population, subjects of economic activity through the prism of the concept "center – periphery").

Our paper considers the NWFD space as heterogeneous. In the process of analysis, we have distinguished its *northern* (RF constituent entities that are part of the European North of Russia[7]: the Arkhangelsk, Murmansk, Vologda regions, the Komi Republics and the Republic of Karelia, the Nenets Autonomous Area) and *southern* (Saint Petersburg, the Leningrad, Novgorod, Pskov, Kaliningrad regions) *latitudinal projections*. The necessity of such an approach is due to the fact that these territories significantly differ from each other in terms of natural and climatic conditions, economic structure, infrastructure and, accordingly, trends in spatial development[8].

The main period of the analysis is 1990–2023; at the same time, we identified a number of time points within it, which allowed revealing the development features at different time intervals and taking into account the specifics of socio-economic and spatial policy carried out in this period.

The information base of the study was formed by the data of Rosstat and its territorial bodies, Rosavtodor; data from the official websites of public authorities of the Russian Federation, Russia's constituent entities, monitoring data of VolRC RAS, materials of periodicals.

Appendices 1 and 2 to the article present the ranks of NWFD regions among 85 RF constituent entities

[7] The European North of Russia is considered within the boundaries in accordance with the All-Russian Classifier of Economic Regions. OK 024-95 (approved by Decree of the State Standard of Russia 640, dated December 27, 1995).

[8] It is worth noting that this approach was once reflected in the Strategy for socio-economic development of the Northwestern Federal District for the period until 2020.

(excluding information on the Donetsk People's Republic, the Lugansk People's Republic, the Zaporozhye and Kherson regions) by the values of key indicators of spatial development in 2023 and by their average value for 2020–2022.

Research results

Settlement frame

The processes of "exodus" of the population from the North began in the post-Soviet period of the country's development, associated with the liberalization of socio-economic relations (*Tab. 1*). For instance, the European North of Russia (ENR) lost 2.12 million in 1989–2023. The European North of Russia (ENR) lost 2.12 million people, or 34.4% of its population. The greatest reduction was observed in the Murmansk Region (-44.7%, or 532 thousand people) and the Komi Republic (-41.9%, or 521 thousand people)[9]. Such processes are associated *not only with natural decline, but also to a large extent with the migration outflow* to more southern subjects and lead to the destruction of the territory's settlement frame.

The situation is somewhat different in the subjects of the southern latitudinal projection of the district. The center of population concentration here is the actively developing largest Saint Petersburg agglomeration: the core is Saint Petersburg (population grew for the given period by 594 thousand people, or 12%) and the surrounding Leningrad Region (by 358.1 thousand people, 21.5%). Along with it, the Kaliningrad Region (by 147.2 thousand people, 16.6%) registered an increase, which is mainly due to the migration inflow. At the same time, due to the "pulling" of human resources by these territories, the population of the neighboring but less developed Novgorod Region (by 178.9 thousand people, 23.8%) and the Pskov Region (by 259 thousand people, 30.7%) decreased.

[9] The Nenets Autonomous Area is the only northern subject of the ENR (due to the active development of oil and gas production in the region), which in recent years has seen a slight increase in population (+1.8% compared to 2000).

Table 1. Average annual population of the Northwestern Federal District in 1990–2023, thousand people

Territory	Year						2023 to 1990, %**	2023 to 2000, %	2023 to 2020, %
	1990	2000	2010	2020	2022	2023			
RF*	148.0	146.6	142.8	147.7	146.7	146.3	98.9	99.0	99.0
NWFD*	15.3	14.3	13.6	14.0	13.9	13.9	90.5	99.3	99.3
Northern latitudinal projection of the macro region (European North of Russia, ENR)									
Republic of Karelia	791.6	732.1	645.7	546.1	530.1	525.9	66.4	71.8	96.3
Komi Republic	1244.4	1050.4	905.6	756.9	730.4	723.5	58.1	68.9	95.6
Arkhangelsk Region without NAA	1520.4	1338.7	1189.1	1004.8	969.5	960.1	63.1	71.7	95.6
Nenets Autonomous Area	51.8	41.1	42.1	41.6	41.4	41.8	80.7	101.8	100.5
Vologda Region	1354.1	1295.0	1204.8	1154.8	1133.6	1125.1	83.1	86.9	97.4
Murmansk Region	1190.1	932.0	796.9	685.4	662.0	657.6	55.3	70.6	95.9
Total for the northern projection	6152.5	5389.2	4784.1	4189.6	4067.0	4033.9	65.6	74.9	96.3
Southern latitudinal projection of the macro region									
Saint Petersburg	5005.0	4728.4	4866.1	5584.6	5604.0	5598.9	111.9	118.4	100.3
Kaliningrad Region	885.9	958.1	940.2	1018.5	1031.7	1033.1	116.6	107.8	101.4
Leningrad Region	1671.2	1683.5	1711.7	1964.1	2014.9	2029.8	121.5	120.6	103.3
Novgorod Region	752.6	714.4	636.2	590.6	578.8	573.7	76.2	80.3	97.1
Pskov Region	843.5	787.5	676.6	608.8	592.3	584.5	69.3	74.2	96.0
Total for the southern projection	9158.3	8872.0	8830.9	9766.6	9821.6	9820.0	107.2	110.7	100.5
* Data for the Russian Federation and NWFD are presented in million people. ** Hereinafter in the tables green shading indicates positive trends, red – negative trends. Source: own compilation based on Rosstat data.									

At the intra-regional level, the depopulation processes are particularly outstanding (Fig. 2, Tab. 2). For example, in the Komi Republic, the population of almost all municipalities of the north-eastern corner (Inta, Vorkuta, Vuktyl, Troitsko-Pechorsky) decreased more than twofold over the period[10]. A similar situation is observed in the two western municipalities of the Republic (Knyazhpogostsky and Udorsky municipal districts), where the population in 2023 was, respectively, 37.1 and 30.9% in relation to 1989. These districts specialize in logging and wood processing, but the local timber processing industry is characterized by low output, labor demand, and low wages, which serves as one of the key reasons for migration.

There was also a noticeable decrease in the population in the Murmansk and Arkhangelsk regions: in the prevailing number of municipalities, it decreased by more than half. Not only rural periphery, but also cities, including administrative centers of the regions (Arkhangelsk, Murmansk) depopulated due to natural and migration loss.

Population also decreased in the Vologda Region, in all municipalities, except for Vologda (from 13 to 57.7%). However, the municipal entities located in the zone of influence of a large city (Vologda) and included in the Vologda agglomeration (Sokolsky, Vologdsky, Gryazovetsky districts) were in a more stable state during the given period, as a result of which the share of the agglomeration in the total population of the region in 1990−2023 increased from 35 to 40%.

As can be seen from Figure 2, in general, the municipalities of the emerging urban agglomerations (Vologda, Murmansk, Arkhangelsk) are characterized by a more favorable demographic situation against the background of depopulation of the middle and far periphery. These facts indicate the predominance of the centripetal vector in the development, weak translation of positive agglomeration effects to the territories remote from large cities.

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[10] In Vuktyl and Troitsko-Pechorsky District, this is due to the low level of social and transport infrastructure development, the preservation of the single industry economic nature; in Inte and Vorkuta, this is supplemented by the crisis in the sectors of territories' specialization (cessation of coal production due to the depletion and closure of a number of coal mines) (Dmitrieva, 2023).

Figure 2. Population of NWFD municipalities in 2023, % to 1989

Source: Rosstat data. The cartogram was compiled with the participation of M.A. Lebedeva using the QGIS toolkit.

Table 2. Grouping of NWFD municipalities by population dynamics in 1989–2023

Population, % to the level of 1989	Number of municipalities in the group, units (% of the total number of NWFD municipalities)	Region (number of municipalities)
20.0–49.9	44 (23.4)	Arkhangelsk Region (11), Republic of Karelia (8), Komi Republic (7), Pskov Region (7), Murmansk Region (6), Novgorod Region (4), Kaliningrad Region (1)
50.0–74.9	94 (50)	Vologda Region (21), Pskov Region (16), Novgorod Region (16), Komi Republic (10), Arkhangelsk Region (10), Republic of Karelia (7), Murmansk Region (6), Leningrad Region (5), Kaliningrad Region (2), Nenets Autonomous Area (1)
75.0–99.9	30 (15.9)	Vologda Region (6), Leningrad Region (6), Kaliningrad Region (5), Republic of Karelia (3), Komi Republic (3), Arkhangelsk Region (3), Pskov Region (2), Nenets Autonomous Area (1), Novgorod Region (1)
Total: population decrease in 168 municipalities (89.3% of the total)		
100.0–124.9	12 (6.5)	Kaliningrad Region (5), Leningrad Region (4), Vologda Region (1), Pskov Region (1), Novgorod Region (1)
125.0–149.9	3 (1.6)	Kaliningrad Region (2), Leningrad Region (1)
150.0–174.9	1 (0.5)	Kaliningrad Region (1)
175.0–199.9	1 (0.5)	Leningrad Region (1)
in 2 times and more	3 (1.6)	Kaliningrad Region (2), Leningrad Region (1)
Total: population increase in 20 municipalities (10.7% of the total)		
Note: due to unavailability, we did not take into account data on 11 municipalities of the Northwestern Federal District (UO Closed City of Mirny and UO Novaya Zemlya, Arkhangelsk Region; UO Closed City of Aleksandrovsk, UO Closed City of Vidyaevo, UO Closed City of Zaozersk, UO Closed City of Ostrovnoy, Polyarnye Zori, Murmansk Region; Ladushkinsky UO, Mamonovsky UO, Pionersky UO and Yantarny UO, Kaliningrad Region). In Saint Petersburg, population in 2023 amounted to 111.4% of the 1989 level.		

The situation is more positive in the more southern subjects of the Northwestern Federal District, including due to the migration inflow. For example, in some districts of the Leningrad Region, the number of residents has increased quite significantly. As a rule, these are the districts that are closest to Saint Petersburg (the number of residents increased 3.4 times in Vsevolzhsky District, in Sosnovoborsky Urban Okrug, the increase amounted to 13.6%; in Vyborgsky District – 79.3%). This was also one of the manifestations of agglomeration processes. At the same time, the districts that do not have a common border with the northern capital, mostly lost from 6 to 39.5% of the population (Priozersky District – 6.7%, Lodeynopolsky District – 32.3%, Tikhvinsky District – 25.6%, Podporozhsky District – 39.5%).

The Pskov and Novgorod regions demonstrate the similar situation: the population is growing only in the area adjacent to the administrative center of the region, while in the administrative center itself the number of residents has slightly decreased. The remaining territories of the subjects also show a decrease in the number of population, reaching almost 60%, both in the peripheral districts and those close to the regional center. For instance, in the Pskov Region, the population loss in Porkhovsky District relative to 1990 amounted to 58.2%, in Bezhanitsky District – 57%, in Kunyinsky District – 58.3%.

The most favorable demographic situation is observed in the Kaliningrad Region. In 1990–2023, 10 out of 22 municipalities experienced population growth, including Guryevsk and Chernyakhovsk municipal districts 2.8 times (from 39.6 to 110.4 thousand people) and 3.5 times (from 12.8 to 45.3 thousand people). Population growth here is provided not only by interregional migration, but to a certain extent by the inflow of residents from Germany and Poland (return of Russians)[11].

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[11] "RG": Foreigners go to the Kaliningrad Region. *RBK*. Available at: https://kaliningrad.rbc.ru/kaliningrad/25/01/20 23/63d0f1af9a79473f596096f8 (accessed: October 12, 2024); The share of those who came to Guryevsky District from abroad was announced. *Russkii Zapad*. Available at: https://ruwest.ru/news/132462 (accessed: October 12, 2024).

Table 3. Total population density in NWFD, people/km^2

| Territory	Year						2023 to 1990, %	2023 to 2000, %	2023 to 2020, %
	1990	2000	2010	2020	2022	2023			
RF	8.7	8.6	8.4	8.6	8.6	8.5	98.6	99.6	99.0
NWFD	9.2	8.5	8.1	8.3	8.2	8.2	89.2	97.1	99.3
Northern latitudinal projection of the macro region (European North of Russia)									
Republic of Karelia	4.6	4.1	3.6	3.0	2.9	2.9	63.5	71.8	96.3
Komi Republic	3.0	2.5	2.2	1.8	1.8	1.7	58.0	68.9	95.6
Arkhangelsk Region without NAA	3.7	3.2	2.9	2.4	2.3	2.3	62.8	71.7	95.6
Nenets Autonomous Area	0.3	0.2	0.2	0.2	0.2	0.2	80.6	101.8	100.5
Vologda Region	9.3	9.0	8.3	8.0	7.8	7.8	83.8	86.9	97.4
Murmansk Region	8.2	6.4	5.5	4.7	4.6	4.5	55.3	70.6	95.9
Southern latitudinal projection of the macro region									
Saint Petersburg	3575.0	3377.4	3475.8	3989.0	4002.8	3999.2	111.9	118.4	100.3
Kaliningrad Region	58.7	63.5	62.3	67.4	68.3	68.4	116.6	107.8	101.4
Leningrad Region	19.8	20.1	20.4	23.4	24.0	24.2	122.3	120.6	103.3
Novgorod Region	13.6	13.1	11.7	10.8	10.6	10.5	77.3	80.3	97.1
Pskov Region	15.3	14.2	12.2	11.0	10.7	10.5	69.2	74.2	96.0
Source: own compilation based on Rosstat data.									

As a result, depopulation processes in significant areas of the district have led to a further *decline in population density*. For instance, if in 1990, as a whole the density exceeded the national average in the NWFD (9.2 vs 8.7 people per thousand square kilometers), in 2023 it was already below it (8.2 vs 8.5, *Tab. 3*). This was mainly due to a further decrease in population density in the subjects of the European North of Russia: in the Murmansk Oblast, it was from 8.2 to 4.5 people per square kilometer, in the Komi Republic – from 3.0 to 1.7 people per square kilometer. This leads to the "collapse" of the capacity of local markets and is a trigger for further stagnation of not only local, but to a certain extent regional economy.

Another trend of changes in the settlement frame is *the increase in the share of the population living in regional administrative centers*, which indicates the centripetal development nature and is a risk for maintaining the stability of the territory's settlement frame (*Fig. 3*). For instance, there was an increase in this indicator in all subjects of the Northwestern

Figure 3. Share of population living in the administrative center of the constituent entity of the RF in 1989 and 2023, %
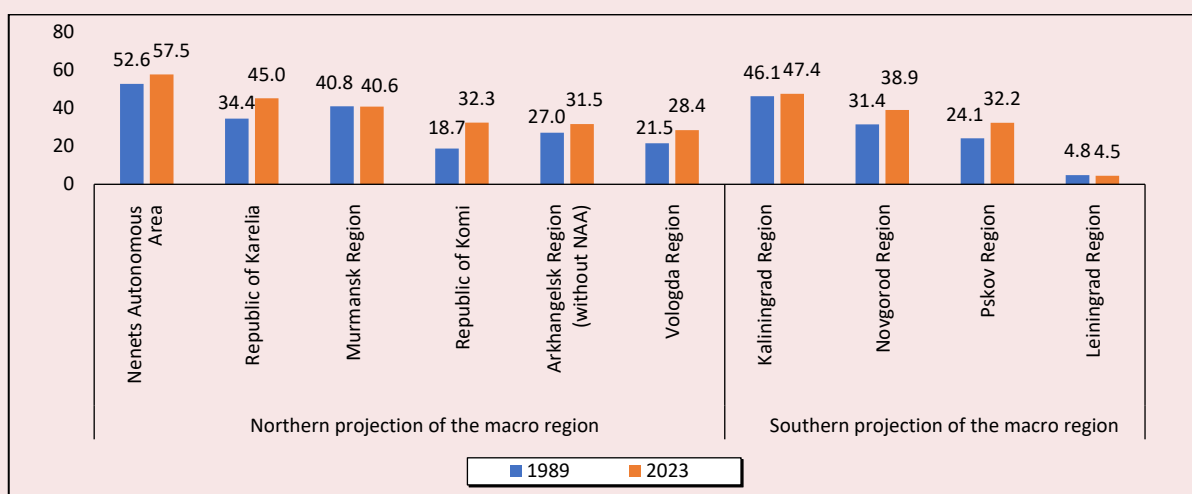
Source: own compilation based on Rosstat data.

Federal District except for the Leningrad Region in 1989–2023 (its share currently varies from 28.4% in the Vologda Region to 57.5% in the Nenets Autonomous Area).

Along with this, another negative trend is the shrinking of the *settlement structure*. For example, even in one of the southernmost subjects of the Northwestern Federal District – the Vologda Region – the number of rural settlements decreased by 655 units in 1989–2020 (from 8,459 to 7,824 units, or 7%). At the same time, the number of uninhabited settlements increased by 967 units (or 72%); there was an increase in the number of settlements with population of less than 10 persons – by 414 units, or 15%. As a result, currently, 70% of rural settlements in the region are without population or with a population of less than 10 persons. Similar trends are observed in other NWFD regions, which against the background of rapidly aging population may lead to almost complete depopulation and economic "desertification" of these settlements in the coming years.

Industrial and economic frame

The Northwestern Federal District is one of the country's leaders in terms of contribution to the national economy: its share in Russia's total GRP in 2022 amounted to 13.5% (+1 p.p. vs 1998; behind the CFD, UFD, and VFD).

One of the key indicators characterizing the scale of economic activity in the region is GRP per capita. In the Northwestern Federal District, it is currently 1.4 times higher than the average Russian value: 1362.9 vs 958.8 thousand rubles per capita. The highest indicators are observed in the Nenets Autonomous Area (11787.8 thousand rubles/person in 2022; *Tab. 4*), Saint Petersburg (1992.6 thousand rubles/person) and the Murmansk Region (1735.2 thousand rubles/person); the lowest are in the Pskov and Novgorod regions (435.2 and 657.6 thousand rubles/person, respectively).

The number of organizations per 1 thousand people characterizes the density of economic activity, business activity and, ultimately, the quality of the region's economic space. In the Northwestern Federal District, as well as in the Russian Federation

Table 4. Gross regional product per capita (in comparable prices of 2022), thousand rubles

Territory	Year						2022 to 1998, times	2022 to 2000, times	2022 to 2020, %
	1998	2000	2010	2020	2021	2022			
RF	389.2	457.9	782.9	884.9	952.7	958.8	2.5	2.1	108.4
NWFD	496.2	594.9	1069.8	1236.5	1394.3	1362.9	2.7	2.3	110.2
Northern latitudinal projection of the macro region (European North of Russia)									
Republic of Karelia	352.8	432.2	602.7	765.4	801.1	738.4	2.1	1.7	96.5
Komi Republic	715.3	784.8	1216.7	1262.6	1315.6	1335.8	1.9	1.7	105.8
Arkhangelsk Region without NAA	295.5	395.5	845.2	1052.0	1129.1	1175.5	4.0	3.0	111.7
Nenets Autonomous Area	No data	No data	No data	695.0	736.5	722.3	-	-	103.9
Vologda Region	No data	3900.7	11903.8	9619.0	10471.4	11787.8	-	3.0	122.5
Murmansk Region	471.1	585.6	772.3	905.4	940.2	903.5	1.9	1.5	99.8
Republic of Karelia	894.1	1034.2	1228.9	1712.2	1846.2	1735.2	1.9	1.7	101.3
Southern latitudinal projection of the macro region									
Saint Petersburg	664.0	783.0	1567.4	1707.2	2043.7	1992.6	3.0	2.5	116.7
Kaliningrad Region	234.5	288.2	603.0	696.1	753.0	715.3	3.1	2.5	102.8
Leningrad Region	247.3	318.4	701.8	790.3	831.6	822.8	3.3	2.6	104.1
Novgorod Region	240.4	268.4	456.4	628.6	660.0	657.6	2.7	2.4	104.6
Pskov Region	180.1	230.5	350.4	420.5	432.8	435.2	2.4	1.9	103.5
Source: own compilation based on Rosstat data.									

Table 5. Number of organizations of all forms of ownership, units per 1 thousand people

Territory	Year						2023 to 2000, %	2023 to 2020, %
	2000	2010	2020	2021	2022	2023		
RF	22.8	33.8	23.8	22.7	22.4	22.3	97.7	93.7
NWFD	27.9	46.4	31.3	29.7	28.8	28.1	100.7	89.9
Northern latitudinal projection of the macro region (European North of Russia)								
Republic of Karelia	21.4	34.7	34.4	32.4	32.0	31.1	145.5	90.4
Komi Republic	18.1	25.7	20.6	19.1	18.4	17.9	99.3	87.2
Arkhangelsk Region without NAA	15.2	27.2	22.5	22.9	23.0	24.4	160.2	108.5
Nenets Autonomous Area	14.5	21.3	18.8	18.0	18.0	18.0	124.0	95.4
Vologda Region	17.4	32.0	30.0	29.3	28.0	26.3	151.6	87.7
Murmansk Region	17.7	28.8	20.6	20.5	20.7	20.7	117.2	100.3
Southern latitudinal projection of the macro region								
Saint Petersburg	46.2	77.0	43.0	40.4	38.8	37.4	80.8	86.9
Kaliningrad Region	28.5	54.7	35.7	33.8	32.6	31.9	111.9	89.3
Leningrad Region	18.6	24.1	16.6	16.1	16.0	17.0	91.4	102.3
Novgorod Region	17.4	23.4	19.9	19.6	18.9	18.7	107.5	94.0
Pskov Region	18.5	23.6	19.8	19.6	19.1	18.8	101.5	95.1
Source: own compilation based on Rosstat data.								

as a whole, this indicator increased in 2000–2010, and since 2010 it has shown a declining trend (*Tab. 5*). The greatest reduction in the number of organizations in absolute terms was in 2021, which is mainly due to the suspension of work, liquidation of organizations during the period of the pandemic and the introduction of appropriate restrictions.

In general, according to 2023 results, the highest density of organizations was observed in Saint Petersburg (37.4 units/thousand people), the Kaliningrad Region (31.9 units/thousand people) and the Republic of Karelia (31.1 units/thousand people). We should note that in 2000 they also held the leading positions. In 2023, the lowest density of organizations was recorded in the Leningrad Region, in 2000 – in the Arkhangelsk Region (17.0 and 14.5 units/thousand people, respectively).

The investment volume in fixed capital is a significant indicator that allows distinguishing the economic activity areas. The Nenets Autonomous Area has been and remains the leader among the Northwestern Federal District subjects in terms of attracted investment funds per capita[12] (in 2023 – 2063.4 thousand rubles, which is 9 times higher than the average Russian level and the macro region level as a whole; *Tab. 6*).

Since 2020 the second place is held by the Murmansk Region (405.9 thousand rubles/person in 2023). Territorially, the funds are directed mainly to the Murmansk urban okrug (53% of the total investment volume in fixed capital of the region in 2023[13]; the type of activity attracting the largest investment volume in Murmansk is "Transportation and storage"); Kola Municipal District (15.0% of the total investment volume in fixed capital of the region; the type of activity attracting the largest volume of investment is "Transportation and storage"); Kirovsk (10%), where the Kirov branch of Apatit JSC is located. The Leningrad Region rounds out the top three (337.8 thousand rubles/person in 2023; 300.6 thousand rubles/person in 2022). Of the total investment volume in the region in 2022, 47% was directed to manufacturing industries, 22% – in the sphere of transportation and storage[14].

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[12] Funds are mainly used for development, storage and transportation through the Varandey terminal of minerals from the Timan-Pechora oil and gas basin.

[13] Official website of Murmanskstat. Available at: https://51.rosstat.gov.ru/folder/72872

[14] Leningrad Region in 2022. Petrostat. Saint Petersburg, 2023.

Table 6. Investment volume in fixed capital per capita (in comparable prices of 2023), thousand rubles

Territory	Year							2022 to 1990, %	2022 to 2020, %
	1990	2000	2010	2020	2021	2022	2023		
RF	244.3	64.0	160.8	184.7	201.3	211.3	232.6	95.2	125.9
NWFD	183.0	62.1	214.6	214.6	222.8	212.2	221.9	121.3	103.4
Northern latitudinal projection of the macro region (European North of Russia)									
Republic of Karelia	155.7	48.8	89.4	141.8	194.5	204.2	197.0	126.5	138.9
Komi Republic	300.8	103.7	282.4	237.3	212.9	178.7	177.7	59.1	74.9
Arkhangelsk Region with NAA	207.7	58.0	202.3	243.3	216.0	206.4	205.6	98.9	84.5
Nenets Autonomous Area	no data	473.4	1763.4	2541.4	2106.8	2206.9	2063.4	-	81.2
Arkhangelsk Region without NAA	no data	no data	no data	148.3	139.0	122.5	124.7	-	84.1
Vologda Region	209.2	46.6	175.1	252.4	241.7	171.8	150.0	71.7	59.5
Murmansk Region	172.0	56.4	128.1	418.0	517.3	443.1	405.9	236.0	97.1
Southern latitudinal projection of the macro region									
Saint Petersburg	124.9	58.9	217.6	200.0	217.6	206.3	213.5	170.9	106.8
Kaliningrad Region	100.3	42.4	137.9	130.0	111.3	133.1	189.7	189.2	145.9
Leningrad Region	170.7	83.5	358.6	268.3	272.5	300.6	337.8	197.9	125.9
Novgorod Region	125.5	56.8	186.6	120.9	108.6	111.6	131.7	104.9	108.9
Pskov Region	174.3	30.8	70.0	92.7	111.2	80.0	81.4	46.7	87.9
Source: own compilation based on Rosstat data.									

In 2023, the per capita volume of investments in comparable prices of 2022 in the Northwestern Federal District was 21.3% higher than the 1990 level: 183.0 vs 221.9 thousand rubles/person. Among the subjects of the northern latitudinal projection the situation is similar: the excess of the 1990 level was observed in Karelia (by 26.5%) and the Murmansk Region (by 2.4 times); among the subjects of the southern projection – in Saint Petersburg (by 70.9%), the Kaliningrad (by 89.2%), Leningrad (by 97.9%), Novgorod (by 4.9%) regions.

The maximum average annual investment growth rates in the NWFD and most of its subjects were observed in the 10-year period from 2001 to 2010 (the exception is the Murmansk Region in the period 2011–2020; *Tab. 7*). In the three-year period 2021–2023, the highest average annual growth rates are characteristic of the Republic of Karelia; growth was also observed in the Kaliningrad, Leningrad, Novgorod regions and Saint Petersburg.

It is important to note that while in 2023 at the macro-regional level the maximum volume of investment in fixed capital (NAA) exceeded the minimum (Pskov Region) *by 25 times, at the intra-regional level the disproportions were significantly greater*: in the Republic of Karelia – 42 times, the Komi Republic – 88 times. This gap has grown since the 1990s both among the NWFD subjects and their municipalities (for example, in Karelia from three to 42 times, etc.). Municipalities with raw materials specialization (for example, Usinsk and Ukhta in Komi, whose share in the total regional investment volume in 1995–2022 increased from 12.5 to 32.3% and from 16.7 to 24.4%, respectively); with developed manufacturing industry (Petrozavodsk, Cherepovets) remain attractive areas for investment since the 1990s and even increase their weight in the total regional investment volume.

The least attractive from the point of view of investment are peripheral municipalities, remote from the centers of extraction and processing of raw materials, with a high proportion of rural population.

Infrastructure frame

In the macro region as a whole, the *density of paved roads* increased by 1.6 times in 2000–2022: from 40 to 63 km of roads per 1 thousand square kilometers of territory (*Tab. 8*). At the same time, if in 2000 the NWFD indicator values exceeded the average Russian level (40 vs 31.2 km of roads/thousand square kilometers of territory), at present they are lower (63 vs 66).

Table 7. Average annual growth rate of investments in fixed capital per capita (in comparable prices in 2023), %

Territory	1991–2000	2001–2010	2011–2020	2021–2023
RF	0.87	1.10	1.01	1.08
NWFD	0.90	1.13	1.00	1.01
Northern latitudinal projection of the macro region (European North of Russia)				
Republic of Karelia	0.89	1.06	1.05	1.12
Komi Republic	0.90	1.11	0.98	0.91
Arkhangelsk Region with NAA	0.88	1.13	1.02	0.95
Nenets Autonomous Area	no data	1.14	1.04	0.93
Arkhangelsk Region without NAA	no data	no data	no data	0.94
Vologda Region	0.86	1.14	1.04	0.84
Murmansk Region	0.89	1.09	1.13	0.99
Southern latitudinal projection of the macro region				
Saint Petersburg	0.93	1.14	0.99	1.02
Kaliningrad Region	0.92	1.13	0.99	1.13
Leningrad Region	0.93	1.16	0.97	1.08
Novgorod Region	0.92	1.13	0.96	1.03
Pskov Region	0.84	1.09	1.03	0.96
Source: own compilation based on Rosstat data.				

Table 8. Density of public roads with hard surface, km of roads per 1 thousand square kilometers of territory

Territory	Year						2023 to 2000, %	2023 to 2020, %
	2000	2010	2020	2021	2022	2023		
RF	31.2	39	64	65	65	66	210.5	102.5
NWFD	40	45	63	63	63	63	156.9	100.3
Northern latitudinal projection of the macro region (European North of Russia)								
Republic of Karelia	38.0	37.0	46.9	46.6	47.2	48.1	126.6	102.5
Komi Republic	13.0	14.0	16.2	16.5	16.2	16.5	126.9	102.0
Arkhangelsk Region with NAA	17.0	25.6	29.4	29.7	29.5	29.6	174.2	100.9
Nenets Autonomous Area	0.9	1.1	1.6	1.7	1.8	1.9	206.5	115.3
Vologda Region	81.0	81.0	115.8	116.5	115.2	110.7	136.7	95.6
Murmansk Region	17.0	19.0	23.6	23.9	23.8	24.2	142.6	102.6
Southern latitudinal projection of the macro region								
Saint Petersburg	no data	no data	2525.8	2522.3	2530.6	2542.4	-	100.7
Kaliningrad Region	303.0	439.0	527.1	526.2	524.1	518.9	171.3	98.4
Leningrad Region	122.0	135.0	216.9	218.0	220.4	221.7	181.7	102.2
Novgorod Region	156.0	175.0	202.7	203.7	203.7	200.8	128.7	99.1
Pskov Region	180.0	200.0	308.1	311.3	298.2	312.6	173.7	101.5
Source: own compilation based on Rosstat data.								

At the same time, significant differences between its northern and southern latitudinal projections remain in the macro region space (even taking into account the exclusion of Saint Petersburg from the analysis). Such differences in 2023 reached 273 times (between the Kaliningrad Region and the Nenets Autonomous Area). Obviously, the northern territories will have a more underdeveloped road network due to unfavorable natural and climatic conditions, dispersed nature of settlement and economic activities[15]. However, this is one of the factors that limit the transport connectivity of the territories.

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[15] For comparison, we note that in the northern foreign countries the density of highways is much higher: in Norway, it is 287 km, Finland — 230 km per 1 thousand square kilometers (although these countries are much smaller in area). Source: Worldstat Info. Available at: http://ru.worldstat.info/

Some increase in road density in the NWFD regions is due to both changes in the statistical accounting system (inclusion of local roads in the length of roads since 2006 and streets since 2012) and direct construction of roads, including within the framework of major infrastructure programs and projects[16].

The share of public roads of regional or inter-municipal significance meeting the standards in the subjects of the Northwestern Federal District in 2022 ranged from 24.6% (Arkhangelsk Region; *Tab. 9*) to 68.2% (Saint Petersburg). At the same time, while in all regions of the southern latitudinal projection this share has increased since 2007, in three out of six regions of the northern projection it has decreased by 6−19 p.p. (Komi, NAA, Vologda Region).

In terms of space connectivity, along with linear (highways), the availability of so-called "soft" infrastructure currently plays a significant role. In 2014, *the share of households with access to the Internet* in most (8 out of 11; *Tab. 10*) subjects of the NWFD was above the national average of 69.9%. By 2023, despite positive trends in the growth of network availability, the situation has changed: the share of households in 8 subjects was below the Russian average of 87.9%.

Despite this, in 2014−2022 there was a decrease in the numerical gap between the NWFD regions due to "pulling up the laggards": the gap between the maximum and minimum values of indicators decreased from 22.6 to 10.7 p.p.

Social infrastructure plays a significant role in the infrastructure provision of the territory. In 1990−2020, *the number of hospital beds per 10,000 people* in the Northwestern Federal District decreased by 40% (from 133.8 to 80.8 units; *Tab. 11*). Then the situation changed slightly: in 2020−2022, there was a 1% increase (from 80.8 to 81.6 units), provided by the positive dynamics of the indicator in the Arkhangelsk and Kaliningrad regions and Saint Petersburg. The situation is the same in the Novgorod Region. In the rest of the NWFD regions the number of beds per 10 thousand people decreased by 0.1−6.6% in 2020−2022.

Table 9. Share of public roads of regional or intermunicipal significance that meet regulatory requirements, %

Territory	Year					2022 to 2007 (+/-), p.p.	2022 to 2020 (+/-), p.p.
	2007	2010	2020	2021	2022		
RF	44.3	36.8	45.8	48.2	50.6	6.3	4.8
NWFD	34.4	23.4	40.7	43	45.4	11	4.7
Northern latitudinal projection of the macro region (European North of Russia)							
Republic of Karelia	25	31	36.2	36.6	36.6	11.6	0.4
Komi Republic	57	43.4	50.6	49.7	50.9	-6.1	0.3
Arkhangelsk Region with NAA	7	8.8	19	20.3	24.6	17.6	5.6
Nenets Autonomous Area	67	8.3	36.9	52.4	55.1	-11.9	18.2
Vologda Region	60	6.5	38.3	39.7	40.6	-19.4	2.3
Murmansk Region	23	21.8	43.8	46.3	45.5	22.5	1.7
Southern latitudinal projection of the macro region							
Saint Petersburg	no data	no data	65.5	68.7	68.2	-	2.7
Kaliningrad Region	30	30	38.2	43.2	48	18.0	9.8
Leningrad Region	47.7	38.5	49.5	50.4	51.3	3.6	1.8
Novgorod Region	9	16.5	47.6	54.1	61.4	52.4	13.8
Pskov Region	30	25.9	34.3	36.4	40.1	10.1	5.8
Source: own compilation based on EMISS data.							

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[16] "Modernization of the Transport System of Russia" (implementation period: 2002−2010); "Transport System Development" (2018−2021); "Safe Quality Roads" (2018−2030); "Comprehensive Plan for Modernization and Expansion of Trunk Infrastructure" (2018−2024).

Table 10. Share of households with access to the Internet, % of the total number

Northern latitudinal projection			Southern latitudinal projection		
Territory	2014	2023	Territory	2014	2023
Republic of Karelia	70.8	84.0	Saint Petersburg	84.9	88
Komi Republic	70.3	83.2	Kaliningrad Region	81.6	89.2
Arkhangelsk Region with NAA	73.2	82.8	Leningrad Region	75.6	84
Nenets Autonomous Area	62.3	87.4	Novgorod Region	63.1	78.5
Vologda Region	62.6	83.2	Pskov Region	63.6	85.9
Murmansk Region	80.4	88.9			
Note: In 2014, the indicator for the RF amounted to 69.9%, for the NWFD – 76.4%; in 2023, the RF – 87.9%, NWFD – 85.7%. Source: own compilation based on Rosstat data.					

Table 11. Number of hospital beds, units per 10,000 people

Territory	Year						2022 to 1990, %	2022 to 2000, %	2022 to 2020, %
	1990	2000	2010	2020	2021	2022			
RF	137.5	115.0	93.8	80.6	79.1	78.0	56.7	67.8	96.8
NWFD	133.8	111.7	93.2	80.8	80.9	81.6	61.0	73.1	101.0
Northern latitudinal projection of the macro region (European North of Russia)									
Republic of Karelia	151.2	121.0	106.0	88.1	86.3	82.7	54.7	68.3	93.9
Komi Republic	147.9	119.9	111.7	104.5	99.3	104.4	70.6	87.1	99.9
Arkhangelsk Region with NAA	142.7	123.1	101.9	87.9	91.1	93.4	65.5	75.9	106.3
Nenets Autonomous Area	120.4	127.8	122.3	79.2	79.9	74.7	62.0	58.5	94.3
Vologda Region	145.3	118.6	89.5	77.2	77.1	76.3	52.5	64.3	98.8
Murmansk Region	112.9	115.3	124.7	111.9	109.3	104.5	92.6	90.6	93.4
Southern latitudinal projection of the macro region									
Saint Petersburg	123.8	101.3	89.3	79.7	81.2	83.6	67.5	82.5	104.9
Kaliningrad Region	143.2	113.0	78.0	77.5	77.5	79.9	55.8	70.7	103.1
Leningrad Region	126	97.9	73.7	57.0	58.4	55.0	43.7	56.2	96.5
Novgorod Region	149.1	135.7	98.6	81.9	80.8	81.9	54.9	60.4	100.0
Pskov Region	142.3	125.8	103.4	96.8	91.5	93.6	65.8	74.4	96.7
Source: own compilation based on Rosstat data.									

Conclusion

The following conclusions can be drawn based on the results of the analysis. The spatial development of the Northwestern Federal District in the post-Soviet period was influenced by many factors, including transformational ones. However, despite this, a number of stable trends, manifested in the settlement, industrial-economic and infrastructural frames of the Northwestern Federal District, are quite clearly distinguished.

The main *positive trends* in the spatial development of the NWFD in 1990–2023 include the following:

— the share of the NWFD in the total GRP of Russia in 2022 amounted to 13.5%, having increased by 2.9 p.p. as compared to the level of 1995; as a result, in 2022, the average per capita GRP in the NWFD was 1.4 times higher than the Russian average: 1362.9 vs 958.8 thousand rubles (the highest indicators are observed in the Nenets Autonomous Area (11786.4 thousand rubles/person), Saint Petersburg (1992.6 thousand rubles/person) and the Murmansk Region (1735.2 thousand rubles/person); the lowest one is in the Pskov and Novgorod regions (435.2 and 657.7 thousand rubles/person));

— the share of the NWFD in the all-Russian volume of shipped goods of own production, works and services performed by own forces in 1990–2023 increased from 9.7% to 12.5%; however, according to the results of 2022–2023, the Northwestern Federal District and most of its regions became one of the most affected by the sanctions pressure of unfriendly countries. The NWFD and most of its constituent

regions became one of the most affected by the sanctions pressure of unfriendly countries;

— the number of organizations per 1 thousand people, which characterizes business activity in the region, increased in 2000−2023 in most subjects of the NWFD and now exceeds the average Russian level: Saint Petersburg − 37.4 units/thousand people, the Kaliningrad Region − 31.9, the Republic of Karelia − 31.1; the average for the Russian Federation − 22.3;

— population growth in some southern subjects of the NWFD: Saint Petersburg − by 11.9% (from 5.0 to 5.6 million people), the Leningrad Region − by 21.5% (from 1.7 to 2.0 million people), the Kaliningrad Region − by 16.6% (from 0.9 to 1.0 million people);

— increasing the density of paved roads from 40 (2000) to 63 km (2022) of roads per 1,000 square kilometers of territory;

— there is a decrease in the gap between the NWFD regions in terms of the share of households with the Internet access due to "pulling up the laggards" (the gap between the maximum and minimum indicators in 2014−2022 decreased from 22.6 to 10.7 p.p.). However, at present, in 8 subjects of the NWFD (out of 11) the share of households with the Internet access is lower than in Russia as a whole (87.9%).

The key *negative trends* include the following:

— decrease in the total population of the NWFD, and especially of the northern subjects of the Russian Federation (in 1990−2023, the population in the European North of Russia decreased by 34.4% (from 6.2 to 4.0 million people); in the Russian Federation − by 1.1%; in the NWFD − 9.5%); this is due not only to natural but also, to a large extent, to migration loss of population;

— depopulation processes have led to a decrease in population density in significant areas of the district; for instance, while in 1990, the density in the NWFD as a whole exceeded the national average (9.2 vs 8.7 people per thousand square kilometers), in 2023 it was already lower (8.2 vs 8.5); this indicator in the Murmansk Region decreased from 8.2 to 4.5 people per square kilometer; in the Komi Republic − from 3.0 to 1.7 people per square kilometer. Along with a general decrease in the number of people, this leads to a "collapse" of the capacity of local markets and is a trigger for further stagnation of their economies;

— locational compression of the developed space of the district and transformation of its settlement frame, which is manifested primarily in the increase in the urban population: for example, in 2023, the share of urban population in the Murmansk Region was 93%, while in most other subjects of the Northwestern Federal District, almost 3/4 of their population lived in cities; at the same time, administrative centers grew especially fast; on the other hand, the settlement network has been shrinking, for example, in the Vologda Region currently 70% of the total number of rural settlements in the region are without inhabitants or with a population of less than 10 people; against the background of a rapidly aging population, this may lead to almost complete depopulation and economic "desertification" of these territories;

— significant shift of the center of economic "gravity" of the macro region in the direction from north to south: in 1995−2022, the share of the regions of the northern projection of the NWFD in the country's GRP decreased from 5.4% to 3.4% (the NWFD as a whole increased from 10.6% to 13.5%);

— growth of inter- and intra-regional differentiation in investment activity: if in 2022 at the macro-regional level, the maximum volume of investments in fixed capital (NAA − 2065.4 thousand rubles/person) exceeded the minimum (Pskov Region − 66.8 million rubles/person) 31 times, then at the intra-regional level such disproportions were multiplied: in the Republic of Karelia, it was 42 times, in the Komi Republic − 88 times, in the Vologda Region − 22 times); this gap has grown since the 1990s both among the subjects of the NWFD and their municipalities (for example, in Karelia, it was from 3 to 42 times, etc.);

— underdevelopment and unsatisfactory quality of roads in the northern regions of the okrug: three out of six regions of the European North of Russia (Komi Republic, Nenets Autonomous Area, Vologda Region) present the decrease in the share of public roads of regional or inter-municipal importance meeting the normative requirements decreased by 6–19 p.p. in 2007–2022. Currently, almost 1/2 of rural settlements in the Arkhangelsk Region are not connected by paved roads to the public road network (48.3%), it is almost one third in the Komi Republic and the Vologda Region (31.9 and 31.4%, respectively).

Thus, we should say that *the centripetal vector of development and peripheralization processes are clearly observed both at the macro- and intra-regional levels* in the post-Soviet period according to the results of the analysis. This is manifested primarily in depopulation, economic "desertification", poor transport connectivity of territories remote from administrative and major centers of economic growth, especially acute in the regions of the North, characterized by more difficult conditions for living and doing business.

In this regard, an important task of the federal and regional authorities is to create conditions promoting the development of the spatial frame of the macro region by unlocking the potential of different kinds of places (cities and agglomerations of different levels of hierarchy, rural, industrial periphery), increasing the connectivity of the NWFD space. Taking this into account, we think that the priority of the spatial development policy should be the implementation of a set of measures (*Tab. 12*), which organically fit into the priorities of the new Concept and Strategy for Spatial Development of the Russian Federation until 2036, which identifies the support of accelerated development of supportive settlements of different hierarchical levels (2,319 units), increasing their infrastructure and transport connectivity as key priorities.

Table 12. Priority directions of spatial development of the NWFD in the context of ensuring spatial connectivity

Economic sphere	Social sphere	Institutional and legal regulation
– Modernization and expansion of "bottlenecks" in the development of transport infrastructure; coordinated development of key transport corridors (Northern Sea Route, Northern Latitudinal Railway, Belkomur), various modes of transport (sea, rail, road, etc.); modernization of roads and development of alternative modes of transport in peripheral areas; – organizational and communication support for the implementation of both small and medium-sized projects in priority areas of cooperation within the framework of inter-municipal cooperation (e.g., northern and Arctic tourism), as well as the implementation of budgetary investments in the form of public-private partnership (PPP), the use of horizontal subsidies and loans for the implementation of joint projects in strategic areas of regional development (neo-industrialization of territorial-economic systems with traditional industrial ecology); – support the formation and development of inter-regional clusters, innovation networks (ICST – Innovative Center of Sciences and Technology) on the basis of existing scientific and technological reserves (e.g., biotechnology, automotive); – stimulating production cooperation between enter-prises along the "north – south" line to support Arctic development projects in the context of implementing the import substitution policy	– Reduction of disproportions in the quality of life and human capital in the macro region along the line "north – south", "urban – rural" by investing in health care, education, science, culture, gasification of remote areas, elimination of their "digital" inequality; – supporting social cohesion, providing informational, scientific and expert support to the initiative "from below" in the development and implementation of territorial public self-government (TPSG) projects in the sphere of culture, education, tourism, management, etc.	– Development and adoption of the strategy and development program for the NWFD and its northern latitudinal projection, specific interregional projects in the economic and social spheres, including those coordinated with the development strategies of large corporations based in the district (e.g., JSC RZD, PJSC Gazprom, etc.); – working out of strategic development and spatial planning documents for several NWFD subjects; parts of the RF constituent entity (subregions, agglomerations) in accordance with Federal Law 172 "On Strategic Planning in the Russian Federation"; – formation of a favorable institutional and legal environment that would enhance the effectiveness of interregional development institutions of the RF constituent entities (e.g., the world-class research and development center "Russian Arctic: New Materials, Technologies and Research Methods")
According to: (Lazhentsev, 2020; Kryukov et al., 2020; Kozhevnikov, 2022).		

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Appendix 1

Regional trends in 2020−2023

The consolidated ranks of the NWFD regions in 2020−2023 presented in *Appendices 1 and 2* are calculated as an arithmetic average of these regions among 85 regions of the Russian Federation[17] according to the indicators characterizing the state and trends in the development of *settlement, industrial-economic, infrastructural frames* (*Tab. 13*).

Table 13. Indicators used to assess trends in spatial development of the NWFD regions

1. Settlement frame	2. Production and economic frame	3. Infrastructure frame
1.1. Population density, persons per square kilometer of territory	2.1. GRP per capita, thousand rubles per person	3.1. Density of public roads with paved surface, km of tracks / thousand square kilometer of territory
1.2. Share of the region's population living in the administrative center, *%*	2.2. Investments in fixed capital per capita, thousand rubles/person	3.2. Number of hospital beds, units per 10,000 people
1.3. Migration rate of population growth, persons per 1 thousand population	2.3. Number of organizations, units per 1 thousand people	3.3. Share of households with access to the Internet, %
Source: for direct indicators (1.1, 1.3, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3), the increase in which indicates positive trends, the region with the maximum value was assigned the 1st place, with the minimum – 85; for reverse indicators (1.2) – vice versa. Due to the non-provision/ non-comparability of data on GRP and hospital beds in open statistics, the data for the previous year were used to calculate the ranks of regions for 2023. Source: own compilation.		

Table 14 presents detailed information on changes in the positions of the NWFD regions by the above nine indicators among 85 constituent entities of the Russian Federation.

Table 14. Change in the positions of the NWFD regions by average per capita / specific[18] indicators
among 85 RF constituent entities for 2023 compared to the average for 2020–2022

Indicator	Significant improvement in positions	Significant deterioration in positions
1. Population density, persons per square kilometer of territory	–	–
2. Share of the region's population living in the administrative center, %	Arkhangelsk Region without NAA (+3 p.: 30→27).	–
3. Migration gain coefficient, people per 1 thousand people	Vologda Region (+8 p.; 55→47); Nenets Autonomous Area (+26 p.: 27→1); Murmansk Region (+48 p.: 77→29)	Republic of Karelia (-3 p.: 27→30); Republic of Komi (-4 p.: 76→80); Kaliningrad Region (-4 p.: 4→8); Saint Petersburg (-5 p.: 18→23); Novgorod Region (-8 p.: 18→26); Pskov Region (-18 p.: 38→56)
4. GRP per capita, thousand rubles per person	Vologda Region (+3 p.: 20→17)	Arkhangelsk Region without NAA (-4 p.: 30→34); Republic of Karelia (-9 p.: 24→33)

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[17] Excluding Donetsk People's Republic, Luhansk People's Republic, Zaporozhye and Kherson regions due to lack of statistical data.

[18] Specific indicators − indicators that are calculated as a ratio of absolute (volumetric) indicators to each other and characterize the quality of economic space (e.g., population density, roads, etc.).

Indicator	Significant improvement in positions	Significant deterioration in positions
5. Investments in fixed capital per capita, thousand rubles/person	Republic of Karelia (+3 p.: 28→25); Novgorod Region (+6 p.: 53→47); Kaliningrad Region (+13 p.: 40→27)	Arkhangelsk Region without NAA (-9 p.: 40→49); Pskov Region (-9 p.: 68→77); Komi Republic (-10 p.: 19→29); Vologda Region (-21 p.: 19→40)
6. Number of organizations, units per 1 thousand population	Murmansk Region (+3 p.: 37→34); Nenets Autonomous Area (+7 p.: 24→17); Leningrad Region (+11 p.: 63→52)	Vologda Region (-4 p.: 8→12); Komi Republic (-4 p.: 43→47)
7. Density of public roads with hard surface, kilometer of tracks per 1 thousand square kilometers of territory	–	–
8. Number of hospital beds, units per 10 thousand population	Arkhangelsk Region without NAA (+6 p.: 24→18); Kaliningrad Region (+7 p.: 58→51); Saint Petersburg (+9 p.: 44→35)	Republic of Karelia (-8 p.: 33→41); Nenets Autonomous Area (-8 p.: 57→65)
9. Share of households with access to the Internet, %	Pskov Region (+14 p.: 66→52); Vologda Region (+5 p.: 67→62)	Republic of Karelia (-4 p.: 54→58); Kaliningrad Region (-6 p.: 28→34); Arkhangelsk Region without NAA (-9 p.: 59→68); Murmansk Region (-13 p.: 22→35); Komi Republic (-14 p.: 50→64); Leningrad Region (-14 p.: 43→57); Saint Petersburg (-18 p.: 22→40)

Note: significant improvement/deterioration of positions is understood as improvement/deterioration by 3 or more positions in the ranking of regions. No significant (by 3 positions or more) changes in the regions' positions were observed in the indicators of population density and density of public roads with hard surface.
Source: own compilation.

We present the change in the composite ranks of the regions of Northwest Russia in 2023 compared to the average for 2020−2022 by the indicators of the settlement frame as follows (*Tab. 15*):

− consolidated ranks of *4 NWFD regions* in 2023 **increased** by 1−16 p.: the Arkhangelsk Region without NAA (+1 p.: from 56th to 55th place), the Vologda Region (+2 p.: from 45th to 43rd place), the Nenets Autonomous Area (+9 p.: from 63rd to 54th place), the Murmansk Region (+16 p.: from 65th to 49th place);

− consolidated ranks of *5 NWFD regions* in 2023 **worsened** by 1−5 p.: the Kaliningrad Region (-1 p.: from 29th to 30th place), the Komi Republic (-1 p.: from 60th to 61st place), the Novgorod Region (-3 p.: from 40th to 43rd place), Saint Petersburg (-3 p.: from 10th to 13th place), the Pskov Region: -5 p. (from 43rd to 48th place);

− consolidated ranks of *2 NWFD regions* (Republic of Karelia, Leningrad Region) in 2023 **remained at the level of the average** for 2020−2022.

At the same time, the leader in 2023 and on average for 2020−2022 was Saint Petersburg (13th and 10th place, respectively).

In general, in terms of key characteristics of the settlement frame, most regions of the northern latitudinal projection of the NWFD (Vologda, Murmansk, Arkhangelsk regions and Nenets Autonomous Area) improved their positions in 2020−2023, although they remained in the 5th−7th tens in the rating table of 85 Russian regions. In turn, the prevailing number of regions of the southern latitudinal projection (Saint Petersburg, Kaliningrad, Novgorod and Pskov regions) lost their positions, but remained in the 2nd−5th tens.

Table 15. Ranks of regions by indicators of the settlement frame among the RF constituent entities

Region	On average in 2020–2022	2023	2023 to 2020–2022 (+/-)
Saint Petersburg	10	13	-3
Leningrad Region	16	16	0
Kaliningrad Region	29	30	-1
Vologda Region	45	43	+2
Novgorod Region	40	43	-3
Pskov Region	43	48	-5
Murmansk Region	65	49	+16
Nenets Autonomous Area	63	54	+9
Arkhangelsk Region without NAA	56	55	+1
Republic of Karelia	55	55	0
Komi Republic	60	61	-1
Source: own compilation. Note: ranked in ascending order of rank values in 2023.			

Table 16. Ranks of regions by indicators of the production and economic frame among the RF constituent entities

Region	On average in 2020–2022	2023	2023 to 2020–2022 (+/-)
Nenets Autonomous Area	9	7	+2
Saint Petersburg	11	11	0
Murmansk Region	18	18	0
Republic of Karelia	19	21	-2
Kaliningrad Region	25	22	+3
Vologda Region	16	23	-7
Komi Republic	25	29	-4
Leningrad Region	33	30	+3
Arkhangelsk Region without NAA	40	43	-3
Novgorod Region	45	44	+1
Pskov Region	59	63	-4
Source: own compilation. Note: ranked in ascending order of rank values in 2023.			

Table 16 shows the change in the composite ranks of the regions of Northwest Russia in 2023 compared to the average for 2020−2022 by the indicators of the ***production and economic frame*** as follows:

— consolidated ranks of *4 regions of the* NWFD in 2023 **improved by** 1−3 p.: the Novgorod Region (+1 p.: from 45th to 44th place), the Nenets Autonomous Area (+2 p.: from 9th to 7th place), the Kaliningrad Region (+3 p.: from 25th to 22nd place), the Leningrad Region (+3 p.: from 33rd to 30th place);

— consolidated ranks of *5 regions of the* NWFD in 2023 **deteriorated** by 2−7 p.: the Republic of Karelia (-2 p.: from 19th to 21st place), the Arkhangelsk Region (-3 p.: from 40th to 43rd place),

the Pskov Region (-4 p.: from 59th to 63rd place), the Komi Republic (-4 p.: from 25th to 29th place), the Vologda Region (-7 p.: from 16th to 23rd place);

— consolidated ranks of *2* NWFD *regions* (Murmansk Region, Saint Petersburg) in 2023 **remained at the level of the average** for 2020−2022.

The Nenets Autonomous Area was the leader in 2023 and on average for 2020−2022 (7th and 9th place, respectively).

In general, in terms of key characteristics of the production and economic frame, all regions of the northern latitudinal projection of the NWFD (except for the Arkhangelsk Region) retained their places in the 1st−3rd tens in the ranking table of 85 Russian regions, despite the absence of unambiguously

positive trends in some cases. At the same time, 3 out of 4 NWFD regions that improved their positions (ranks) in 2023 compared to the average for 2020–2022 are part of the southern latitudinal projection of the macro region; 4 out of 5 regions that worsened their positions are part of the northern latitudinal projection.

Table 17 presents the change in the consolidated ranks of the NWFD regions in 2023 compared to the average for 2020–2022 in terms of *infrastructure frame* indicators as follows:

— consolidated ranks of *3* NWFD *regions* in 2023 **improved** by 1–14 p.: the Novgorod Region (+1 p.: from 81 to 80th place), the Vologda Region (+1 p.: from 67 to 62nd place), the Pskov Region (+14 p.: from 66 to 52nd place);

— composite ranks of *8 regions of* the NWFD in 2023 **deteriorated** by 2–18 p.: the Nenets Autonomous Area (-2 p.: from 40 to 42 place), the Republic of Karelia (-4 p.: from 54 to 58 place), the Kaliningrad Region (-6 p.: from 28 to 34 place), the Arkhangelsk Region without NAA (-9 p.: from 59 to 68 place), the Murmansk Region (-13 p.: from 22 to 35 place), the Leningrad Region (-14 p.: from 43 to 57 place). the Komi Republic (-14 p.: from 50th to 64th place), Saint Petersburg (-18 p.: from 22nd to 40th place).

The leader in 2023 was the Kaliningrad Region (34th place); in 2020–2022, leaders were the Murmansk Region and Saint Petersburg (22nd place each).

In general, in terms of key characteristics of the infrastructure frame, most of the NWFD regions that are part of both the southern and northern projection (8 out of 11) lost their positions in the all-Russian rating.

Table 17. Ranks of NWFD regions in terms of infrastructure frame indicators among RF constituent entities

Region	On average in 2020–2022	2023	2023 to 2020–2022 (+/-)
Kaliningrad Region	28	34	-6
Murmansk Region	22	35	-13
Saint Petersburg	22	40	-18
Nenets Autonomous Area	40	42	-2
Pskov Region	66	52	+14
Leningrad Region	43	57	-14
Republic of Karelia	54	58	-4
Vologda Region	67	62	+5
Republic of Komi	50	64	-14
Arkhangelsk Region without NAA	59	68	-9
Novgorod Region	81	80	+1
Source: own compilation. Note: ranked in ascending order of rank values in 2023.			

Regional cases

Depending on the values of key indicators characterizing the development of the settlement, production, economic and infrastructural frames, the NWFD regions occupy different positions in the consolidated rating of the RF constituent entities.

The leader of the macro region in terms of the average ranking by these indicators was Saint Petersburg (16th place among 85 RF constituent entities) in 2023. The Kaliningrad Region entered the 3rd ten of the rating (28th place). The rest of the NWFD regions took positions in the 4th−5th tens.
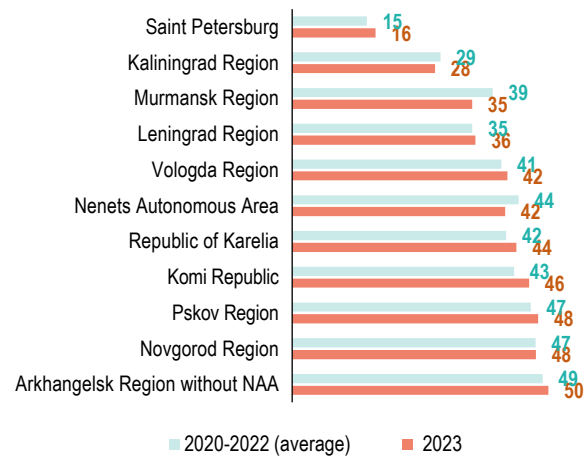
1. Saint Peterburg

The region's consolidated rank in 2023 was 16, having deteriorated by 1 p. (on average, 2020−2022 − 15).

Saint Petersburg became the country's leader in the density of paved public roads in 2023. It was one of the top three regions in terms of population density and the number of organizations per 1,000 people. It improved its position in terms of the number of hospital beds per 10,000 people in 2023. The situation has worsened in terms of migration growth and the proportion of households with the Internet access.

At the same time, a significant (by 18 p.: from 22nd to 40th place) decline in the share of households with the Internet access is due to the outpacing growth rates of the indicator in other regions of Russia (Kaliningrad, Murmansk regions, Krasnodar Territory, etc.).
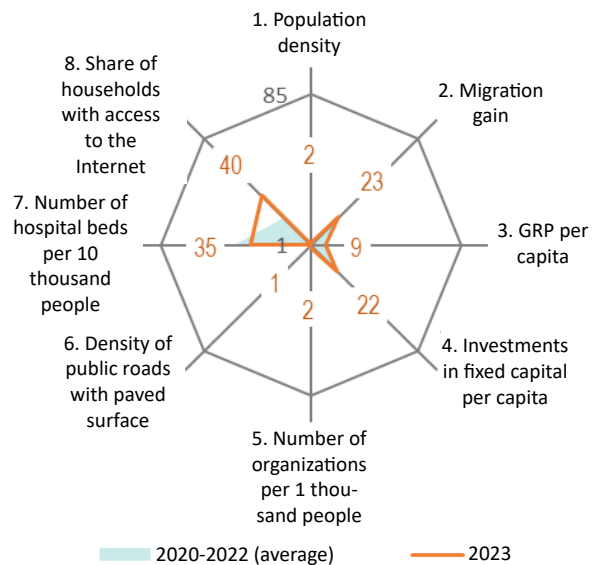
2. Kaliningrad Region

The region's consolidated rank in 2023 was 28, having improved by 1 p. (on average 2020−2022 − 29).

The Kaliningrad Region was among the top three regions in terms of the number of organizations per 1,000 people in 2023. The region's position has improved in terms of the number of hospital beds per 10,000 people, as well as the per capita volume of investments in fixed assets. The situation in the region has worsened in terms of migration growth and the proportion of households with the Internet access.

At the same time, a significant (+13 p.: from 40 to 27th place) improvement in the region's position in terms of investments in fixed assets per capita is due to a 1.8-fold increase in 2023 compared to 2020 in the investment volumes directly related to the launch of large investment projects in the region

(a plant for the production of equipment for solar energy, pharmaceutical plant of the company Otisipharm Pro, etc.[19]).
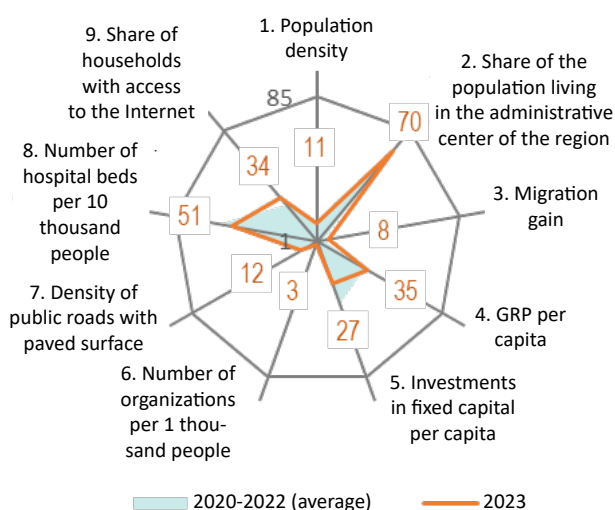
3. Murmansk Region

The region's consolidated rank in 2023 was 35, having improved by 4 p. on average, 2020−2022 − 39).

The Murmansk Region held high positions in terms of the number of hospital beds per 10,000 people, GRP and fixed capital investments per capita in 2023. The region's position in terms of migration growth and the number of organizations per 1,000 people has improved. The situation in the region has worsened in terms of the proportion of households with the Internet access.

According to Rosstat, a significant decrease (by 13 points: from 22nd to 35th place) in positions in terms of the share of households with the Internet access was due to the outpacing growth rates of the indicator in other Russia's regions; the improvement in positions in terms of migration growth was due

to the implementation of a whole range (70 units) of social support measures for various categories of citizens, attracting personnel for the implementation of large infrastructure projects, etc.[20]

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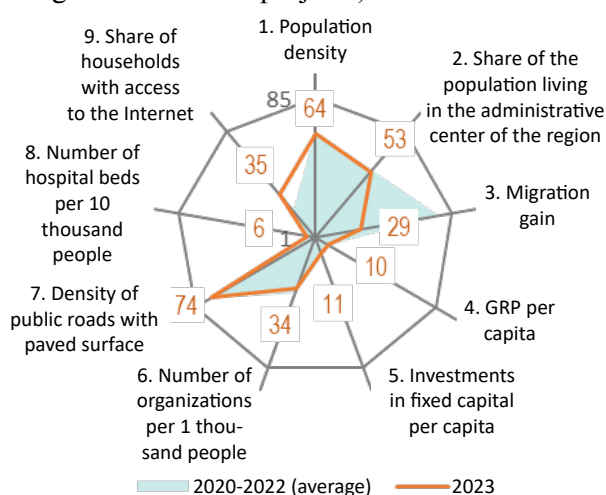
[19] Website of the Government of the Kaliningrad Region. Available at: https://gov39.ru/press/338923/

[20] Website of the Ministry of Information Policy of the Murmansk Region. Available at: https://mininform.gov-murman.ru/info/news/521761/
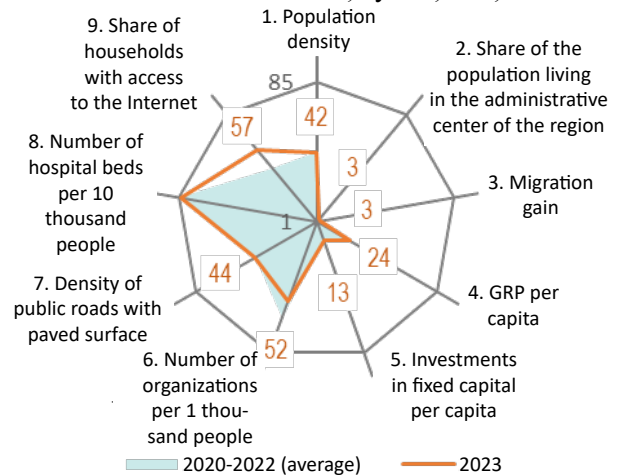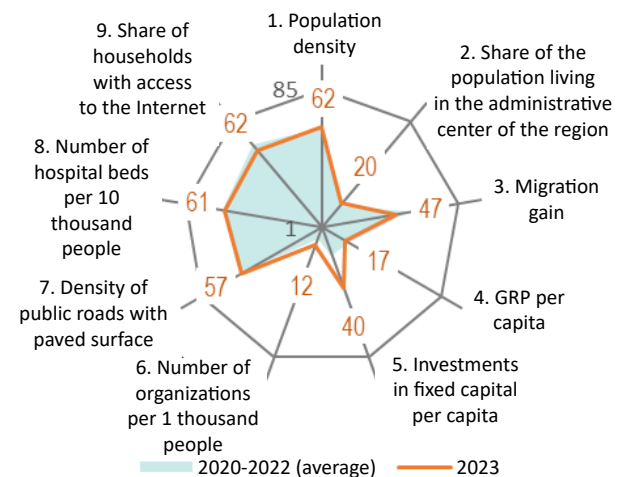
4. Leningrad Region

The region's consolidated rank in 2023 was 36, having deteriorated by 1 p. (on average, 2020–2022 – 35).

The region holds high positions in terms of migration population growth and per capita investment in fixed assets. In 2023, there was an improvement in the rank of the number of organizations per 1,000 people. The region's position in the ranking table by the proportion of households with the Internet access worsened in 2023.

A significant decline (by 14 p.: from 43 to 57th place) in the share of households with the Internet access was due to the outpacing growth rates of the indicator in other Russia's regions according to Rosstat. In turn, an essential improvement (by 11

p.: from 63 to 52nd place) in the region's position in terms of the number of organizations per 1,000 people is mainly due to an increase in their number: in 2023, compared with 2020, by 6%, or 1,860 units.

5. Vologda Region

The region's consolidated rank in 2023 was 42, having deteriorated by 1 p. (on average, 2020–2022 – 41).

The region holds high positions in terms of the share of the population living in the administrative center, the per capita volume of investments in fixed assets and the number of organizations per 1,000 people. In 2023, there was an improvement in the ranks in terms of GRP, the share of households with the Internet access, and migration growth. We noted the deterioration of the region's position in the ranking table by the number of organizations per 1,000 people, and the volume of investments in fixed assets.

A significant decrease (by 21 p.: from 19th to 40th place) in positions in the indicator of investments in fixed assets per capita is associated with a 19% decrease in 2023 compared to 2020 in the volume

of investments itself due to the completion of investment cycles by a number of companies, as well as the negative impact of sanctions from foreign countries on the activities of large enterprises in the region (Severstal, etc.).

6. Nenets Autonomous Area

The region's consolidated rank in 2023 was 42, having improved by 2 p. (on average, 2020−2022 − 44).

The region took a leading position in 2023 in terms of migration population growth and GRP per capita. It also took high positions in terms of investments in fixed assets per capita and the number of organizations per 1,000 people. In 2023, there was an improvement in the ranks of migration growth and the number of organizations per 1,000 people. We noted the deterioration of the region's position in terms of the number of hospital beds per 10,000 people.

A significant improvement in the position in terms of migration growth (+26 p.: from 27 to 1 place) is mainly due to the influx of personnel for the implementation of large projects in the field of natural resource development while maintaining a relatively low average annual population.
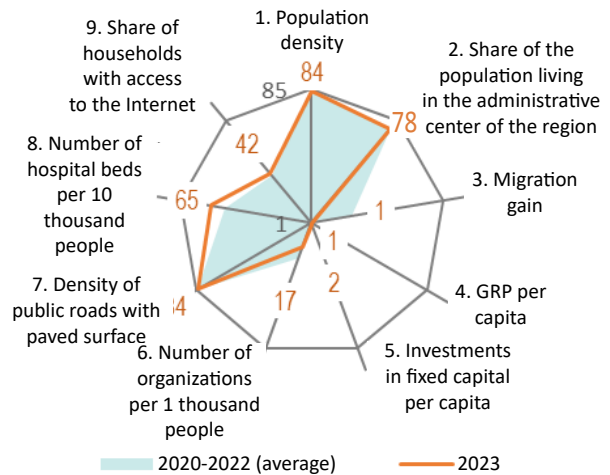
7. Republic of Karelia

The region's consolidated rank in 2023 was 44, having deteriorated by 2 p. (on average, 2020−2022 − 42).

The region holds high positions in terms of the number of organizations per 1,000 people. In 2023, there was an improvement in the region's positions in the ranking table in terms of investments in fixed assets, a deterioration in positions in terms of migration growth, the share of households with Internet access, the number of hospital beds per 10,000 people and the volume of GRP per capita.
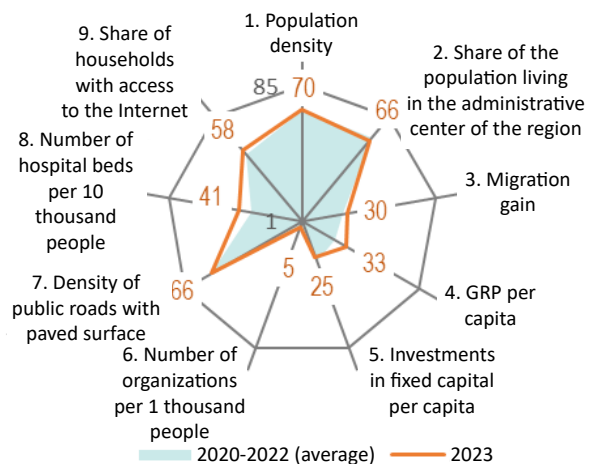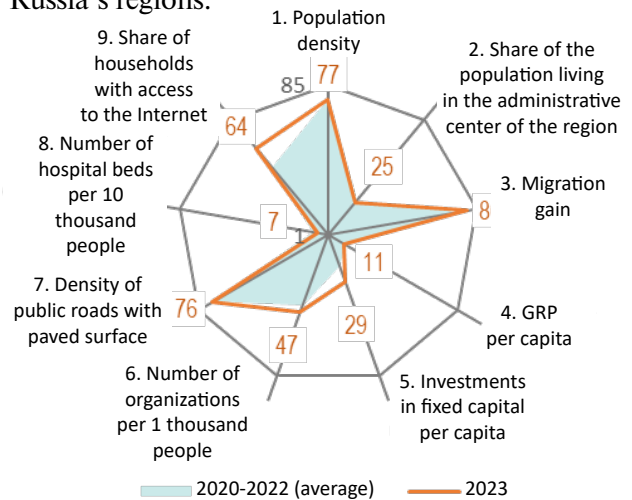
8. Komi Republic

The region's consolidated rank in 2023 was 46, having deteriorated by 3 p. (on average, 2020–2022 – 43).

The region holds high positions in terms of the number of hospital beds per 10,000 people and the volume of GRP per capita. In 2023, the region's position in the all-Russian ranking deteriorated in terms of migration growth, the number of organizations per 1,000 people, the volume of investments in fixed assets per capita, and the proportion of households with Internet access. There was no significant improvement in the analyzed indicators in 2023.

A significant decrease (by 10 p.: from 19th to 29th place) in positions in the indicator of investments in fixed assets per capita is associated with an 8% decrease in 2023 compared to 2020 in the volume of investments itself due to the completion of investment cycles by a number of companies, as

well as the negative impact of sanctions from foreign countries on the activities of large enterprises in the region. In turn, an essential decline (by 14 p.: from 50 to 64th place) in the share of households with the Internet access, according to Rosstat, was due to the outpacing growth rates of the indicator in other Russia's regions.
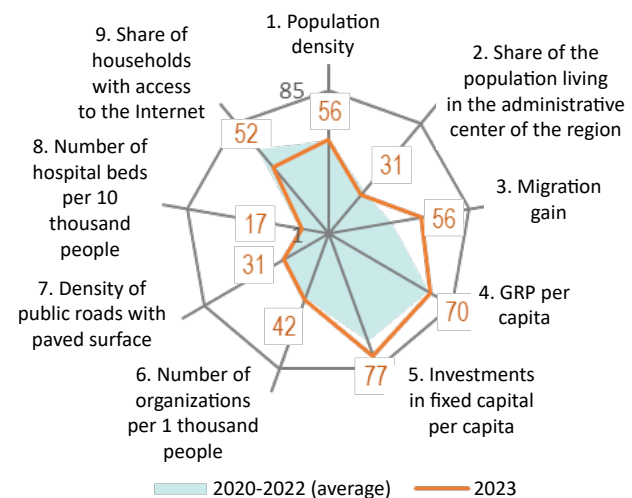

9. Pskov Region

The region's consolidated rank in 2023 was 48, having deteriorated by 1 p. (on average, 2020–2022 – 47).

The region holds high positions in the all-Russian ranking in terms of the number of hospital beds per 10,000 people. In 2023, there was an improvement in the share of households with the Internet access; a deterioration in the position in terms of investments in fixed assets per capita, migration growth.

A significant improvement (by 14 p.: from 66 to 52nd place) in the share of households with the Internet access is directly due to the high growth rates of the indicator in the region (+10%: from 75.4% in 2020 to 85.9% in 2023) according to Rosstat. A decrease in positions in the rating table for

migration growth (-18 p.: from 38th to 56th place) is due to the traditionally high outflow of population to Saint Petersburg and the Leningrad Region, which has been especially increasing in recent years.

10. Novgorod Region

The region's consolidated rank in 2023 was 48, having deteriorated by 1 p. (on average, 2020−2022 − 47).

The region occupies an average position among the regions of the country in most of the key indicators characterizing the settlement, production, economic and infrastructural frameworks. In 2023, there was an improvement in the region's position in the all-Russian rating in terms of investments in fixed assets, and a deterioration in positions in terms of migration growth.
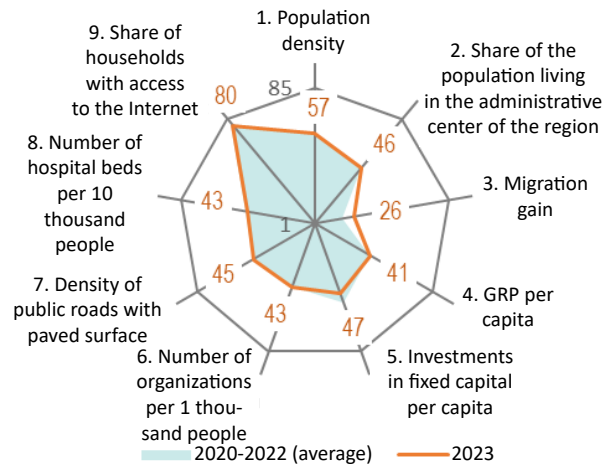
11. Arkhangelsk Region (without the Nenets Autonomous Area)

The region's consolidated rank in 2023 was 50, having deteriorated by 1 p. (on average, 2020−2022 − 49).

The region ranks high in terms of the number of hospital beds per 10,000 people. In 2023, the region will improve its position in the ranking table by the share of the population living in the administrative center and the number of hospital beds; its position will deteriorate by the volume of GRP and investment in fixed capital per capita, the share of households with access to the Internet.
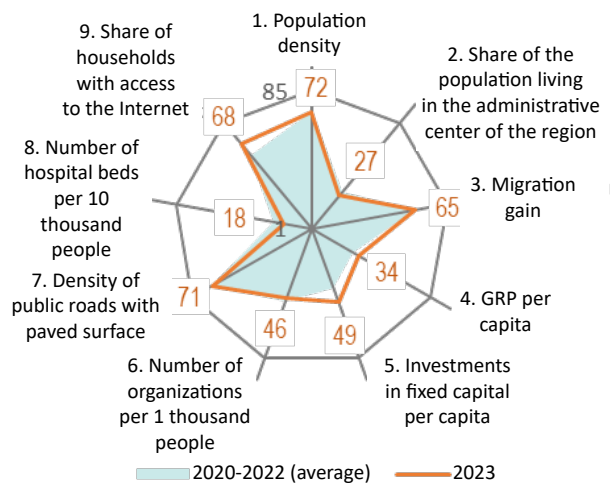
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