

Cluster Typology of Small and Medium-Sized Towns in the Russian North-West: From Formal Statuses to Structural Profiles



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Abstract. The relevance of the study stems from the need to move from universal support measures for small and medium-sized towns in Russia to a differentiated regional policy that takes into account the real diversity of socioeconomic profiles of settlements. The aim of the work is to construct an empirically grounded typology of small and medium-sized towns of the Northwestern Federal District based on a multidimensional cluster analysis of indicators reflecting spatial position, the state of the economy, and the social sphere. The empirical base includes data on 137 towns (130 after cleaning) across nine indicators characterizing economic activity, social and household infrastructure, the quality of the urban environment, and transport accessibility. Due to the strong asymmetry of the distributions of most indicators, logarithmic transformation followed by standardization was applied. Using hierarchical clustering performed in IBM SPSS Statistics, four stable types were identified: 1) “remote industrial centers” (41% of towns), 2) “tourism and service centers” (16%), 3) “comfortable periphery” (38%), and 4) “nearby commuter towns” (5%). For the first time for the macro region, two previously unidentified types were empirically verified: the “comfortable periphery”, uniting both nearby suburbs and remote tourism centers with a high quality of environment and weak development of the economic core, and “nearby commuter towns” – satellite towns of large centers with low local employment and a lack of social infrastructure despite formally high wage and urban environment quality indicators. The scientific novelty of the work lies in the use of multidimensional cluster analysis, which made it possible to identify

For citation: Sekushina I.A. (2026). Cluster typology of small and medium-sized towns in the Russian North-West: From formal statuses to structural profiles. *Economic and Social Changes: Facts, Trends, Forecast*, 19(4), 98–114. DOI: 10.15838/esc.2026.4.106.6

types of towns that do not coincide with traditional classifications and to reveal hidden imbalances in their socioeconomic development. Based on the resulting typology, differentiated directions of regional policy are formulated for each of the identified town types.

Key words: small and medium-sized towns, Northwestern Federal District, town typology, hierarchical cluster analysis, socio-economic development.

Acknowledgment

The study was carried out within the framework of the state assignment for the Vologda Research Center of the Russian Academy of Sciences on the topic FMGZ-2025-0013 “Factors and Instruments for Ensuring Balanced Spatial Development of Russian Regions amid the Escalation of Major Challenges”.

Introduction

Small and medium-sized towns play a key connecting role between major agglomerations and the rural periphery. They serve as vital nodes in a territory’s supporting framework and ensure the stability of local settlement systems (Sekushina, Uskova, 2020; Alekseev et al., 2025). Despite this high functional importance, a pronounced imbalance persists in academic discourse: urban research tends to focus on large cities and agglomerations, while small and medium-sized towns remain “invisible”, on the margins of scholarly attention (Servillo et al., 2017). Yet these settlements are often the most vulnerable in the face of geopolitical and economic challenges (Lebedeva, 2026).

Researchers estimate that publication activity on small and medium-sized towns is about 7.2 times lower than on the largest cities (“global cities”, “world cities”) that act as centers of the world economic system (Wagner, Growe, 2021). At the same time, in many countries the majority of the urban population lives precisely in such towns. In the European Union, for example, almost 40% of the population lives in small and medium-sized towns (Hamdouch et al., 2017). In the Russian Federation the problem is no less acute. Small and medium-sized towns form the backbone of the country’s settlement system: 85% of Russian towns fall into this category, and they are home to more than 26 million people, or almost 18% of the national population (Uskova, Sekushina, 2021).

The prevailing research practice, oriented mainly toward large cities, not only fails to reflect the real structure of settlement but also leads to solutions that are poorly applicable to smaller settlements, which typically have fewer resources, lower-density development, and closer social ties (Nowaczyk et al., 2022).

From the perspective of spatial development theories (Walter Christaller’s central place theory, August Lösch’s theory of the organization of economic space, the growth pole concept of François Perroux and Jacques Boudeville, among others), small and medium-sized towns are seen primarily as elements of economic space that perform certain functions: production, transport, administrative, and others. Under post-industrial transformation and growing socio-economic differentiation across territories, a large share of small and medium-sized towns has faced the problem of sustained “urban shrinkage”, which has been especially pronounced in post-Soviet Russia (Kirillov et al., 2023). These processes are highly heterogeneous: depopulation is not always accompanied by a decline in economic activity, just as the preservation of economic activity does not guarantee the stability of the social sphere. This can largely be explained by the diversity of the towns themselves. Some are former industrial centers with surviving but technologically outdated production; others are administrative centers of rural districts; still others are suburban “commuter” areas of large

cities; and yet others are historic settlements with tourism potential. These differences are shaped not only by established specialization but also by position within the spatial structure: proximity to major agglomerations, access to transport corridors, and integration into interregional linkages. At the same time, formal membership in a single category (for example, “industrial centers”) does not preclude substantial differences in the socio-economic situation of towns.

In this context, the transition from universal support measures to differentiated approaches that take into account the real diversity of socio-economic profiles of small and medium-sized towns becomes a priority direction of state policy. This is in line with the provisions of the Spatial Development Strategy of the Russian Federation¹.

However, despite the severity of the problem and the variety of existing approaches to classifying small and medium-sized towns, current classifications are generally limited either to a purely demographic criterion (population size) or to sectoral specialization. As a result, they fail to capture hidden imbalances (such as high employment combined with a poor urban environment, or developed social and household infrastructure alongside a lack of jobs) that are not reflected in standard classifications yet are of fundamental importance for designing targeted regional policy measures.

The problem of multidimensional typology is especially acute for the Northwestern Federal District (NWFD). This macroregion is characterized by a high degree of spatial heterogeneity: it contains one of the country’s largest urban agglomerations, the Saint Petersburg agglomeration; vast, remote, and sparsely developed territories of the Far North (the Komi Republic, the Arkhangelsk and Murmansk regions); and border and coastal

areas with distinctive geoeconomic conditions. At the same time, the NWFD is among the regions with a high share of “shrinking” towns: from one third to one half of its settlements show sustained depopulation, most of them small towns (Kirillov et al., 2023).

Thus, the research problem stems from the contradiction between the declared need for a differentiated regional policy toward small and medium-sized towns and the absence of empirically grounded typologies that capture multidimensional structural imbalances. This complicates the development of targeted state support measures and leads to a “one-size-fits-all” approach that does not reflect the real diversity of socio-economic profiles of small and medium-sized towns.

The problem is particularly urgent for the Northwestern Federal District – a macroregion marked by high internal heterogeneity, with dynamically developing suburban zones (around Saint Petersburg and Kaliningrad) coexisting with depressed peripheral territories (the Pskov Region, the Novgorod Region, the Komi Republic).

In light of the above, this study aims to construct an empirically grounded typology of small and medium-sized towns in the Northwestern Federal District, using multivariate cluster analysis of indicators that capture spatial location, the state of the economy, and the social sphere of settlements.

To achieve this aim, the following objectives were set: 1) to develop a system of indicators that comprehensively characterize economic activity, social and household infrastructure, the quality of the urban environment, and transport accessibility of the NWFD’s towns; 2) to preprocess the data (log transformation of highly skewed distributions, standardization) to ensure the correctness of cluster analysis; 3) to identify stable types of towns through hierarchical clustering and provide a substantive

¹ RF Government Resolution 4146-r dated December 28, 2024, “On Approval of the Spatial Development Strategy of the Russian Federation for the period up to 2030 with a forecast to 2036”.

interpretation of them; 4) to test the robustness of the resulting clusters using one-way analysis of variance (ANOVA) and post hoc tests; and 5) to formulate differentiated regional policy directions for each type of town.

The object of the study is the small and medium-sized towns of the Northwestern Federal District (all towns of the district, excluding the federal city of Saint Petersburg and cities with populations above 100,000²). The subject is the typological differences among towns across a set of economic, social-infrastructure, environmental, and spatial characteristics, as well as the stable types (clusters) formed by these differences.

The research hypothesis is that traditional views on the typology of small and medium-sized towns and their formal statuses based on one or two criteria (population size, distance from a major city, economic specialization, etc.) are oversimplified and do not capture the real diversity of their socio-economic profiles.

The novelty of the study is that, for the first time, multivariate cluster analysis based on nine indicators is applied to the entire set of small and medium-sized towns in the NWFD. For the first time, a combination of logarithmic transformation and standardization is used to correct the extreme skewness of socio-economic indicators in urban typology tasks. It is empirically demonstrated that the formal statuses of small and medium-sized towns (“industrial”, “tourist”, “administrative centers”, etc.) do not reflect their actual socio-economic profile or existing development imbalances. The study identifies and substantively interprets two types not previously distinguished for the region: the “comfortable periphery” (towns with a high-quality environment and a weak economy, located both in the near and far periphery) and “nearby commuter towns” (satellite towns with paradoxically low local

employment despite formally high wages and a good urban environment).

Literature review

A retrospective analysis of territorial typologization shows its evolution from simple classifications based on demographic criteria to modern multidimensional models incorporating functional, historical-genetic, dynamic, and polycriterial approaches (Blonsky, 2024).

(Babkin, 2022) proposes a comprehensive typology of Russian municipalities based on nine parameters reflecting three main spheres: economy (specialization, socio-economic risks, and geo-economic position), sociodemographic characteristics (agglomeration position, population size, and degree of urbanization), and geographic location (settlement status and role, climatic conditions, and territory area). Testing on the Kursk, Kaliningrad, and Irkutsk regions showed that the proposed approach captures territorial contrasts and center–periphery polarization of municipal socio-economic development well (Babkin, 2022).

A significant body of typological research has been accumulated in studies of large and major cities. The work (Limonov, Nesena, 2015) proposes a structural-economic typology of Russian cities with populations over 100,000. Using principal component analysis combined with cluster analysis, the authors identify 20 types of settlements based on the structure of employment by economic sector.

The modern scholarly literature also increasingly includes studies devoted to the typology of small and medium-sized towns. In Russia, this research covers the federal level (Alekseev et al., 2025; Poznanskaya et al., 2026) as well as individual macroregions (Sekushina, Uskova, 2020; Gumenyuk, 2021) and regions (Dolinskaya et al., 2025; Melnikova, 2023). Among foreign studies, the most large-scale typological work has been

² According to the Russian Ministry of Construction’s code of practice “Urban Planning. Planning and Development of Urban and Rural Settlements” (SP 42.13330.2016), towns with a population of up to 100,000 people are classified as small and medium-sized towns.

carried out within the ESPON TOWN project for the countries of the European Union (Russo et al., 2017; Servillo et al., 2017; Hamdouch et al., 2017) and at the level of individual states (Fertner et al., 2023). An overview of research on the typology of small and medium-sized towns is presented in *Table 1*.

Overall, similar typologization criteria appear in many studies: population size and density (Russo et al., 2017; Dolinskaya et al., 2025), economic profile (Hamdouch et al., 2017; Sekushina, Uskova, 2020), position in the settlement system (Alekseev et al., 2025), and urban development dynamics indicators (Fertner et al., 2023; Gumenyuk, 2021).

Table 1. Review of research on the typology of small and medium-sized towns

Author, year	Country/region	Object	Criteria/method	Typology results
Alekseev A.I. et al. (2025)	Russia	1,838 small towns and urban-type settlements	Technical grouping by population and construction dynamics, position relative to large cities; algorithmic clustering using the k-means method	4 macrotypes and 10 types of settlements with different socio-economic development trajectories
Sekushina I.A., Uskova T.V. (2020)	European North of Russia	61 small and medium-sized towns	Grouping by two criteria: economic specialization and position in the settlement system	14 types of small and medium-sized towns
Dolinskaya I.M. et al. (2025)	Kaluga Region	20 small towns	Intra-category typology by population size	6 subcategories of small towns
Gumenyuk L.G. (2021)	17 regions of Russia's western borderlands	182 small towns	Population dynamics and the urban environment quality index	4 types of small towns
Seleznev P.S. et al. (2025)	Central Federal District of Russia	165 small towns classified as single-industry towns	Matrix of sectoral innovation and technological specialization	5 types of towns by level of innovation and technological development
Melnikova (2023)	Sverdlovsk Region, Orel Region, Republic of Crimea	53 small and medium-sized towns	k-means in SPSS; 5 barriers to knowledge diffusion	5 clusters with different combinations of barriers
Poznanskaya S.A. et al. (2026)	Russia	793 small towns	k-means in SPSS; population size, population dynamics, employment structure (OKVED), share of tourism employment, number of cultural heritage sites per 1,000 people	7 types: growing; service centers (large and small); monofunctional industrial (large and small); tourist (resorts); historical
Russo A.P. et al. (2017)	European Union	78,307 urban settlements	GEOSTAT 1 km ² grid; classification by population density and population size	3 categories: HDUC (high-density urban clusters), SMST (small and medium-sized towns), VST (very small towns)
Hamdouch A. et al. (2017)	10 EU countries	31 small and medium-sized towns	Economic activity profiles (by employment share) and dynamics of socio-economic indicators	3 types: residential, production, mixed
Fertner C. et al. (2023)	Denmark	111 small and medium-sized towns	Population and employment dynamics	4 types: residential centers; growing suburban centers; tourist/industrial centers; isolated small towns
Compiled from: (Alekseev et al., 2025; Sekushina, Uskova, 2020; Dolinskaya et al., 2025; Gumenyuk, 2021; Seleznev et al., 2025; Melnikova, 2023; Poznanskaya et al., 2026; Russo et al., 2017; Hamdouch et al., 2017; Fertner et al., 2023).				

In contemporary research on territorial typologization, authors increasingly turn to multidimensional statistical methods, particularly cluster analysis, which makes it possible to group objects objectively according to a set of characteristics and to uncover hidden patterns of territorial development. It should be noted that, given the scarcity of municipal statistics, this approach is most widely used at the macro level (Prokhorenkov et al., 2022; Ledeneva et al., 2022; Lokosov et al., 2019).

Cluster analysis combined with principal component analysis is also widely used in international practice. This approach has been applied to classify centers and subcenters on the basis of socio-economic indicators and data on accessibility and built-up areas (Krehl, Siedentop, 2019), to construct a “smart sustainability” index for the capitals of EU countries (Akanke et al., 2019), and to develop a large-scale typology of 331 cities from 124 countries using 64 indicators (Oke et al., 2019).

In Russian scholarly literature, studies using cluster analysis for city typologization have also become more frequent in recent years. In particular, Melnikova (2023) applied the k-means method in SPSS to cluster small and medium-sized towns in the Sverdlovsk Region, the Orel Region, and the Republic of Crimea on the basis of five indicators: urban environment quality, financial accessibility, social capital, transaction costs, and geographic distance (Melnikova, 2023).

S.A. Poznanskaya and co-authors from HSE University (Poznanskaya et al., 2026) clustered Russia’s small towns using the k-means method in SPSS, employing indicators of population size, population dynamics, the sectoral structure of employment (according to OKVED), and the concentration of cultural heritage sites.

Thus, it can be concluded that international practice has developed a stable methodological tradition of using cluster analysis in combination with factor methods for urban typologization. The use of cluster analysis for territorial typologization has several significant advantages over other classification methods. First, cluster analysis makes it possible to compress a large volume of information by identifying a limited number of typical groups of objects. Instead of analyzing data for each object separately, the researcher can work with a small number of clusters, each with clearly defined characteristics. This is especially important when dealing with a large number of towns and indicators. Second, cluster analysis is objective and reproducible. Unlike expert classifications, which may depend on subjective judgments, cluster analysis relies on formal mathematical criteria and can be reproduced by other researchers. Third, cluster analysis can reveal hidden patterns of territorial development that are not obvious in a superficial analysis.

Cluster analysis in SPSS for the typology of small and medium-sized towns in the Northwestern Federal District using a comprehensive set of indicators has not previously been conducted. The proposed typology makes it possible to identify groups of towns with similar structural profiles, thereby creating an empirical basis for a differentiated regional policy. Cluster analysis is treated here as a diagnostic tool: it reveals stable combinations of indicators that are interpreted as structural imbalances (for example, “high employment – low urban environment quality”), but it does not replace an in-depth study of the problems and potential of individual territories. The identified types serve as a prioritization tool: they indicate in which towns imbalances are most pronounced and require further, including field, research to develop targeted support measures.

Methods and data

The study was conducted in several stages.

1) Construction of the initial database. The initial set consisted of 137 small and medium-sized towns of the Northwestern Federal District, for each of which we collected data for 2024 on nine indicators characterizing the state of the economy (wages, the number of organizations, and the number of employees), social and household infrastructure (the number of consumer service facilities, sports facilities, and health care organizations), tourism infrastructure (the number of collective accommodation facilities, CAF), the quality of the urban environment (the urban environment quality index, UEQI), and transport accessibility (distance to the nearest large or major city). All relative indicators, except wages, distance, and the UEQI, were recalculated per 10,000 people.

It should be noted that each of the indicators has certain limitations related to the specific features of statistical accounting: for example, incomplete coverage of the informal sector in consumer services, the inclusion of specialized medical institutions, and the limited representation of tourism infrastructure. However, for the purposes of typology rather than precise sectoral diagnostics, these limitations are not critical, since the key requirement is not the absolute accuracy of each indicator but its comparability across all towns and its ability, in combination with other indicators, to reveal stable profiles.

The information base draws on data from the Federal State Statistics Service and its regional offices, the Ministry of Construction³, the SPARK system⁴, and the official websites of local government bodies. Distances between towns by road were obtained from Yandex Maps⁵.

Seven towns were excluded from the analysis because they had missing values for most indicators: they belong to the category of closed administrative-territorial entities (ZATO), for which official statistics on most variables are not published. The final sample consisted of 130 towns.

2) Data preprocessing. Before conducting cluster analysis in IBM SPSS Statistics, we checked the normality of the distribution of the initial variables. The check was performed using visual methods (histograms, Q – Q plots), skewness and kurtosis coefficients, and the Shapiro – Wilk test, which is most informative for samples of fewer than 2,000 observations (Razali, Wah, 2011; Field, 2018). The Kolmogorov – Smirnov test was applied as an additional criterion. The results showed that most initial variables have significant positive skewness (> 1.5).

To bring the distributions closer to normality, a logarithmic transformation of the form $X' = \ln(X + 0.1)$ was applied to variables with skewness > 1.0 (distance, number of organizations, consumer service facilities, sports facilities, CAF, and number of employees), as well as to health care organizations (skewness 0.9) to ensure consistency with other social infrastructure indicators.

Although the Shapiro – Wilk and Kolmogorov – Smirnov tests revealed statistically significant deviations from normality ($p < 0.05$), after logarithmic transformation the skewness of all variables does not exceed $|0.86|$ and kurtosis does not exceed $|1.79|$, which meets the criteria of acceptable normality for the use of parametric methods (George, Mallery, 2010; Hair et al., 2010). Average monthly wages (skewness 1.089) were left in the original form, since a slight excess above the threshold with $N = 130$ does not reduce the

³ Urban environment quality index by city and constituent entity of the Russian Federation for 2024. Available at: <https://www.minstroyrf.gov.ru/docs/422497> (accessed: 15.05.2026).

⁴ SPARK counterparty verification service. Available at: <https://spark-interfax.ru/> (accessed: 15.05.2026).

⁵ Yandex.Maps. Available at: <https://yandex.ru/maps> (accessed: 15.05.2026).

robustness of parametric methods, and preserving the interpretation in rubles was considered a priority. The urban environment quality index (skewness -0.142) initially has a distribution close to normal and does not require transformation.

All variables (both transformed and original) were standardized (Z-scores) before conducting the cluster analysis to eliminate the influence of different scales.

3) Selection of the clustering method and its justification. To test the possibility of automatically identifying groups of towns, a two-step cluster analysis with automatic determination of the number of clusters based on the Bayesian information criterion (BIC) was applied. If a one-cluster solution was obtained, a transition to a hierarchical method was planned, which makes it possible to set the number of clusters based on an analysis of the jump in agglomeration coefficients and the substantive interpretability of the resulting groups.

4) Statistical validation of clusters and interpretation. To test the statistical significance of differences between the identified clusters for each of the nine indicators, one-way analysis of variance (ANOVA) was conducted. Homogeneity of variances was first checked using Levene's test, whose results determined the choice of post hoc tests for pairwise comparisons. For variables where the hypothesis of equal variances was not rejected ($p > 0.05$), Tukey's test was applied; otherwise, the

robust Games – Howell test, which does not require the assumption of equal variances, was used. The significance level was set at $\alpha = 0.05$.

For each resulting cluster, a substantive interpretation was provided based on the mean values of the original indicators, and directions of socio-economic policy were proposed for each type of town.

Research results

To test the possibility of automatically identifying groups, a two-step cluster analysis was performed. The Bayesian information criterion (BIC) increased monotonically with the number of clusters from one to six (from 894.8 to 1195.3; *Tab. 2*). The largest ratio of distance measures (1.193) was recorded in the transition from three to four clusters, indicating the potential significance of a four-group structure. However, the BIC, which penalizes model complexity, did not consider this improvement sufficient, and the algorithm proposed a one-cluster solution, placing all 130 towns into a single group.

Since the two-step cluster analysis with automatic selection of the number of clusters did not identify a stable partition, hierarchical cluster analysis using Ward's method with squared Euclidean distance as the proximity measure was used for the typologization.

According to the “elbow rule” (a sharp increase of 14.7% at step 129; *Tab. 3*), the optimal number of clusters is two. However, in our view, a two-cluster

Table 2. Quality criteria of two-step clustering

Number of clusters	Bayesian information criterion (BIC)	Change in BIC	Ratio of BIC changes	Ratio of distance measures
1	894.815	–	–	–
2	968.004	73.188	1.000	1.055
3	1 029.771	61.768	0.844	1.073
4	1 104.323	74.551	1.019	1.193
5	1 185.227	80.905	1.105	1.164
6	1 195.274	10.047	0.137	1.015
Calculated from SPSS data.				

Table 3. Fragment of the agglomeration schedule (clusters)

Stage	Combined clusters	Coefficient	Increase over previous stage, %
126	1–3	860.432	–
127	15–69	930.592	8.2
128	1–10	1013.180	8.9
129	1–15	1161.726	14.7 (sharp jump)
Calculated from SPSS data.			

solution combines qualitatively different types of towns, which reduces its practical usefulness. Guided by the principle of substantive interpretability and the objectives of differentiated regional policy, we opted for a four-cluster solution, which makes it possible to identify more homogeneous and practically meaningful groups of towns.

To check the robustness of the resulting four-cluster solution, a five-cluster partition was also performed in the course of the study. However, testing this solution showed that the additional cluster does not form a new type but merely

splits the third cluster into two subtypes that differ in distance to a large city while retaining a common characteristic – high quality of the urban environment combined with weak economic activity.

Thus, a simpler and more interpretable four-cluster typology of 130 small and medium-sized towns of the Northwestern Federal District was adopted as the main one. The mean values of indicators by cluster are presented in *Table 4*, and the distribution of towns is shown in *Table 5*.

Based on the results obtained, the following characteristics can be given to the resulting clusters.

Table 4. Mean values of indicators by cluster

Indicator	Cluster 1 (n = 53)	Cluster 2 (n = 21)	Cluster 3 (n = 50)	Cluster 4 (n = 6)	All towns (n = 130)
Distance to a large/major city, km	324.6	165.0	105.1	44.2	201.5
Number of consumer service facilities per 10,000 people	42.4	84.3	42.3	19.5	48.0
Number of sports facilities per 10,000 people	32.1	41.9	27.2	14.7	31.0
Number of health care organizations per 10,000 people	3.21	4.10	4.59	2.52	3.85
Urban environment quality index (UEQI), points	208.6	223.0	237.0	241.8	223.3
Number of organizations per 10,000 people	130.2	230.0	173.9	160.5	164.5
Average monthly wages, rubles	83539	68922	65795	83240	74340
Average number of employees (excluding small businesses) per 10,000 people	3187	3384	2266	838	2756
Number of CAF per 10,000 people	3.91	9.35	3.46	0.18	4.44
Calculated from SPSS data.					

Table 5. Distribution of Northwestern Federal District towns by cluster

Cluster	Name	Town
1	Remote industrial centers	Komi Republic: Usinsk, Ukhta, Inta, Yemva, Sosnogorsk, Vorkuta, Pechora, Vuktyl, Mikun; Republic of Karelia: Belomorsk, Suoyarvi, Kem; Pskov Region: Velikiye Luki, Porkhov, Sebezh, Pechory, Pytalovo, Nevel, Dno; Nenets Autonomous Area: Naryan-Mar; Murmansk Region: Kirovsk, Apatity, Kandalaksha, Monchegorsk, Olenegorsk, Polyarnye Zori, Kovdor, Zapolyarny; Leningrad Region: Primorsk, Kirishi, Sosnovy Bor, Podporozhye, Volkhov, Svetogorsk, Tikhvin, Boksitogorsk, Pikalyovo, Kamennogorsk; Vologda Region: Ustyuzhna, Vytegra, Kirillov, Nikolsk, Babayevo, Krasavino; Arkhangelsk Region: Koryazhma, Kotlas, Velsk, Mezen, Kargopol, Nyandoma, Shenkursk, Onega, Solvychevodsk
2	Tourism and service centers	Republic of Karelia: Lakhdenpokhya, Sortavala, Pitkyaranta, Kostomuksha, Olonets, Segezha, Medvezhyegorsk; Pskov Region: Gdov, Pustoshka, OPOCHKA, Novorzhev; Novgorod Region: Okulovka; Murmansk Region: Kola; Leningrad Region: Luga, Priozersk, Vysotsk; Kaliningrad Region: Svetlogorsk, Bagrationovsk, Nesterov, Krasnoznamensk; Vologda Region: Belozersk
3	Comfortable periphery	Republic of Karelia: Kondopoga, Pudozh; Pskov Region: Novosokolniki, Ostrov; Novgorod Region: Pestovo, Malaya Visheva, Chudovo, Borovichi, Valdai, Kholm, Staraya Russa, Soltsy; Leningrad Region: Vsevolozhsk, Vyborg, Gatchina, Volosovo, Kirovsk (Leningrad Region), Tosno, Kingisepp, Ivangorod, Lodeynoye Pole, Otradnoye, Slantsy, Shlisselburg, Novaya Ladoga, Syasstroy; Kaliningrad Region: Svetly, Zelenogradsk, Guryevsk, Slavsk, Pionersky, Polessk, Gvardeysk, Chernyakhovsk, Pravdinsk, Ozersk, Sovetsk, Baltiysk, Neman, Gusev, Ladushkin, Mamonovo, Primorsk (Kaliningrad Region); Vologda Region: Veliky Ustyug, Totma, Sokol, Gryazovets, Kadnikov, Kharovsk; Arkhangelsk Region: Novodvinsk
4	Nearby commuter towns	Leningrad Region: Kudrovo, Sertolovo, Kommunar, Nikolskoye, Koltushi, Lyuban
Compiled from the results of the calculations.		

Type 1. Remote industrial centers (53 towns, 41%).

The first cluster comprises towns located mainly in remote peripheral territories (the average distance to the nearest large or major city is 325 km), with high average monthly wages (83.5 thousand rubles) and a high average number of employees (3,187 per 10,000 people). The vulnerable point of settlements of this type is their single-industry character (a low number of organizations), low urban environment quality (average UEQI of 208.6), and a shortage of social and household infrastructure.

Type 2. Tourism and service centers (21 towns, 16%).

This cluster is characterized by the highest provision of consumer service facilities (84.3 per 10,000 people), sports facilities (41.9 per 10,000 people), and hotels (9.35 per 10,000 people), as well as a high density of organizations (230 per 10,000 people). Wages here are below the average (68.9 thousand rubles), which is typical of an economy oriented toward tourism and/or services. The remoteness from large or major cities of the macroregion can be described as moderate (165 km).

Type 3. Comfortable periphery (50 towns, 38%).

The third cluster brings together towns with a high quality of the urban environment (average UEQI = 237 points) and good provision of health care facilities (4.59 per 10,000 people), but low economic activity (wages of 65.8 thousand rubles and 2,266 employees per 10,000 people). It is important to note that this group is heterogeneous in terms of distance: along with nearby suburbs (Vyborg, Gatchina, Novodvinsk), it includes remote towns (Veliky Ustyug, Pudozh). This indicates that a high quality of the urban environment can coexist with a weak economy both in settlements located near large cities and in the far periphery.

Type 4. Nearby commuter towns (6 towns, 5%).

The last cluster is the most problematic and hidden type. It includes satellite towns (Kudrovo, Sertolovo, Kommunar, Nikolskoye, Koltushi, Lyuban) located 20–50 km from Saint Petersburg. These settlements are characterized by high wages (83.2 thousand rubles) and a high UEQI (241.8 points). At the same time, they can be classified

as outsiders according to almost all other indicators. Local employment here is catastrophically low (838 per 10,000 people), and consumer service facilities (19.5 per 10,000 people), sports facilities (14.7 per 10,000 people), and hotels (0.18 per 10,000 people) are almost absent. This group of towns is characterized by a functional imbalance: while having significant demographic potential, they retain a low degree of economic autonomy, serving primarily as “commuter” suburban zones within the Saint Petersburg urban agglomeration.

At the next stage of the study, one-way analysis of variance (ANOVA) was conducted to test the statistical significance of differences between the clusters. The choice of a post hoc test was determined by the results of a preliminary Levene’s test (Tab. 6). For six indicators with homogeneous variances ($p > 0.05$), Tukey’s test was used; for the remaining three variables, for which homogeneity was not confirmed ($p \leq 0.05$), the robust Games – Howell test was used.

Table 6. Results of homogeneity of variance tests, one-way analysis of variance (ANOVA), and post hoc testing

Indicator	Levene’s test (p)	F	p (ANOVA)	Post hoc test	Significant differences between clusters ($p < 0.05$)
Distance to a large/major city, km	0.377	27.5	< 0.001	Tukey	1–2, 1–3, 1–4, 2–3, 2–4
Average number of employees (excluding small businesses) per 10,000 people	0.976	26.8	< 0.001	Tukey	1–3, 1–4, 2–3, 2–4, 3–4
Number of consumer service facilities per 10,000 people	0.006	28.8	< 0.001	Games – Howell	1–2, 2–3, 2–4
Number of collective accommodation facilities per 10,000 people	0.069	18.2	< 0.001	Tukey	1–2, 1–4, 2–3, 2–4, 3–4
Number of organizations per 10,000 people	0.476	13.6	< 0.001	Tukey	1–2, 1–3, 2–3
Urban environment quality index (UEQI), points	0.694	11.1	< 0.001	Tukey	1–3, 1–4
Number of sports facilities per 10,000 people	0.383	8.7	< 0.001	Tukey	1–4, 2–3, 2–4, 3–4
Average monthly wages, rubles	0.028	5.9	0.001	Games – Howell	1–3
Number of health care organizations per 10,000 people	0.005	4.2	0.007	Games – Howell	1–3
Calculated from SPSS data.					

The ANOVA results confirm that all four clusters differ statistically significantly across each of the nine indicators ($p < 0.01$). The strongest differences ($F > 20$) are recorded for the number of consumer service facilities ($F = 28.8$), distance to a large/major city ($F = 27.5$), and the average number of employees ($F = 26.8$). The post hoc analysis shows that the first and fourth clusters – “remote industrial centers” and “nearby commuter towns” – are the most contrasting. They differ significantly from each other in distance to a large/major city ($p < 0.001$), the number of employees ($p < 0.001$), the provision of sports facilities ($p = 0.001$), hotels ($p < 0.001$), and the UEQI ($p = 0.020$). These two types represent opposite poles in most characteristics.

The second and third clusters (“tourism and service centers” and “comfortable periphery”) also differ in the number of consumer service facilities ($p < 0.001$), organizations ($p = 0.018$), sports facilities ($p = 0.008$), and CAF ($p < 0.001$). However, they show no significant differences in the UEQI ($p > 0.05$) or in distance to a large city ($p > 0.05$). This means that a high-quality urban environment and moderate remoteness are common features of both types, while the key difference lies in the level of development of service infrastructure and economic activity.

The third and fourth clusters (“comfortable periphery” and “nearby commuter towns”) differ in remoteness from large cities ($p = 0.094$, at the margin of significance), the number of employees ($p < 0.001$), sports facilities ($p = 0.011$), and CAF ($p < 0.001$). At the same time, they are similar in the number of organizations, consumer service facilities, health care institutions, and the UEQI.

The first and second clusters have few similarities in terms of distance to large cities ($p = 0.007$), the number of consumer service facilities ($p < 0.001$), organizations ($p < 0.001$),

and CAF ($p = 0.014$). The first and third clusters differ from each other in all key indicators except the number of sports facilities, consumer service facilities, and collective accommodation facilities.

It is important to note that, despite the statistical significance of differences between the identified types (ANOVA, $p < 0.001$), within each cluster one can find towns whose characteristics do not fully correspond to the “typical” profile of the group. For example, the town of Veliky Ustyug, traditionally positioned as a tourism center, fell into the third cluster (“comfortable periphery”) based on the set of economic indicators, while the industrial towns of Kostomuksha and Segezha were assigned to the second cluster (“tourism and service centers”) due to their high density of organizations and well-developed social and household infrastructure.

Towns such as Kargopol, Solvychegodsk, and Kirillov, traditionally regarded as tourism centers, fell into the first cluster despite their relatively high number of hotels. The reason is the low quality of the urban environment and the shortage of social and household infrastructure, which outweigh their tourism potential.

Proximity to a regional center does not in itself determine a town’s type. Thus, Kola (less than 15 km from Murmansk) was assigned to the tourism and service centers because of its high density of organizations (420 per 10,000 people), its provision of consumer service facilities (105 per 10,000 people), and its UEQI (255 points). The town functions more as an independent local center of business activity and services than as a commuter suburb.

Another illustrative example is Novodvinsk. Despite its proximity to Arkhangelsk (about 25 km), the town was assigned to the “comfortable periphery” cluster rather than to the “nearby commuter towns” because employment there (2,810 per 10,000 people) is considerably higher than in typical

commuter towns (838 per 10,000 people), and the presence of the city-forming enterprise Arkhangelsk Pulp and Paper Mill provides a local economic base. At the same time, the level of development of consumer service facilities (30.9 per 10,000 people) and the density of organizations (103 per 10,000 people) do not allow it to be placed in the second cluster.

In our view, these deviations are not clustering errors but reflect the multidimensional nature of socio-economic development: towns can have features of different types, and their cluster membership is determined by the combination of all nine indicators. Borderline cases do not invalidate the typology; rather, they point to the need for an individual approach when designing socio-economic policy measures for such settlements.

The results of the cluster analysis support the hypothesis that traditional categories are inadequate. For example, Kargopol and Solvychevodsk, traditionally perceived as tourism centers, fell into the first cluster, while Kostomuksha, a single-industry town, was assigned to the second. This suggests that a town's formal status does not predetermine its actual profile, and that management decisions based on stereotypes (a tourist town means investing in tourism) can be misguided.

Drawing on the identified types of small and medium-sized towns, differentiated directions of regional socio-economic policy can be proposed.

For remote industrial centers (Cluster 1), it is important not merely to expand the production capacity of town-forming enterprises but also to develop the social sphere. Given high wages and employment levels, the low quality of the urban environment and the shortage of social and household infrastructure create risks of population outflow. The priority direction of socio-economic policy for such towns should therefore be targeted

funding of urban improvement projects, the construction of health care institutions, and the development of sports and cultural-leisure centers. To reduce dependence on town-forming enterprises (this cluster contains the largest number of single-industry towns; Sekushina, 2024), economic diversification is needed, together with measures to improve transport accessibility – subsidizing passenger transport and developing logistics infrastructure – which is critical for remote settlements (average distance 325 km).

For tourism and service centers, the key problem is the mismatch between well-developed social and household infrastructure and the relatively low quality of the urban environment. A serious constraint on the development of towns of this type is the low level of wages, which fails to ensure an adequate standard of living and reduces their attractiveness to skilled personnel. In our view, for settlements with a developed tourism sector it is critically important to focus not only on expanding tourism infrastructure (hotels, public catering) but also on improving the quality of public spaces and the urban environment. Another important area is supporting entrepreneurial initiatives aimed at raising local employment and household incomes.

For the third cluster, the “comfortable periphery”, with its high-quality urban environment and good provision of health care organizations, the most pressing problem is stimulating local economic activity. The key policy directions in this case are support for small and medium-sized businesses and the creation of industrial and agro-industrial parks. The high quality of the urban environment can be used as a competitive advantage to attract residents who work remotely and to develop ecological and event tourism. Improving transport accessibility for remote towns and strengthening agglomeration connectivity for settlements in the near periphery are also important.

For the “nearby commuter towns” type, the key problem, in our view, is the imbalance between rapid population growth and the lagging development of the local economy and social infrastructure. On the one hand, proximity to Saint Petersburg gives residents access to the metropolitan labor market and high wages. On the other hand, these settlements objectively lack consumer service facilities, sports facilities, cultural and leisure institutions, and, importantly, jobs. This is precisely what makes them commuter towns in the purest sense, where residents are forced to meet most of their daily needs outside the town.

Resolving this situation requires a set of measures aimed at creating a local economic base and improving the quality of life within the town. The first-priority measure should be to stimulate small businesses in the service sector, which would create new jobs and allow residents to access essential services without leaving the town. The second important area is improving transport connectivity with Saint Petersburg (developing suburban rail services, increasing road capacity) to enhance population mobility and reduce transport pressure. The third area is targeted subsidization of the construction of social and household infrastructure – outpatient clinics, cultural and entertainment centers, and sports complexes – taking into account the continuing population growth.

Conclusions

Thus, the study makes it possible to draw the following conclusions.

First, a multidimensional cluster analysis of 130 small and medium-sized towns in the Northwestern Federal District across nine socio-economic indicators identified four stable types: “remote industrial centers” (41% of towns), “tourism and service centers” (16%), “comfortable periphery”

(38%), and “nearby commuter towns” (5%). The statistical significance of the differences between the types is confirmed by one-way analysis of variance and post hoc tests.

Second, two of the resulting clusters deserve special attention because they are rarely captured in existing classifications of small and medium-sized towns. The first type is the “comfortable periphery”, which includes both nearby suburbs and remote towns with a high-quality urban environment but a weak economy. The second type is “nearby commuter towns” – satellite towns of major cities with extremely low local employment and a lack of social infrastructure despite formally high wages and urban environment quality indicators.

Third, the proposed typology makes it possible to move from universal support measures to targeted instruments of regional policy. For remote industrial centers, the priority is improving the quality of the urban environment and diversifying the economy. For tourism and service centers, the priority is upgrading the urban environment and raising household incomes. For the comfortable periphery, the focus should be on stimulating entrepreneurship and creating new jobs. For nearby commuter towns, special mechanisms are needed to support local employment and improve the provision of social and household infrastructure.

The theoretical significance of the study lies in advancing the methodology for typologizing small and medium-sized towns through the use of multidimensional cluster analysis, which makes it possible to account for a set of economic, social, environmental, and spatial characteristics.

The practical significance lies in the possibility of using the results by state and local authorities when designing targeted support measures for each of the identified types of towns. The proposed typology does not claim to be an exhaustive

classification of all towns. Rather, it is an analytical framework that reveals the most typical combinations of problems. It can serve as a kind of “navigator” for regional policy, showing where particular imbalances are likely and where resources should be directed for more detailed research.

Prospects for further research include expanding the indicator system for a more refined typology of towns, scaling the proposed approach to other regions of Russia, and conducting a similar cluster analysis for the entire set of small and medium-sized towns across the country.

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Use of AI Tools

In preparing this article, the author used DeepSeek solely as an auxiliary tool to perform the following formalized operations: extracting and filtering statistical data from Excel files according to specified criteria, structuring data into tables, and stylistic editing of the text. The author manually verified the results obtained after the data were processed by the neural network. All substantive decisions, including the selection of variables, interpretation of results, and formulation of conclusions, were made exclusively by the author, who bears responsibility for the accuracy of the source data and the correctness of the results.

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Received July 13, 2026.