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PROBLEMS OF TERRITORY'S DEVELOPMENT

Peer-reviewed scientific and practical journal covering a wide range of issues on the socio-economic development of territories.

The journal's primary aim is to provide broad scientific communities and practitioners with the opportunity to familiarize themselves with scientific research findings in the field of scientific support for territorial economies and to participate in discussions on these issues. Key topics include territorial development problems, regional and sectoral economics, socio-economic development of territories, issues of regional budget revenue formation and expenditure rationalization, innovation economics, and current issues in the development of the agro-industrial complex.

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МОНИТОРИНГ ПЕРЕМЕН: ОСНОВНЫЕ ТЕНДЕНЦИИ

FROM THE EDITOR

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ON IMPROVING THE EFFICIENCY OF PUBLIC ADMINISTRATION OF TERRITORIAL DEVELOPMENT

The complexity and ambition of the tasks facing the Russian Federation, and the severity of the socio-economic problems that its territories are encountering, lend urgency to the question of how effective public administration is in developing socio-economic systems at various levels. This question occupies a central place in the work of Russian economists. A number of their recent studies are presented in the current issue of the journal.

For instance, noting the importance of the potential of the Arctic territories for achieving Russia's strategic objectives, *E.A. Kuklina* and *D.D. Ulzetueva* advance the methodology for modeling the development of a macro-region using modern data analysis techniques. The model they propose can be used by public authorities in drafting strategies for the sustainable development of the Arctic territories, in planning infrastructure projects, and in making managerial decisions – all of which will undoubtedly help to improve the effectiveness of public administration.

The ongoing sanctions pressure, the slowing economic growth of the territories, the declining investment activity of enterprises, and the high key interest rate, among other factors, only heighten the need to use the

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available resources of the territories effectively. At the same time, the constituent entities of the Russian Federation are obliged to meet the state's social commitments in full and to ensure that national goals are achieved. The principal source for performing the functions entrusted to public authorities is the budget. The article by *T.V. Uskova* and *E.D. Kopytova* identifies the specific features of the formation and execution of the regional budget of the Vologda Region, provides a comprehensive assessment of the new budget cycle, and compares its parameters with the previous planning period.

A.G. Karimov and *P.A. Ivanov* investigate the patterns and distinctive features of household financial behavior amid epidemiological and sanctions-related restrictions. Drawing on the results of sociological surveys in the Republic of Bashkortostan, the article identifies the factors influencing the dynamics of the population's financial behavior, analyzes the instruments for channeling household finances as an investment resource for ensuring the socio-economic development of the regions, and proposes a set of measures aimed at improving the population's financial literacy and the investment potential of households.

The study by *R.K. Polyakov* addresses the problem of the spatial analysis of clusters from the standpoint of the theory of the self-organization of complex adaptive systems. The author develops and tests a methodology for identifying and assessing the spatial patterns of self-organization, using the example of the shipbuilding and ship repair industry of the Kaliningrad Region. He establishes that the concentration of enterprises gravitates toward key infrastructure and manifests itself on specific spatial scales, i.e., radii. He concludes that agglomeration effects are present, and that conditions for synergistic interaction exist.

The work by *V.I. Belov* draws on the territorial approach, the method of groupings, and correlation and regression analysis to demonstrate the influence of electricity consumption on regional economic growth. The author concludes that the use of electricity acts as a driver of economic growth and offers practical recommendations to the regional public authorities on how to adjust their tariff policy.

K.E. Kosygina and *N.N. Mikhalko* assess the resilience of the cultural sphere of the subjects of the Northwestern Federal District to crises. In the course of their study, they develop a methodology for the quantitative assessment of the resilience of the regions' cultural sphere and confirm that public cultural institutions can adapt to challenges and threats in much the same way as commercial organizations and regional and national economies. The findings may prove useful for improving the mechanisms for managing the cultural sphere at both the regional and the federal levels.

One of the Russian Federation's most important state objectives is to raise the population's life expectancy. Given the regions' limited financial resources, it becomes critically important to assess how efficiently the available regional resources are being transformed in pursuit of this objective. *M.N. Makarova* carries out such an assessment. She establishes that long-term growth in life expectancy is determined by the volume of available resources, the level of technological development, and the quality of governance. She concludes that a differentiated demographic policy is necessary.

The state of and trends in the development of the economy of Northwest Russia in March 2026 are presented in the section "Monitoring of Changes: Key Trends", prepared by *M.A. Sidorov* and *E.V. Lukin*.

We hope that the work of the scholars will find practical application and will help to improve the effectiveness of public administration.

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TERRITORIAL ORGANIZATION AND MANAGEMENT

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MODELING THE DEVELOPMENT OF THE ARCTIC MACRO-REGION

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The relevance of the research topic is determined by the importance and role of the Arctic potential for solving Russia's strategic tasks in modern conditions of challenges and threats, as well as the possibilities of modeling in forming a qualitative basis for managerial decision-making to improve the effectiveness of public administration. Fundamentally new infrastructure and production solutions are being implemented in the Arctic macro-region, which can be scaled in the future, which determines the importance of modeling the development of the Arctic zone of the Russian Federation based on modern data analysis methods. When modeling the development of the Arctic macro-region, it is necessary to take into account such features as the limited and fragmented information collected, as well as the complexity of integrating heterogeneous data (economic, social, environmental, etc.). In this regard, the implementation of a set of modeling tasks based on modern data analysis methods requires various approaches (econometric modeling, cognitive technologies, machine learning, and big data analysis

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methods) that allow analyzing complex socio-economic, environmental, and infrastructural processes. The combination of various methodological approaches makes it possible to ensure the accuracy of the model, which can be used in developing strategies for the sustainable development of Arctic territories, planning infrastructure projects and making management decisions. The aim of the study is to explore the possibilities of modeling the development of the Arctic macro-region using modern data analysis methods. The aim defined the objectives of the study: to analyze the results of research in this subject area; to consider the clustering method (cluster analysis) as one of the effective methods of substantiating management decisions on the implementation of the Development Strategy of the Arctic zone of the Russian Federation; to identify promising areas of future research. The work used a systematic approach, logical analysis, synthesis, open source content analysis, regression analysis, and cluster analysis. The information base was compiled by Rosstat data on the Arctic regions for the period 2015–2023. As a result of the study, the expediency of using the hierarchical clustering procedure implemented using the JASP data analysis program is substantiated. During the cluster analysis, all the Arctic regions of Russia were grouped into two clusters based on the proximity of specific GRP values, which allows for subsequent regression analysis within each cluster to obtain more accurate results. As a promising area of research, the use of synthetic control methodology is proposed, which makes it possible to create an alternative scenario for the development of a macro-region for comparison with real development and assessment of the economic effect of implementing a set of strategic decisions of the state. The scientific novelty of the study is to improve the approach to modeling the development of the Arctic macro-region using predictive (predictive) analytics methods such as regression analysis, time series method, clustering. The practical significance of the results is determined by the possibility of their application by public authorities and management to develop forecasts for the development of the Arctic zone.

Regional development, Arctic macro-region, modeling, forecast, econometric model, data, predictive analytics, cluster analysis.

ACKNOWLEDGMENT

The study was carried out within the framework of the initiative research of the North-West Institute of Management of the RANEPA under the President of the Russian Federation "Assessment of the prospects for cooperation between the BRICS Forum states in the Arctic economic space (in the context of updating global governance institutions)", number in the EGISU R&D system 125022002759-3 dated 02/20/2025.

Introduction

The goals, objectives and priorities of the development of the Russian Arctic zone are set out in such strategic documents as Presidential Decree 645, dated October 26, 2020 "On the Strategy for the Development of the Arctic Zone of the Russian Federation and Ensuring National Security for the Period up to 2035", "Fundamentals of State Policy in the Arctic until 2035" (approved by Presidential Decree 164, dated March 5, 2020), RF Government Resolution 3014-r, dated October 27, 2025 on long-term plans for the integrated socio-economic development of the Arctic zone's anchor settlements for the period up to 2035, the Strategy of the State National Policy of Russia for the period up to 2036 (RF Government Resolution 4147-r, dated December 29, 2025). According to these documents, one of the strategic priorities of the Russian Federation is the development

of the economic potential of the Arctic zone of the Russian Federation (hereinafter – AZRF) for the purpose of balanced regional development, which is a rather difficult task: the Arctic macro-region as a space for economic activity has specific features of natural (harsh climate, remoteness from the center) and socio-economic (low population density, insufficient level of development of transport and social infrastructure, uneven industrial and economic development of individual territories) character. It is worth noting the high resource intensity of economic activity in the Arctic, as well as the stable geographical, historical and economic connection with the Northern Sea Route, which is currently the dominant development of the Arctic macro-region.

The specifics of economic activity shape the peculiarities of Arctic projects: difficult conditions for carrying out production activities; the use of a public-private partnership mechanism involving debt financing; the fragility of the Arctic ecosystem and its extreme vulnerability (Kuklina, 2025). The fragility and vulnerability of the Arctic ecosystem make it critically important to ensure the environmental safety of economic activity (Greaves, 2016).

One of the key factors in the regional development of the northern regions is the differentiation of the socio-economic environment (Skufina et al., 2018). The analysis of ongoing processes and the determination of the prospects for the development of the Arctic macro-region shape the choice of public policy instruments (Arctic Space …, 2016; Schach, Madlener, 2018). But development here is always "a compromise between the need, on the one hand, to ensure environmental protection and adaptation to the effects of climate change, and, on the other hand, the need to develop economic activity" (Heininen, 2020).

Russia's modern Arctic policy is focused on creating conditions and frameworks for launching innovative projects as the basis for solving all other development tasks in the Russian Arctic. Fundamentally new infrastructure and production solutions are currently being implemented in the Arctic macro-region, which can be further scaled both in the subarctic regions and throughout the country as a whole. This determines the importance of modeling the development of the Russian Arctic based on modern data analysis methods. The use of models will make it possible to form the most reliable and qualitative basis for making managerial decisions in order to increase the effectiveness of public administration and strategizing. Modeling GRP and GDP makes it possible to identify the factors that need to be optimized first, as this can become a decisive lever for accelerating the economic growth of regions and the country as a whole.

The aim of this study is to explore the possibilities of modeling the development of the Arctic macro-region using modern data analysis methods. The aim defined the objectives of the study: to analyze the research results in this subject area; to consider the clustering method (cluster analysis) as one of the effective ways to justify management decisions on the implementation of the Development Strategy of the Russian Arctic; to identify promising areas for future research.

Methodological approaches and research methods

The theoretical and methodological basis of the research is the works of Russian and foreign scientists devoted to the AZRF development in terms of analysis, forecasting, and modeling. A systematic approach, logical analysis, synthesis, open-source content analysis, regression analysis, and cluster analysis were used as the methodological basis of the study.

We propose a comprehensive use of predictive analytics methods, including two consecutive stages, to improve the accuracy of estimates for making managerial decisions regarding the development of the Russian Arctic: at the first stage, a hierarchical clustering procedure is performed (for example, using the JASP2 data analysis program); at the second stage, regression analysis is performed within each selected cluster using an integrated autoregression model based on the moving average method for analyzing and predicting ARIMA (0,1,0) time series with Drift in Python 3.

Extent of elaboration of the problem

The key mechanism for achieving strategic interests and ensuring national security in the AZRF is the supporting development zones (hereinafter referred to as the SDZ), which develop as integral projects, including transport, industrial and social projects. If we consider the SDZ in the context of the implementation of resource projects (The Economy of..., 2020), which seems logical, given the powerful natural resource potential of the macro-region and the importance of its development for solving strategic tasks of the state, then seven development zones can be identified within the borders of the AZRF (Kola, Arkhangelsk, Taimyr-Turukhansk, Yamal-Nenets, Chukotka, North-Yakut, Nenets), which differ both in quantitative (territory, population, etc.) and qualitative (economic potential, level of socio-economic development, GRP, etc.) metrics.

The evolution of the normative economic and spatial image of the SDZ is presented in detail in a study by specialists from the Institute for Socio-Economic & Energy Problems of the Komi Science Research Centre of the Ural Branch of the Russian Academy of Sciences (Dmitrieva, Buryi, 2019). To analyze the activities of economic entities and develop development forecasts in the territory of the Russian Arctic, reference, basic and industrial settlements are distinguished, differing in the composition of economic entities and the population (Fauzer et al., 2019). The basic taxonomic unit of the SDZ is supporting settlements (hereinafter referred to as SS), which perform several functions: strategic, including ensuring security; administrative and managerial; scientific and research; ensuring accessibility to residents of all types of infrastructure; hosting unique enterprises; cultural development (Maracha, Krasnikova, 2024).

Thus, an object of modeling for the development of forecasts and strategies of socio-economic development can be as follows (listed in order of increasing their area as a geometric characteristic): SS; SDZ; Arctic region (subject of the Russian Federation); a group of regions identified by any criteria; the Russian Arctic as a whole.

We consider it necessary to note the achieved and promising significant research results in this subject area.

For instance, the work (Zemskov et al., 2022) carried out an assessment of the economic contribution of the Russian Arctic to the overall economic development of the country and constructed a linear model of the dependence of GDP on development indicators based on regression analysis. The advantage of this study, in our opinion, is the adjustment of estimated indicators (development indicators) using a correction factor calculated based on the number of administrative-territorial units belonging to the AZRF.

The article (Smirennikova et al., 2019) uses two opposite approaches: 1) individualization of scenarios for the socio-economic development of the AZRF territories; 2) development of generalized models that take into account the fundamental similarities of the AZRF subjects. We group all Arctic regions into three groups,

propose three indicators for the development of Arctic socio-ecological and economic systems, and build regression models. As an advantage of the results obtained, we consider it necessary to note the fact that the authors have grouped the regions according to the appropriate criteria, i.e. their aggregation. Thus, further, for the purposes of analysis and forecasting, it is possible to operate not with local data for individual regions, but on their totality.

The paper (Kikkas, 2015) presents a model of six econometric equations for analyzing the sustainable development of the Chukotka Autonomous Area[1]. To model the development of a sustainable type, the author's version of the content of the category "sustainable development of the region's space" is proposed as a controlled process of development of three spheres of human activity (production, society, environmental management). The author defines indicators of sustainable development in the context of three areas: industrial development, social development, and the state of environmental management. The main idea of the author was to form a set of indicators reflecting the sustainability of development in each of the analyzed areas. On the one hand, the proposed approach is intuitive and quite easy to implement in practice for assessment and analysis, but on the other hand, it does not allow building a comprehensive model that takes into account all these areas as a whole, as a system consisting of three subsystems (economic, social and environmental)[2]. The author concludes that the methodological principles of building the model and the results of its solution can be successfully used in the future when developing a strategy for the sustainable development of a municipality, a separate Arctic region, or the totality of all Arctic regions of the Russian Federation. It seems to us that this conclusion is not correct due to the fact that all regions are different, they differ in their metrics, and there cannot be a universal model applicable to all equally, especially to the AZRF as a whole.

The study (Didenko, Skripnyuk, 2014) presents an approach to modeling the sustainable socio-economic development of the AZRF regions using a system of econometric equations, formulates the concept of regional typologization of the Arctic territories, and substantiates a model of growth and development of the Arctic regions, taking into account the type of territory. Thus, the proposed models take into account the specifics of the research object – a region of a certain type, which allows for more accurate results.

In the paper (Antipov, 2019), an innovation economy model for the Yamal-Nenets Autonomous Area was built on the basis of the ADL model, based on the results of previous research (Didenko, Kunze, 2014; Romashkina et al., 2017). The developed model represents a system of econometric equations reflecting a set of key indicators that make it possible to create an innovative economy, as well as factors that have a significant impact on achieving this goal. The strengths of the performed study include a fairly representative set of factors, including five endogenous and eight exogenous factors.

In continuation of research in this subject area, the same author built a model based on neural networks for three areas of the Murmansk Region (Antipov, 2022). The advantage of this modeling approach is due to the ability to quickly build a model with any given number of hidden layers and input variables. The model

[1] As an ADL model.

[2] In this context, it is worth noting that this problem was discussed earlier in the article "Comparison of regional sustainability assessments using indicator systems: is it feasible or not?" (Zeijl-Rozema et al., 2011), but no clear answer has been received; we adhere to the view that the answer to this question, most likely, it is negative.

is capable of scaling and almost unlimited increase in the amount of data, the effectiveness of its application is explained by the coverage of the assessed factors. The author considers the development of "more global cluster models describing not only individual regions, but also the entire Arctic zone as a whole" to be a promising vector of research in this subject area (Antipov, 2022, p. 156), and we fully support him in this.

In recent years, machine learning methods have been successfully applied to model the region's macroeconomic indicators and forecast GDP. For example, in the work (Adewale et al., 2024), ensemble methods (Random Forest Regressor, XGBoost Regressor and Linear Regression) were considered, Random Forest Regressor was recognized as the most reliable: the coefficient of determination is 0.96; the average absolute error (MAE) is 24.29.

In the study (Maikova et al., 2025), machine learning methods using the Python programming language were used to predict GRP. The choice of exogenous variables combining both traditional economic indicators and digitalization factors (the volume of investments in fixed assets aimed at acquiring information, computer and telecommunications equipment; the share of people employed in the ICT sector in the total number of employed people, etc.), made it possible to take into account current trends in the digital transformation of regional development, which is an undoubted advantage of this study.

At the end of a brief overview of the degree of study and elaboration of the topic, we consider it necessary to note a certain gap in scientific knowledge due to the practical lack of models describing the AZRF as a whole. Our study is an attempt to close this gap.

Results and their discussion

Decisions on the development of economic systems at any level are based, as a rule, on the results of predictive analytics and are focused mainly on the accuracy of the results obtained and the number of factors considered. The key idea of predictive analytics as an approach to data analysis that allows predicting future events (actions) based on existing ones (which have occurred) is that past data contains patterns that can be used to predict the future. The emergence of new data analysis and machine learning tools allows for deeper analysis based on structured information.

Currently, there are three groups of predictive analytics methods:

classical statistical methods based on calculations based on mathematical formulas selected depending on the type of task (regression analysis, clustering, time series analysis, etc.);

machine learning methods – predictions that apply automated algorithms using historical data (decision trees, neural networks, etc.);

large language models – solutions obtained using neural networks that are trained on information from the Internet or data provided by it.

The clustering method (cluster analysis) is a method of data processing by dividing a large group of objects into small groups based on similarity: each cluster includes objects that are as similar as possible, and objects from different clusters differ significantly[3].

Previously, we have successfully applied cluster analysis to substantiate proposals for the development of forms of tourism organization in China based on a spatial approach involving

[3] Seol H. (2025). SnowCluster: Multivariate Analysis. (Version 7.4.8) [jamovi module]. Available at: https://github.com/hyunsooseol/snowCluster

the creation of tourist macro-territories and the "master plan" tool; Random Forest Regressor was used, which implements the data analysis procedure through decision trees (Kuklina et al., 2025).

The information base for economic and mathematical modeling of the development of the Russian Arctic in this study was compiled by Rosstat data for the period 2015–2023 for nine subjects of the AZRF.

To select a similarity metric, a three-factor model was constructed and correlation coefficients were calculated *(Tab. 1)* between the resulting indicator – the GRP of the Arctic regions (Y) and three variables: specific GRP (X_1); average monthly memorial wages of employees in a full range of organizations in the economy as a whole (X_2); internal costs of research and development (X_3).

Figure 1 shows regression statistics and the results of regression analysis of the three-factor linear model.

Figure 2 presents a graphical interpretation of the results.

Table 1. Correlation coefficients for factors X_i

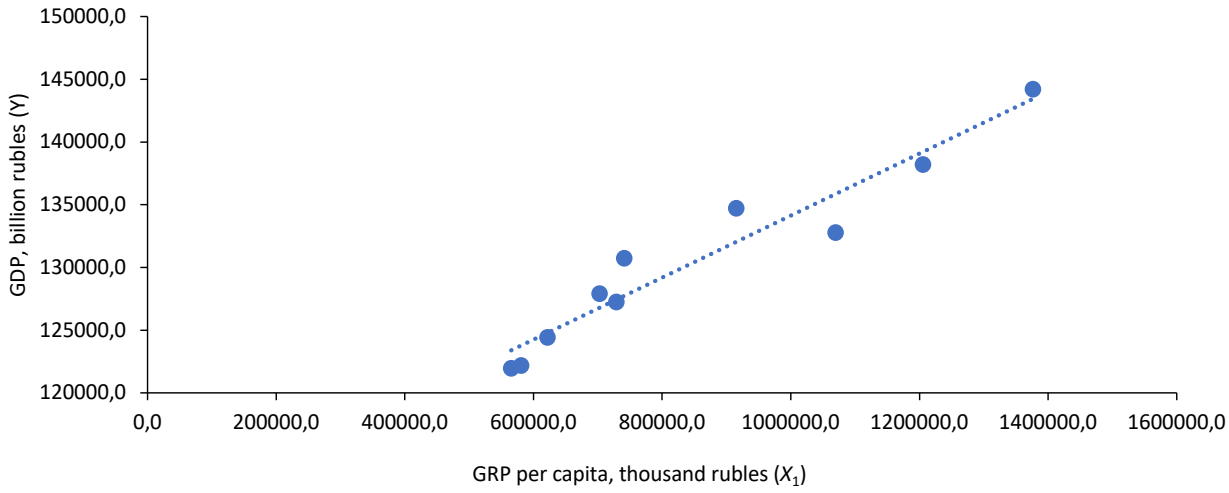
GRP per capita, thousand rubles	Average monthly nominal accrued salary of employees in full range of organizations in the economy as a whole, rubles	Internal research and development costs, million rubles
X_1	X_2	X_3
0.9637583	0.918878	0.947745
Source: own compilation.		

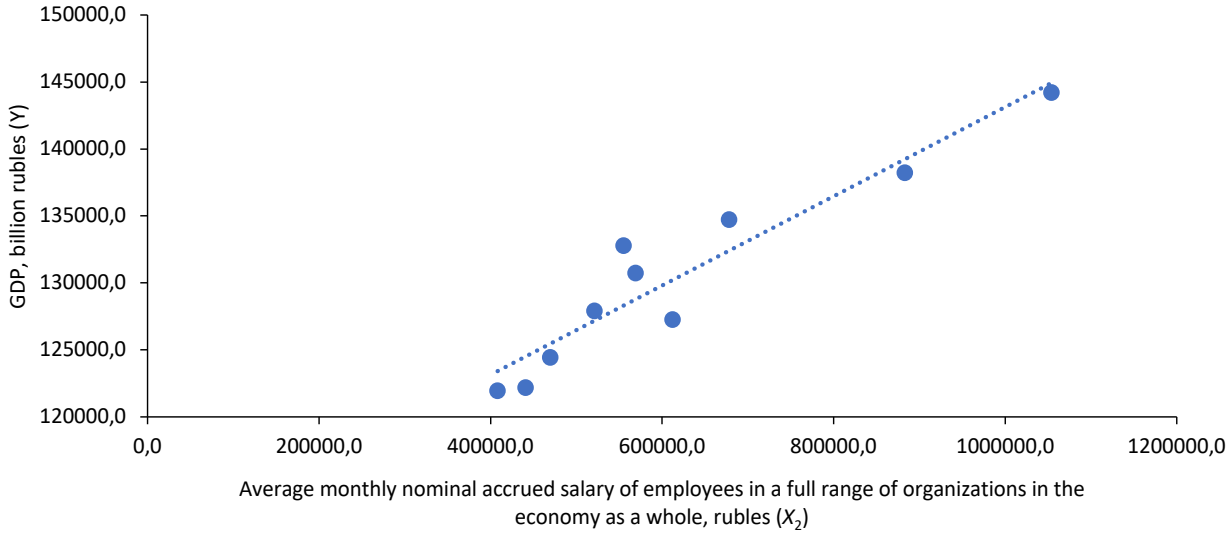
Regression statistics	
Multiple R	0.981
R-square	0.962
Normalized R-square	0.943
Standard error	1724.145
	10

	df	*SS*	*MS*	*F*	*Significance of F*
Regression	3	448980173.3	149660057.8	50.34525032	0.000120251
Remains	6	17836048.9	2972674.817		
Total	9	466816222.2			

	Coefficients	*Standard error*	*t-statistics*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95%*
Y-intersection	115751.2718	6136.461094	18.86287064	1.43413E-06	100735.8925	130766.6512	100735.8925	130766.6512
Variable X_1	0.039093822	0.02035194	1.92088919	0.103138892	-0.010705582	0.088893226	-0.010705582	0.088893226
Variable X_2	0.02325724	0.010647696	2.184250945	0.071640246	-0.002796734	0.049311214	-0.002796734	0.049311214
Variable X_3	-0.026400099	0.022018481	-1.198997276	0.275728887	-0.080277382	0.027477184	-0.080277382	0.027477184

Figure 1. Results of regression analysis of three-factor linear model
Source: own compilation.





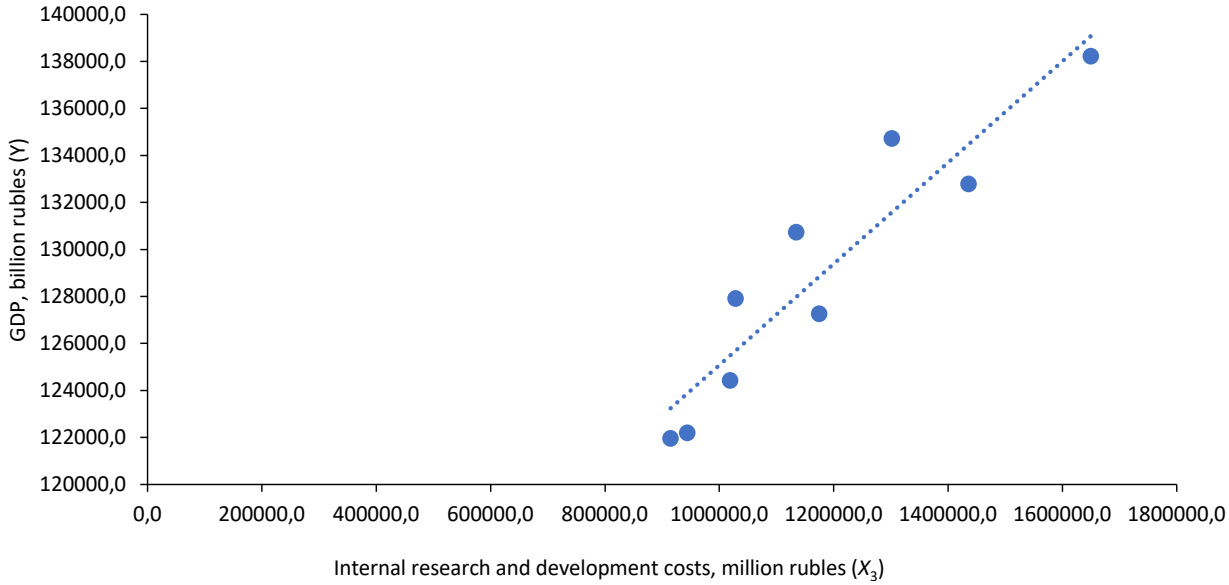


Figure 2. Graphical interpretation of regression analysis results

Source: own compilation.

The obtained results allowed selecting the indicator X_1 with the highest correlation coefficient (0.964) as a sign of similarity. Thus, the specific GRP indicator (i.e., per capita GRP) was further used when performing the Ward. D2 cluster analysis based on the hierarchical clustering procedure and calculating the Euclidean value for two selected clusters *(Fig. 3)*.

Visualization of the results of the performed hierarchical clustering is shown on the dendrogram *(Fig. 4)*.

Thus, the first cluster includes five Arctic regions, and the second cluster includes four regions of the AZRF. At the same time, most of the subjects of the first cluster (60%) are the old-developed regions of the Arctic (Komi Republic, Republic of Karelia, Arkhangelsk Region), characterized by an average level of economic development with a developed manufacturing industry, negative demographic trends, insufficient economic and transport development of the territory, and a low standard of living for the population. Half of the regions in the second cluster are two autonomous areas (Yamal-Nenets and Chukotka) with high levels of economic development and living standards, but with low levels of economic development and transport accessibility.

Cluster No	Count
1	5
2	4

Variables	Cases	Distances	Clustering method
8	9	euclidean	Ward.D2

Figure 3. Results of hierarchical data clustering

Source: own compilation.

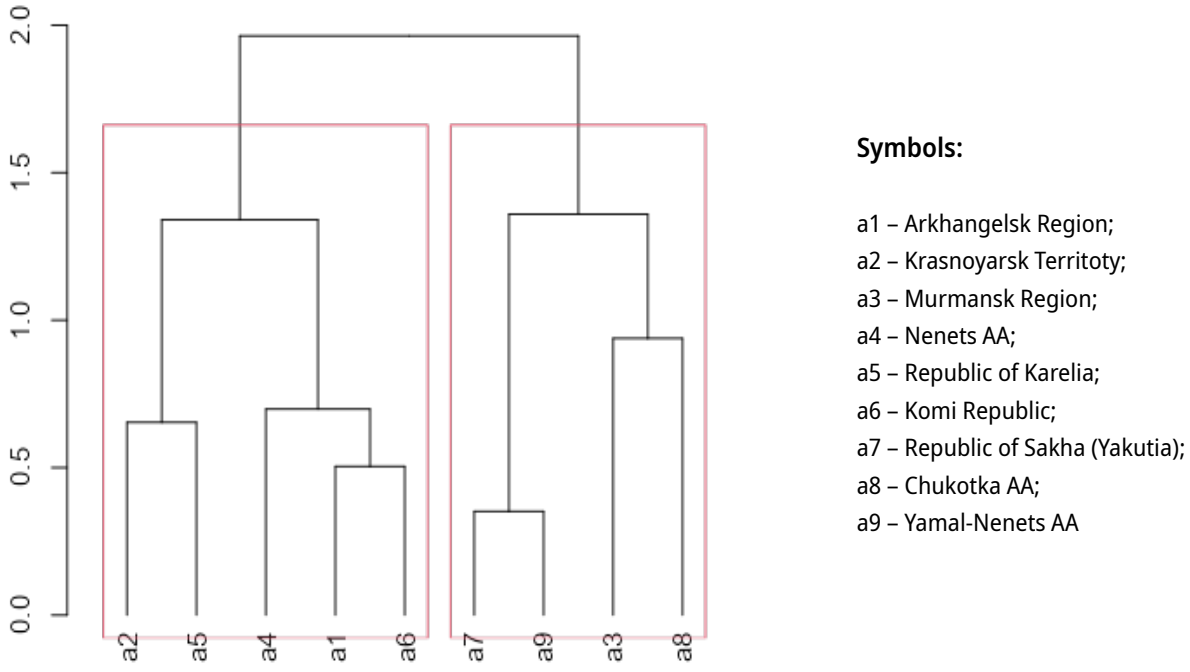


Figure 4. Dendrogram by regions of the Arctic zone of the Russian Federation

Source: own compilation.

Based on the results of the regression analysis, it can be seen that the confidence value of the R^2 approximation for the two clusters is almost the same for both the variant without data processing *(Fig. 5a)* and with data processing *(Fig. 5b)*.

For more advanced analytics, one should make a forecast for two clusters using an integrated ARIMA (0,1,0) moving average autoregression model with Drift in Python 3. As a result, to justify management decisions, it is possible to obtain more accurate data adequate to the internal structure of the objects of the two clusters than the regression analysis data obtained using indicators for all Arctic regions in aggregate. In this case, improved forecast accuracy is provided by more structured and homogeneous information within each of the two aggregates – the first cluster *(Fig. 6a)* and the second cluster *(Fig. 6b)*.

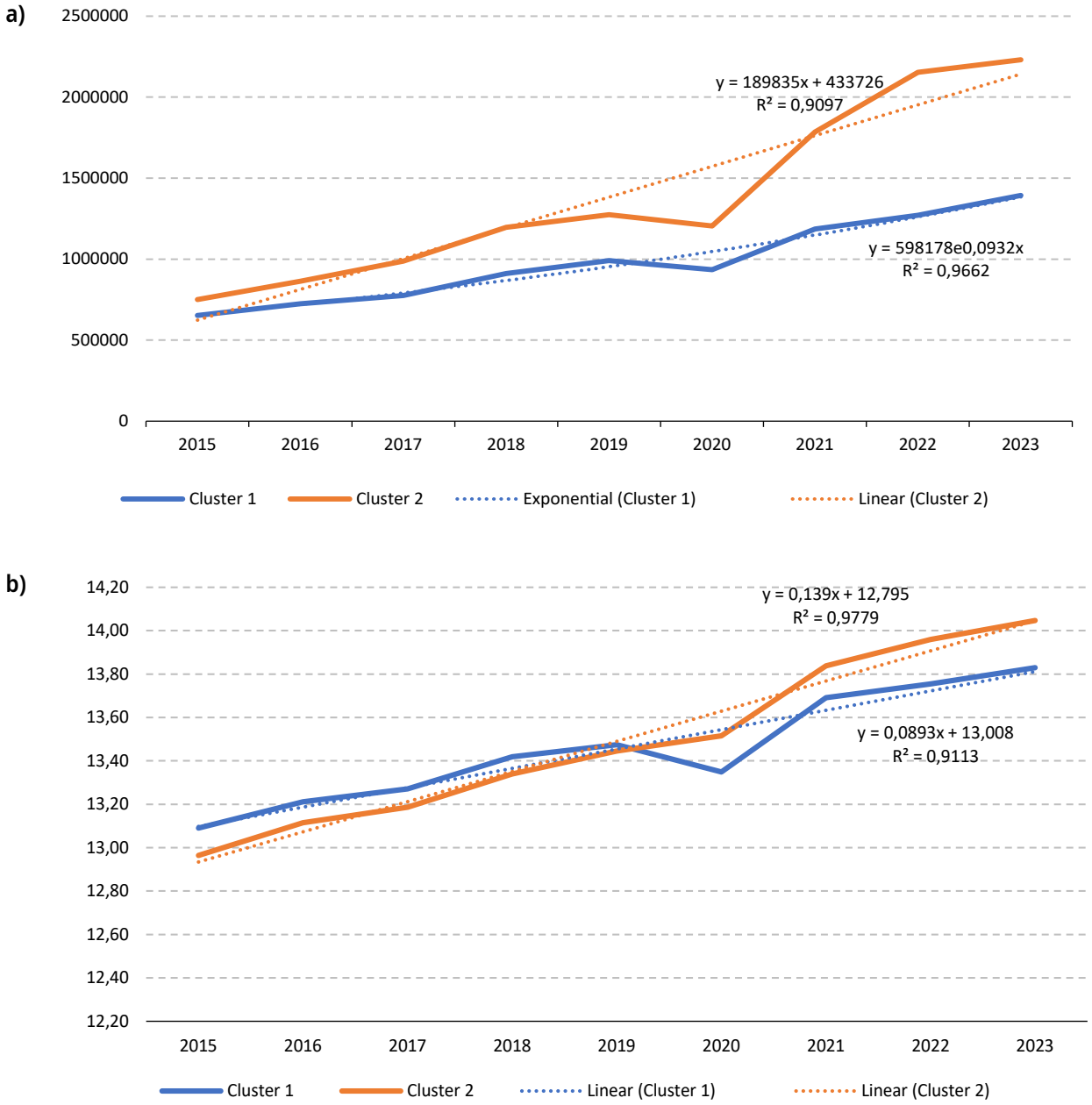
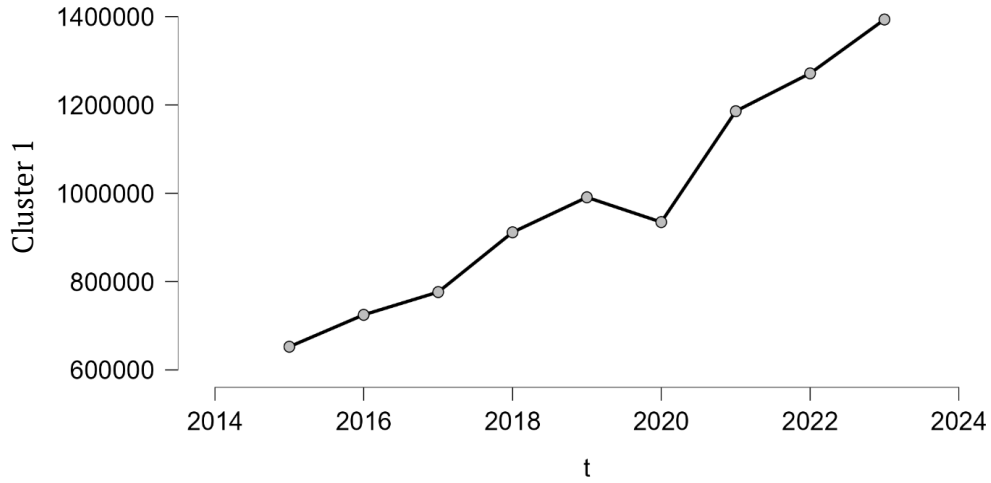


Figure 5. Time cluster graphs with a trend line and their approximation
Source: own compilation.

а) ARIMA

Time Series Plot



Model Summary

σ²	Log-Likelihood	AICc	AIC	BIC
$7{,}469\times10^{+9}$	-101,754	209,907	207,507	207,666

Coefficients

					95% CI	
	Estimate	Standard Error	t	p	Lower	Upper
Drift	92635,460	28582,011	3,241	0,014	25049,743	160221,177

Note. An ARIMA (0, 1, 0) model was fitted.

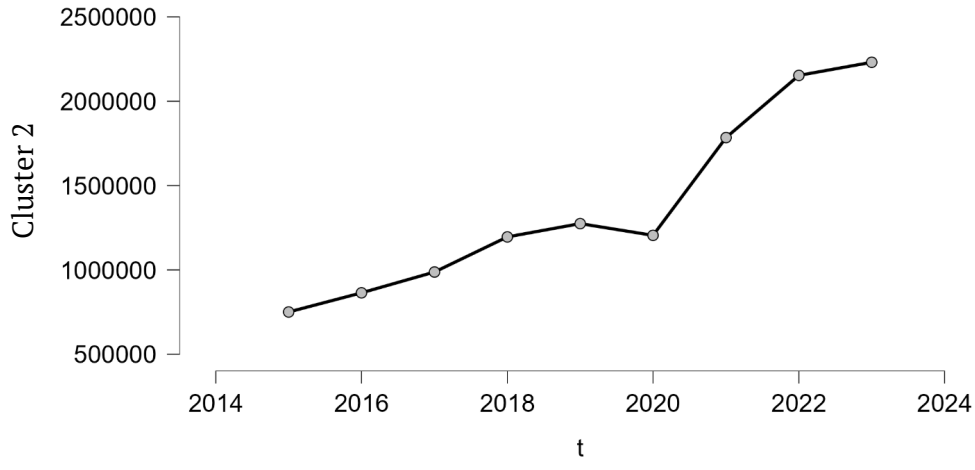
Stationarity Tests

Test	Statistic	Truncation lag parameter	p	H_0
Augmented Dickey-Fuller t	-5,415	2	0,010[a]	Non-stationary
Phillips-Perron regression coefficient ρ	-7,798	2	0,623	Non-stationary
Phillips-Perron studentized τ	-2,375	2	0,429	Non-stationary

[a] The p-value is actually less than p-value shown (see Help file).

б) ARIMA

Time Series Plot



Model Summary

σ²	Log-Likelihood	AICc	AIC	BIC
4,091×10+10	-108,556	223,511	221,111	221,270

Coefficients

					95% CI	
	Estimate	Standard Error	t	p	Lower	Upper
Drift	185021,234	66890,297	2,766	0,028	26850,817	343191,652

Note. An ARIMA (0, 1, 0) model was fitted.

Stationarity Tests

Test	Statistic	Truncation lag parameter	p	H_0
Augmented Dickey-Fuller t	2,654	2	0,990[a]	Non-stationary
Phillips-Perron regression coefficient ρ	-4,517	2	0,843	Non-stationary
Phillips-Perron studentized τ	-1,546	2	0,745	Non-stationary

[a] The p-value is actually less than p-value shown (see Help file).

Figure 6. Time series graphs for two clusters

Source: own compilation.

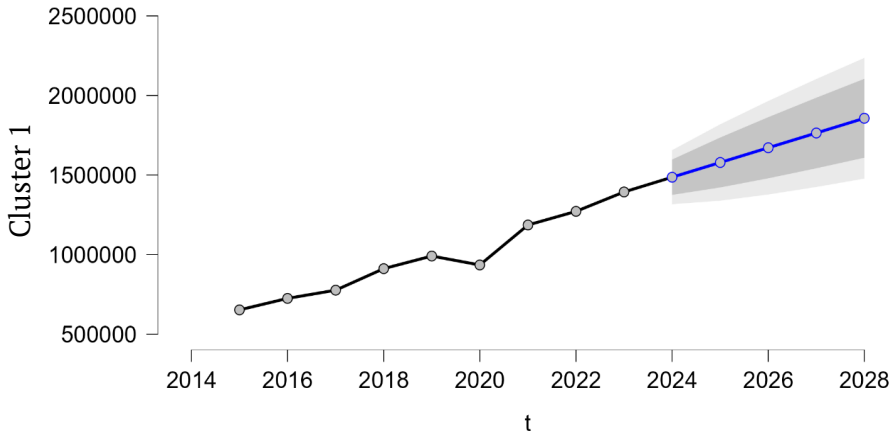
The data obtained through the Time Series using ARIMA (0, 1, 0) allows concluding that the time series for both clusters are unstable – the obtained confidence intervals give a vague estimate due to the small number of observations. *Table 2* shows the time series graphs show a point and interval forecast for clusters (Forecast Time Series Plot) *(Fig. 7a, 7b)*, their numerical values.

Table 2. Point and interval estimates of the forecast for clusters

Forecasts					
		80% CI (dark fill)		95% CI (light gray fill)	
t	Cluster 1	Lower	Upper	Lower	Upper
2024-01-01	1,486×10+6	1,375×10+6	1,597×10+6	1,317×10+6	1,656×10+6
2025-01-01	1,579×10+6	1,422×10+6	1,735×10+6	1,339×10+6	1,818×10+6
2026-01-01	1,671×10+6	1,480×10+6	1,863×10+6	1,378×10+6	1,965×10+6
2027-01-01	1,764×10+6	1,543×10+6	1,986×10+6	1,425×10+6	2,103×10+6
2028-01-01	1,857×10+6	1,609×10+6	2,104×10+6	1,478×10+6	2,236×10+6
Forecasts					
		80% CI (dark fill)		95% CI (light gray fill)	
t	Cluster 2	Lower	Upper	Lower	Upper
2024-01-01	2,416×10+6	2,157×10+6	2,675×10+6	2,019×10+6	2,812×10+6
2025-01-01	2,601×10+6	2,234×10+6	2,967×10+6	2,040×10+6	3,162×10+6
2026-01-01	2,786×10+6	2,337×10+6	3,235×10+6	2,099×10+6	3,473×10+6
2027-01-01	2,971×10+6	2,453×10+6	3,489×10+6	2,178×10+6	3,764×10+6
2028-01-01	3,156×10+6	2,576×10+6	3,736×10+6	2,270×10+6	4,042×10+6

Source: own compilation.

a) Forecast Time Series Plot



b) Forecast Time Series Plot

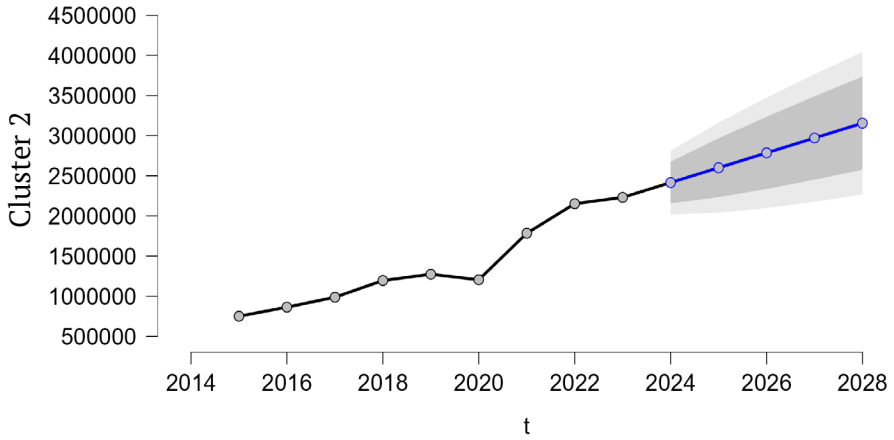


Figure 7. Time series graphs for two clusters with forecast
Source: own compilation.

On the graphs, the blue line shows a point forecast of GRP values from 2024 to 2028, calculated using the ARIMA autoregressive model (0, 1, 0). Since there are few observed values for building models, the confidence intervals turn out to be quite wide, however, with further research and an increase in the sample size, the width of the confidence intervals may decrease. In our case, the confidence interval for predicting GRP values is shown in the graphs *(Fig. 7a, 7b)*: a darker fill shows the confidence interval with a probability of 80%; The light gray fill is a 95% confidence interval.

Table 2 shows the numerical values of the confidence intervals for the levels of the series from 2024 to 2028. As the level of the series increases, the confidence interval becomes wider, so the forecast for this model for a longer period of time becomes meaningless; for a more accurate forecast, it is necessary to increase the number of observations.

A separate difficult task is the assessment of the results of the implementation of large, integrated projects that affect the economic development of each Arctic region of the Russian Federation in which they are localized.

It seems to us that for this purpose it is advisable to use the methodology of synthetic control, formed by solving the optimization problem, minimizing the differences between the real and synthetic units according to the given predictors in the previous period.

The synthetic control method (hereinafter referred to as SCM) was developed by A. Abadie, J. Gardeazabal (Abadie et al., 2003) and later improved by A. Abadie, A. Diamond, J. Hainmueller. (Abadie et al., 2010) in the direction of expanding the methodological apparatus. For example, formal conditions for the validity of synthetic control were developed, statistical tests were compiled to assess the significance of the results, advanced algorithms for selecting weights were created, and the applicability of the method for comparative case studies in conditions of a small number of observations was substantiated.

This method is widely used in economics to assess the impact of economic shocks, social programs, and political changes (for example, to assess the impact of "new" policies on economic performance), and is also useful in cases where traditional randomized controlled trials are not possible for ethical, logistical, or practical reasons. The disadvantage of SCM is the lack of knowledge about what would have happened with non-intervention – this is the problem of missing data, which affects the ability to draw conclusions about causality. In relation to our task, SCM allows creating an alternative scenario for the development of the Arctic macro-region for comparison with real development to assess the economic impact of the implementation of a set of strategic decisions of the state.

The Synth package has been developed for SCM data analysis in statistical software for the R language (Abadie et al., 2011).

Using this tool, for example, in 2015, S. Klößner, A. Kaul, G. Pfeifer, M. Schieler "synthesized" counterfactual Germany based on such metrics as per capita GDP, investment level, trade openness, number of schools, the share of industry in the surplus product of Austria (42%), the USA (22%), Japan (16%), Switzerland (11%) and the Netherlands (9%) (Klößner et al., 2018). Examples of the use of SCM by Russian researchers can be given. For example, SCM was previously used to assess the impact of the creation of the Titanium Valley SEZ in the Sverdlovsk Region (Podkorytova, 2019) and to assess the impact of policy on real GRP per capita in the Far Eastern Federal District (Goryunov et al., 2023). The synthetic control was created using the software package for statistical analysis of Stata data[4]. The SCM was also used to assess the consequences of the adoption of a law banning smoking in public places and its impact on the smoking rate in Russia (Potekhina et al., 2018).

The experience of using SCM suggests that this method is particularly effective for analyzing rare events in small samples. Thus, evaluating the effectiveness of government initiatives to implement large, integrated projects in the AZRF using the SCM method is a promising area of future research.

Conclusion

The performed research allowed confirming the assumption about the expediency of using cluster analysis as one of the effective methods of substantiating management decisions on the implementation of the Development Strategy of the AZRF. To select a similarity metric, a three-factor model was built and correlation coefficients were calculated between the resulting indicator (GRP of the Arctic regions of the Russian Federation) and

[4] Designed for statistical research on a variety of data samples from various subject areas and disciplines, it is used by researchers and analysts for data analysis, modeling and visualization.

three variables (specific GRP, average monthly memorial wages of employees in a full range of organizations in the economy as a whole, internal costs of research and development). The results obtained made it possible to select the "specific GRP" indicator with the highest correlation coefficient as a sign of similarity. When using the JASP data analysis program, all Arctic regions of Russia were grouped into two clusters based on the proximity of specific GRP values, including, respectively, five and four subjects of the Russian Federation. Regression analysis performed without and with data processing showed high reliability of the R2 approximation for both clusters. The results of applying the integrated ARIMA (0, 1, 0) moving average autoregression model with Drift in Python 3 made it possible to make a point forecast of GRP values from 2024 to 2028 and formulate the conclusion that both clusters of the time series are non-stationary (data obtained through the Time Series Time Series), the values for the two clusters time also have a significant effect on the forecast (data on the number of forecast levels).

The theoretical and methodological significance of the research lies in the development of approaches to modeling the development of the Arctic macro-region using modern data analysis methods (predictive analytics). The practical significance of the study is determined by the possibility of using the results obtained by public authorities and management to develop forecasts for the development of the AZRF in the context of both the Arctic regions of the Russian Federation and the Arctic macro-region as a whole.

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МОДЕЛИРОВАНИЕ РАЗВИТИЯ АРКТИЧЕСКОГО МАКРОРЕГИОНА

Актуальность темы исследования определяется значением и ролью арктического потенциала для решения стратегических задач России в современных условиях вызовов и угроз, а также возможностями моделирования в формировании качественной базы для принятия управленческих решений с целью повышения эффективности государственного управления. В Арктическом макрорегионе реализуются принципиально новые инфраструктурные и производственные решения, которые в дальнейшем могут быть масштабированы, что обусловливает значимость моделирования развития Арктической зоны Российской Федерации на основе современных методов анализа данных. При моделировании развития Арктического макрорегиона необходимо учитывать такие особенности, как ограниченность и фрагментарность собираемой информации, а также сложность интеграции разнородных данных (экономических, социальных, экологических и др.). В связи с этим реализация комплекса задач моделирования на основе современных методов анализа данных требует различных подходов (эконометрическое моделирование, когнитивные технологии, методы машинного обучения и анализа больших данных), позволяющих анализировать сложные социально-экономические, экологические и инфраструктурные процессы. Сочетание различных методологических подходов дает возможность обеспечить точность модели, которая может быть использована при разработке стратегий устойчивого развития арктических территорий, планировании инфраструктурных проектов и принятии управленческих решений. Цель исследования состояла в изучении возможностей моделирования развития Арктического макрорегиона с помощью современных методов анализа данных. Поставленная цель определила задачи исследования: проанализировать результаты исследований в данной предметной области; рассмотреть метод кластеризации (кластерный анализ) как

один из эффективных методов обоснования управленческих решений по реализации Стратегии развития Арктической зоны Российской Федерации; выявить перспективные направления будущих исследований. В ходе работы использовались системный подход, логический анализ, синтез, контент-анализ открытых источников, регрессионный анализ, кластерный анализ. Информационную базу составили данные Росстата по арктическим регионам за период 2015–2023 гг. В результате исследования обоснована целесообразность применения процедуры иерархической кластеризации, реализованной с помощью программы для анализа данных JASP. В ходе кластерного анализа все арктические регионы России по признаку близости значений удельного ВРП сгруппировались в два кластера, что позволяет выполнять последующий регрессионный анализ внутри каждого кластера с получением более точных результатов. В качестве перспективного направления исследований предложено использование методологии синтетического контроля, позволяющей создать альтернативный сценарий развития макрорегиона для сравнения с реальным развитием и оценки экономического эффекта от реализации комплекса стратегических решений государства. Научная новизна исследования заключается в совершенствовании подхода к моделированию развития Арктического макрорегиона с использованием методов предиктивной (прогнозной) аналитики, таких как регрессионный анализ, метод временных рядов, кластеризация. Практическая значимость результатов определяется возможностью их применения органами государственной власти и управления для разработки прогнозов развития Арктической зоны.

Региональное развитие, Арктический макрорегион, моделирование, прогноз, эконометрическая модель, данные, предиктивная аналитика, кластерный анализ.

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THE STATE OF THE VOLOGDA REGION REGIONAL BUDGET IN 2021–2025 AND BUDGET RISKS FOR 2026–2028

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Against the background of continued sanctions pressure, a slowdown in the growth of the territory's economy, a decrease in investment activity of enterprises, and a high key interest rate, the socio-economic development of regions continues to depend on their ability to adapt to new conditions, effectively use existing potential, and attract resources. At the same time, the constituent entities of the Russian Federation are obliged to fully fulfill their social obligations and ensure the achievement of the national goals. The main source of performing the functions assigned to public authorities is the budget, which is the leading link in the financial system and the largest fund of funds. According to the Budget Code of the Russian Federation, one of the principles of the budget system is its independence, which can be achieved if the relevant territory has its own sources of income. However, the key problem lies in the low share of own incomes in the budget structure of most constituent entities of the Russian Federation and their high dependence on inter-budget transfers from the federal center. In addition, many regions depend on a single industry (raw materials, agriculture, etc.), which makes their budgets

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vulnerable to price fluctuations and macroeconomic shocks. As a result, there is a high risk of inability to ensure the accuracy and reliability of budget planning due to the high volatility of macroeconomic parameters. These problems at the national level are the focus of attention not only of Russian scientists, but also of representatives of research organizations. However, at the regional level, these issues are studied fragmentarily and insufficiently systematically, due to limited research resources and the lack of specialized centers. In this regard, it is relevant to study the features and analyze the parameters of budget formation at the regional level, which determined the aim of this study. The scientific novelty consists in a comprehensive assessment of the new budget cycle of the regional budget (using the example of the Vologda Region) and comparing its parameters with the previous planning period of 2025–2027, as well as the impact of macro-economic factors on structure of income and expenses, debt burden and development prospects. It is proved that the systematic deviation of the actual budget indicators from the planned ones, the growth of budget risks and the decrease in the efficiency of spending funds are mainly related to the increasing macroeconomic uncertainty and the lag of the applied budget planning tools from modern challenges. The final part of the article reflects the key changes in the legislation on taxes and fees that entered into force in 2026, concerning VAT, tax rates, preferential tariffs, etc.

Budget, regional budget, main areas of budget policy, public debt, deficit/surplus, taxes, benefits, Vologda Region.

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Introduction

The financial mechanism, whose central link is the government budget, occupies an important place in the system of state economic and social regulation. Its key role lies in creating the financial foundation necessary for the effective functioning of federal and regional authorities, as well as local self-government, and for the fulfillment of the tasks assigned to them (Pechenskaya, 2014; Uskova, Galukhin, 2015; Salimova, Sharifyanova, 2016). The budget's most fundamental function is the redistribution of financial flows across territories, social groups, and sectors of the economy in order to optimize fiscal capacity. In the context of ongoing geopolitical transformations and economic instability, there is a growing need to strengthen state regulation of financial resource redistribution to minimize budgetary risks. During the COVID-19 pandemic, for instance, budget spending aimed at supporting the Russian economy increased substantially. The Ministry of Finance estimated the total cost of anti-crisis measures at 9% of GDP (2020–2021). The funds were channeled into financing the healthcare system, supporting small and medium-sized enterprises (credit holidays, subsidies), making payments to families with children, and other purposes. This indicates that Russia was among the global leaders in anti-crisis economic support[1].

[1] Accounts Chamber assesses the amount of spending on the fight against the pandemic. Available at: https://www.rbc.ru/economics/24/02/2021/6034d7659a7947b5e4403bdd

The facts confirm that the essence of the government budget as an economic category, and the specific nature of its qualitative characteristics, find direct expression in the set of functions that this institution performs within the national economy (Shvetsov, 2012). Beyond redistributing national income, the budget fulfills a number of other critical tasks. In particular, state regulation of the economy through the normative-distributive function involves setting the rates of mandatory payments into the budget system (taxes, levies, duties, and other fiscal revenues). The allocation of funds for achieving national goals and implementing state programs and projects is carried out through budget financing, among other mechanisms.

By exercising these functions, the state, acting within its legally defined powers, is able to concentrate financial resources on priority areas of socio-economic development across its territories. This is essential for ensuring the resilience of the national economy and social stability, smoothing out regional disparities, and improving the well-being of the population.

However, one of the main problems of the Russian Federation's budget system is the low share of own revenues in the budget structure of most federal subjects and their significant dependence on intergovernmental transfers from the federal center. The situation is further complicated by the narrow industry specialization of a large number of regions, which makes regional budgets highly vulnerable to price fluctuations on commodity markets. The consequence of these factors is a high risk of reduced accuracy and reliability in budget planning. While specialized organizations conduct research and produce expert assessments at the national level, corresponding issues are studied only fragmentarily and lack systemic coverage at the regional level, due in part to limited research resources and a shortage of specialized research centers.

In light of the above, studying the specific features of budget formation and execution at the regional level is highly relevant, and this determines the aim of the present study. A distinctive feature of this work is that it provides a comprehensive assessment of the new budget cycle of the Vologda Region's regional budget and compares its parameters with the previous planning period of 2025–2027. This has made it possible to draw conclusions about the influence of macroeconomic factors on its formation, its revenue and expenditure structure, its debt burden, and its development prospects.

Methods and materials

The theoretical and methodological basis of the study includes scholarly works and analytical materials devoted to the fundamental aspects of budget planning, the systematization and analysis of budget risks, and research on the impact of external macroeconomic conditions on the formation and execution of the government budget. The source of empirical data was official materials from the Ministry of Finance of the Russian Federation and the Federal Treasury of the Russian Federation, as well as official internet resources (the official internet portal of legal information of the Legislative Assembly of the Vologda Region). For the analytical part of the study, legislative acts were used as the information base, namely Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027"[2], and Vologda Region

[2] On the Regional Budget for 2025 and the Planning Period of 2026 and 2027: Law of the Vologda Region 5789-OZ of December 19, 2024. Available at: https://www.vologdazso.ru/actions/npa/laws/search.php?docid=TkRZM016QTRPVUUwVFc

Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028"[3].

The study employed a set of scientific methods. At the stage of reviewing the literature on the problem under study, the method of theoretical generalization was applied. To analyze the current situation in the Russian economy and budget risks, methods of systematization and structural analysis were used. Synthesis and comparison made it possible to summarize the data obtained.

Fundamentals of budget planning

The government budget, as the central element of the financial system, legally formalizes the monetary relations that develop between the state, represented by authorized government bodies, and other economic agents (enterprises and organizations of various forms of ownership, and individuals as taxpayers and recipients of budget funds). Through its execution, a stable resource base is formed, enabling public authorities to exercise their powers in the sphere of strategic territorial development management, including the allocation of budget funds and the implementation and coordination of programs and projects.

In accordance with the provisions of the Budget Code of the Russian Federation, the budget process includes several stages: drafting the budget, reviewing and approving it, executing it, and compiling and approving the execution report (Pechenskaya, 2014). These stages are characterized by a strict temporal sequence and functional interconnectedness. The approved budget operates within the budget period established by the legislation of the Russian Federation: from January 1 to December 31 (12 months). At the same time, the legislation provides for medium-term budget planning over a three-year horizon. At present, Federal Law 426-FZ of November 28, 2025, "On the Federal Budget for 2026 and the Planning Period of 2027 and 2028", has been approved at the federal level. At the regional level, budgets for the upcoming budget cycle have also been approved; in the Vologda Region, in particular, deputies of the Legislative Assembly passed the law "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028" in its final reading on December 10, 2025.

The quality of budget planning directly determines the effectiveness of subsequent budget execution. However, the parameters of this process in any country are significantly influenced by macroeconomic indicators, external threats, and challenges (Olayungbo, Olayemi, 2018; Shevlin et al., 2019). As noted in leading Russian and international studies, the modern economy is subject to the substantial negative impact of financial and economic instability, which is characterized by considerable fluctuations in key macroeconomic indicators (often driven by cyclicality) that create heightened risks for businesses, investors, and the public (Fedosov, 2024; Novskaya, 2025). Other research emphasizes that, under the conditions of striving for technological leadership, a transition to a "budget breakthrough" strategy becomes necessary (Afanas'ev, Shash, 2025). At the same time, as M.E. Kosov points out, the contemporary budget system is experiencing the impact of a set of interrelated structural challenges (Kosov, 2025). On the one hand, unprecedented sanctions pressure and geopolitical tensions necessitate a large-scale reallocation of budget spending in favor of items related to defense and security.

[3] On the Regional Budget for 2026 and the Planning Period of 2027 and 2028: Law of the Vologda Region 6046-OZ of December 16, 2025. Available at: https://www.vologdazso.ru/actions/npa/laws/search.php?docid=TlRBM016VXhOa0UwVFc

Simultaneously, these factors restrict access to traditional sources of financing the budget deficit and create permanent risks for export revenues. The impact of sanctions restrictions and inflation on the budget system is confirmed by the work of other authors: declining investment activity shrinks the tax base, while rising prices for imported goods increase expenditures on the procurement of equipment and medicines (Borodulin, Malyshev, 2025).

Contemporary foreign studies also analyze the resilience of the Russian Federation's budget system under large-scale sanctions. For instance, E. Rasoulinezhad notes that the long-term risks for regional budgets lie primarily in reduced investment in non-resource sectors (Rasoulinezhad, Akhavan, 2024). A team of other authors points to the increasing dependence of regional budgets on domestic sources of financing (Demertzis et al., 2022). S.H. Allen writes that the sustainability of budgets for achieving strategic goals remains uncertain (Allen, 2022).

Against this backdrop, the execution of regional budgets in the Russian Federation shows a tendency for actual indicators to deviate from the originally approved parameters (Klimanov et al., 2025). Statistical data indicate the existence of substantial discrepancies between planned and actual values, both when a surplus is recorded and when a deficit is formed. However, these changes are not reflected in official reporting, since adjustments are made either by adopting amendments to the normative legal act or by reallocating budget appropriations without changing the total volume of expenditures (in the consolidated budget schedule).

These factors give rise to a high degree of complexity in budget planning, which is predetermined by the presence of risks within the budget system[4].

The study of budget risks and their classification has been addressed in numerous works (Dvas, 1999; Galukhin, Uskova, 2016; Schick, 2002; Sprinkle et al., 2018; Romer, Romer, 2010; Baksha et al., 2001), which served as the foundation for the gradual deepening and broadening of the research field in the area of budget risks. Subsequently, V.V. Gamukin continued investigating this issue and formulated three groups of risks: external environment budget risks (environmental risks), system budget risks, and contingency budget risks (Gamukin, 2015).

At the same time, as N.E. Tereshkina and O.A. Khalturina note, the budget planning and forecasting process is fragmented due to the untimely introduction of adjustments that are necessary because of the influence of endogenous and exogenous factors (Tereshkina, Khalturina, 2026).

The works of foreign authors also highlight problems in implementing performance-based budgeting (Curristine, 2005). Among the key difficulties mentioned are the quality of indicators, the time lag, and the need to create and fine-tune a mechanism for collecting and verifying data for an objective assessment of the achievement of planned targets.

Assessing the budget risks of imbalance between revenues and expenditures at various levels of the Russian Federation's financial system is one of the important forecasting tasks. Ensuring the predictability of cash flow movements is the main condition for fulfilling the key objectives within the management of this system (identifying and forecasting trends in the volume and structure of revenues/expenditures; evaluating debt policy parameters; redistributing financial resources

[4] Sudakova A.E., Agarkov G.A., Tarasyev A.A. (2019). Budget Planning and Forecasting: A Textbook. Yekaterinburg: Ural University Press. 308 p.

among the levels of the budget system). The results obtained form a well-founded basis for developing a set of measures to optimize the functioning of the budget system, aimed at strengthening the role of the budget as an instrument for achieving the strategic goals of the state's socio-economic development[5] (Blanchard, Perotti, 2002).

Currently, however, the economic situation in Russia remains extremely tense. As researchers from the Research Association of Plekhanov Russian University of Economics note, preliminary GDP estimates for 2025 point to a sharp slowdown in the Russian economy (Lykova, Bukina, 2026). GDP grew by only 1.0% (compared to 4.9% in 2024), and industrial production by 1.3% relative to 2024. The impact of foreign trade and financial sanctions continues to have a negative effect on freight turnover, which has been declining year on year. Investment activity by organizations has practically ground to a halt.

Within the framework of strategic planning of fiscal policy for 2025, restoring the structural balance of the federal budget was declared a priority task. However, as a study by the Center for Macroeconomic Analysis and Short-Term Forecasting (CMASF) showed, the actual budget execution and the scenario plans for 2026 significantly diverged from the original parameters: a deficit of 1.6% of GDP was forecast[6]. This is due to the slowdown in economic growth relative to forecast estimates; the growth of expenditure commitments driven by the need to finance anti-crisis and social programs; the increase in the Central Bank's key interest rate; and other factors.

According to the Ministry of Economic Development, GDP in January 2026 contracted by 2.1% year-on-year, after growing by 1.9% in December[7]. In this connection, as I.S.Bukina notes, the macroeconomic effect of fiscal policy should be expected to weaken in 2026. Against the backdrop of the need for tightening, the forced restructuring of the federal budget's revenue side is continuing (Bukina, 2025). Analytical materials dealing with trends in Russia's fiscal sphere state the fact of a decline in mineral extraction tax (MET) revenues on hydrocarbon raw materials against the backdrop of falling oil prices amid the ruble's strengthening against the US dollar (Lykova, Bukina, 2026). This led to a colossal drop in revenues from taxes, levies, and payments for the use of natural resources to the consolidated budget of the Russian Federation in 2025. The decline in oil and gas revenues was planned to be offset by "non-oil-and-gas" revenues through raising the tax burden on profits, the standard VAT rate, and so on. In reality, however, corporate profit tax revenues fell. The most significant losses occurred in the Komi Republic (49.5% of the 2024 revenue level), the Orenburg Region (59.7%), and the Yamal-Nenets Autonomous Area (60.6%). At the same time, it is important to note that in 17 constituent entities of the Russian Federation where corporate profit tax revenue losses exceeded 20%, the increase in personal income tax revenues did not compensate for them (Lykova, Bukina, 2026). This situation, against the backdrop of slowing economic growth and declining entrepreneurial activity, creates additional risks.

[5] Sudakova A.E., Agarkov G.A., Tarasyev A.A. (2019). Budget Planning and Forecasting: A Textbook. Yekaterinburg: Ural University Press. 308 p.

[6] Ablaev E.Yu. (2025). On the draft federal budget for 2026–2028. Center for Macroeconomic Analysis and Short-Term Forecasting. Available at: http://www.forecast.ru/_Archive/analitics/Ablaev/bud20262028.pdf

[7] Gadzhieva M. (2026). Stagnation on the doorstep: Russia's economy finds itself one step away from stagflation. Available at: https://iz.ru/2054885/milana-gadzhieva/zastoi-na-poroge-ekonomika-rf-okazalas-v-odnom-shage-ot-stagfliatcii

According to CMASF, the implementation of a tight financial policy accompanied by tax changes and high interest rates may increase the risk of prolonged stagnation[8]. At the same time, the strengthening of the ruble helps to curb inflation but simultaneously weakens incentives for investment and limits the economy's long-term growth potential.

The Central Bank considers the stagflation scenario unlikely: the economy will grow, with GDP possibly increasing by 0.5–1.5% in 2026, and by 1.5–2.5% annually in 2027 and beyond. Meanwhile, sustainable inflation, according to the Bank of Russia's estimate, will settle at around 4% as early as the second half of 2026[9].

The state of the regional budget system depends to a large extent on corporate profit tax revenues, including those from manufacturing enterprises. At the same time, this sector is dependent on global market conditions. The Vologda Region is one of the subjects where fluctuations in the profits of metallurgical and chemical corporations are substantially reflected in the state of regional finances. The region, as one of the single-industry territories where ferrous metallurgy and the chemical industry account for up to 70% of industrial production and, correspondingly, their share in tax revenues reaches up to 70% of the budget's revenue side, demonstrates vulnerability to external shocks. In 2020, tax revenues fell to 73.6 billion rubles due to the pandemic, while by 2021 they had sharply risen to 120.3 billion rubles thanks to the temporary recovery of the metallurgical and chemical industries (Borodulin, Malyshev, 2025). By 2024, however, growth rates had slowed to 6.5%, indicating the exhaustion of short-term stimuli and the intensification of structural imbalances.

The structural vulnerability of the Vologda Region's economy is manifested in the dominance of raw material sectors (on average over 2020–2023, ferrous metallurgy accounted for up to 51.2% of industrial output, and the chemical industry for up to 20.7%), whose dynamics directly depend on fluctuations in world prices and logistical constraints (Borodulin, Malyshev, 2025). In addition, as noted in a CMASF report, the Vologda Region was the only region to experience a decline in personal income tax (PIT) revenues in 2025[10].

These circumstances have a significant impact on budget execution and its planning for 2026–2028. Under economic crises, the functional capabilities of the budget system at all levels (federal, regional, and municipal) are substantially constrained. This translates into a shrinking revenue base, widening deficits, forced cuts in social spending, and a reduced capacity to implement strategic objectives for the socio-economic development of territories.

In this context, it is pertinent to analyze the current state of the regional budget and the parameters being set for the upcoming period.

Key parameters of the current state of the regional budget

Within economic theory, government budget revenues are viewed as the financial basis for fulfilling the state's tasks. From an institutional perspective, they represent the result of distributive economic relations that arise between the state, on the one hand, and enterprises, organizations of various forms of ownership, public-sector institutions, and individuals as taxpayers and payers of other mandatory charges, on the other[11].

[8] Ablaev E.Yu. (2025). On the draft federal budget for 2026–2028. Center for Macroeconomic Analysis and Short-Term Forecasting. Available at: http://www.forecast.ru/_Archive/analitics/Ablaev/bud20262028.pdf

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[10] Ablaev E.Yu. (2025). On the draft federal budget for 2026–2028. Center for Macroeconomic Analysis and Short-Term Forecasting. Available at: http://www.forecast.ru/_Archive/analitics/Ablaev/bud20262028.pdf

[11] Polyak G.B., Pilipenko O.I., Eriashvili N.D. (2017). Finance: A Textbook for University Students Studying Economics, Specializing in "Finance and Credit". Moscow: UNITY-DANA. 735 p.

The increasingly complex situation in the national economy could not but affect the execution of the budgets of Russia's constituent entities in 2025. At the same time, as S.I. Shabelnikova noted, the parameters for balancing regional budgets over the upcoming three-year period have been determined by taking into account the growth of the territories' own revenues and the continued provision of financial support from the federal budget for fulfilling the tasks of achieving national development goals (Shabelnikova, 2025).

However, as of 2025, the total revenues of the Vologda Region's budget amounted to 129.8 billion rubles *(Tab. 1)*, representing a 9.4% decline in total receipts compared to 2024, while the budget's own revenues fell by 10.7% relative to the 2024 level. One of the main reasons for this situation was the economic slowdown. As a result, corporate profit levels were low, leading to a decline in corporate profit tax receipts[12].

It is also worth noting that, at the end of 2025, the initially planned targets for own-revenue receipts, as set out in Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027"[13], were not achieved. The budget version for 2025–2027 had projected 138.5 billion rubles, which is 6.7% above the actually achieved level (129.8 billion rubles; *Fig. 1*). The decline in budget revenues was driven by significant losses in corporate profit tax receipts, which were mainly linked to falling revenues at metallurgical enterprises. In addition, as mentioned earlier, there was a slight decline in PIT revenues.

The expenditure side of the budget reflects the capacity of territories to foster economic and social development, maintain national security, deliver public services, and meet the needs of society. In economic theory, expenditures are understood as a system of institutionally established economic relations that take shape as the state's budget system functions – encompassing the accumulation, distribution, and targeted use of financial resources[14]. Up to 2025, budget spending had been trending upward year after year, driving an increase in

Table 1. Key parameters of the current state of the Vologda Region's budget, billion rubles

Parameter	2021	2022	2023	2024	2025	2025 to 2021, %	2025 to 2024, %
Total revenues	142.6	132.0	145.0	142.7	129.8	91.0	91.0
including tax and non-tax revenues	111.2	102.8	121.8	123.3	110.1	99.0	89.3
gratuitous receipts	31.4	29.2	23.2	19.4	19.7	62.7	101.5
Expenditures	109.4	123.2	137.3	173.4	168.3	153.8	97.1
Deficit (-) / Surplus (+)	33.2	8.8	7.7	-30.7	-38.5	+71.7 billion rubles	+7.8 billion rubles
Compiled from: Federal Treasury of Russia. Available at: https://roskazna.gov.ru/ispolnenie-byudzhetov/konsolidirovannye-byudzhety-subektov/							

[12] Ablaev E.Yu. (2025). On the draft federal budget for 2026–2028. Center for Macroeconomic Analysis and Short-Term Forecasting. Available at: http://www.forecast.ru/_Archive/analitics/Ablaev/bud20262028.pdf

[13] Official internet portal of legal information of the Legislative Assembly of the Vologda Region. Available at: https://www.vologdazso.ru/actions/npa/laws/search.php?docid=TkRZM016QTRPVUUwVFc

[14] Polyak G.B., Pilipenko O.I., Eriashvili N.D. (2017). Finance: A Textbook for University Students Studying Economics, Specializing in "Finance and Credit". Moscow: UNITY-DANA. 735 p.

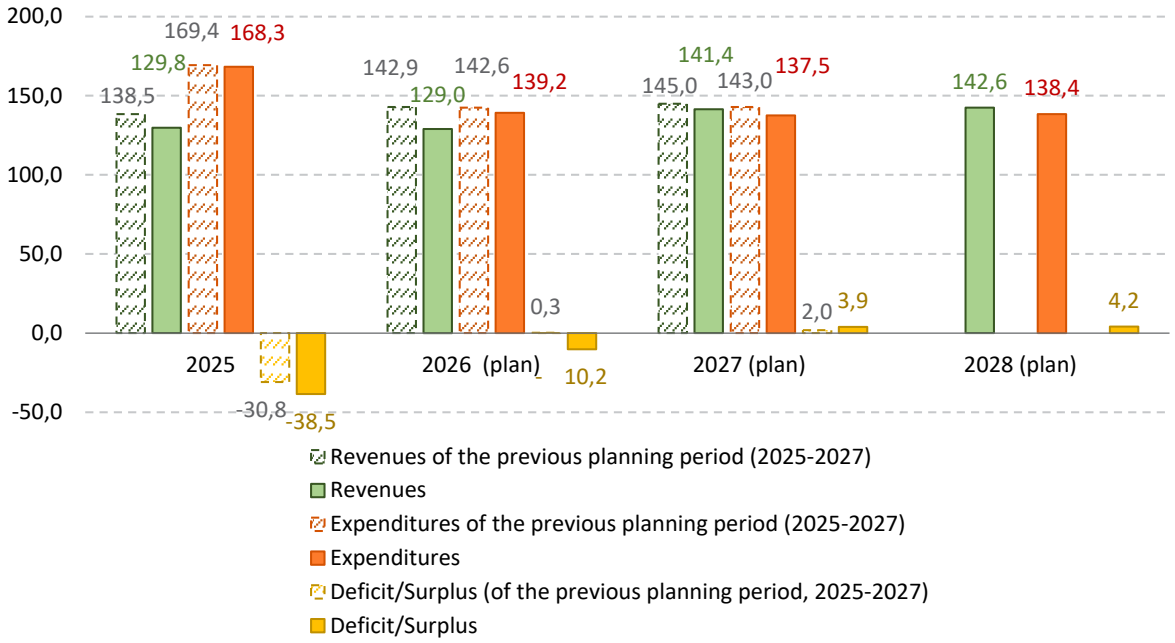

Figure 1. Key parameters of the Vologda Region's budget and their deviation from the previous year's parameters (2025–2027)

Note: revenues, expenditures, and deficit/surplus for 2025 represent actual budget execution.
Compiled from: data of the Federal Treasury of Russia; Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027"; Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028".

government borrowing. By the end of 2025, however, actual expenditures amounted to 168.3 billion rubles, which was 1.1 billion rubles below the level planned in the previous budget cycle and 2.9% lower than in 2024.

The budget deficit at the end of 2025 reached 38.5 billion rubles, whereas the deficit originally planned in the Vologda Region's budget for 2025 had been 30.8 billion rubles, further underscoring the persistence of the negative trend and the risks that accompany it.

Planned indicators of the Vologda Region's budget for 2026–2028

Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028", was drafted taking into account the following normative legal documents:

- Budget Code of the Russian Federation;
- Main Directions of Budgetary, Tax, and Customs-Tariff Policy of the Russian Federation;
- Main Directions of Budgetary, Tax, and Debt Policy of the Vologda Region;
- Agreements with the Ministry of Finance of the Russian Federation and the Federal Treasury on the provision of budget loans;
- Federal Law "On the Federal Budget for 2026 and the Planning Period of 2027 and 2028", and others.

In essence, the budget serves as the key source of financing for the measures set out in the Strategy for the Socio-Economic Development of the Vologda Region for the Period up to 2036[15], as well as for the region's state programs and national and regional projects. The 2026–2028 regional budget, which is built around a program-based expenditure

[15] On the Strategy for the Socio-Economic Development of the Vologda Region for the Period up to 2036: Resolution 194 of the Vologda Region Government of February 20, 2026. Available at: http://publication.pravo.gov.ru/document/3500202602200002

structure, envisages a transition to a new system for managing state programs – one designed to improve the goal-setting mechanism and align it more closely with the achievement of national development goals.

The budget parameters for 2026 and the 2027–2028 planning period rest on the baseline scenario of the region's socio-economic development forecast, which projects economic growth of 2.3% in 2026, 1.9% in 2027, and 2.7% in 2028[16].

The economy, however, is operating in an environment of unstable market conditions, escalating geopolitical tensions, sanctions pressure from Western countries, a high key interest rate set by the Central Bank of the Russian Federation, and persistent inflation. As a result, budget revenues are declining over the planning period under review. Specifically, total budget revenues for 2026 are projected at 129 billion rubles, while expenditures are expected to reach 139 billion rubles. The budget is planned to run a deficit.

At the same time, several positive trends in the upcoming budget cycle can be identified.

1. Maintaining the status of a region that does not receive equalization grants.

In the upcoming three-year period, just as in 2023–2025, no equalization grants for fiscal capacity are planned, which provides additional room for maneuver in implementing budget policy.

2. Efforts to ensure budget balance.

The Vologda Region Government has set a serious goal of reducing the budget deficit from 38.5 billion rubles in 2025 to 10.2 billion rubles in 2026, with a subsequent move into surplus in 2027–2028 (3.9 and 4.2 billion rubles, respectively; *Tab. 2*).

However, due to the deterioration of macroeconomic conditions, the initial trajectory of surplus budget execution (as set out in the 2024 version of the regional budget law) of 343.7 thousand rubles in 2026 was revised toward a deficit.

3. Strengthening the social orientation of the regional budget.

In the upcoming budget cycle, it is planned not only to maintain but also to reinforce the expenditure structure that has been in place for many years, with a dominant social orientation (60% of expenditures annually; *Tab. 3*).

In 2026, the following expenditures remain priorities in terms of budget financing: social policy (26.9%), education (22.7%), and the national economy (18.9%). These areas are consistent with the key socio-economic

Table 2. Changes in the budget balance envisaged in the Vologda Region's Budget for 2026–2028, relative to the planned indicators in 2025, billion rubles

Deficit (-) / Surplus (+)	2025	2026	2027	2028
Previous planning period (2025–2027)	-30.8	0.3	2.0	–
Current planning period (2026–2028)	–	-10.2	3.9	4.2
Deviation	+7.7*▼	+10.5▼	+1.9▼	–

* In 2025, the budget was executed with a deficit of 38.5 billion rubles.
Compiled from: data of the Federal Treasury of Russia; Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027"; Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028".

[16] On the Forecast of the Socio-Economic Development of Vologda Region for the Medium-Term Period of 2026–2028: Resolution 1484 of the Vologda Region Government of October 31, 2025. Available at: http://publication.pravo.gov.ru/document/3500202510310002

Table 3. Structure of regional budget expenditures, %

Expenditure category	2021	2022	2023	2024	2025	Plan		
						2026	2027	2028
Social sphere, including:	61.4	60.0	55.8	52.2	57.9	60.6	60.4	60.0
social policy	**27.0**	**26.1**	**23.4**	**20.2**	**24.0**	**26.9**	**26.8**	**27.8**
education	**19.8**	**20.3**	**20.5**	**20.5**	**20.2**	**22.7**	**22.7**	**20.2**
healthcare	11.7	9.6	8.7	8.3	9.7	7.3	8.0	8.0
culture, cinematography	1.3	1.6	1.6	1.7	2.3	2.8	2.6	3.7
physical education and sport	1.7	2.4	1.6	1.6	1.7	0.9	0.4	0.4
National economy	**25.1**	**25.5**	**27.3**	**27.1**	**21.9**	**18.9**	**21.7**	**20.2**
Intergovernmental transfers	5.2	5.9	6.3	7.2	2.1	7.0	3.5	2.6
General government issues	3.6	3.4	3.5	8.5	3.9	5.8	5.6	5.3
Housing and utilities	2.8	3.2	5.1	4.1	7.1	4.6	4.8	5.6

Compiled from: data of the Federal Treasury of Russia; Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028".

development priorities of the region, as set out in the Strategy for the Socio-Economic Development of the Vologda Region for the Period up to 2036[17].

At the same time, the decline in spending across key areas of the regional budget has been driven by falling revenues at both the federal and regional levels against a backdrop of difficult macroeconomic conditions. As specialists from CMASF note in their analytical review of the parameters and priorities of budget policy for 2026–2028, "given the transformation of both the economy and the budget system, accompanied by a drop in resource revenues, restructuring the budget revenue base has become an objective necessity"[18].

The planned volume of budget expenditures has also shifted somewhat compared to the previous period *(Tab. 4)*. Overall, total spending in the Vologda Region's budget system has been scaled back slightly relative to earlier plans. The deepest cuts are in social policy, education, healthcare, and intergovernmental transfers to municipalities. Meanwhile, expenditures on housing and utilities, the national economy, general government functions, culture, and cinematography have been raised significantly.

It is planned to reduce intergovernmental transfers within the expenditure structure. This is undoubtedly linked to the ongoing municipal reform and the decrease in the number of municipal entities. The emerging situation can be assessed positively, on the one hand, because the concentration of limited financial resources allows them to be spent more optimally. On the other hand, however, it leads to a diminished role for local self-government in addressing the concerns of the local population.

[17] On the Strategy for the Socio-Economic Development of Vologda Region for the Period up to 2036: Resolution 194 of the Vologda Region Government of February 20, 2026.

[18] Ablaev E.Yu. (2025). On the draft federal budget for 2026–2028. Center for Macroeconomic Analysis and Short-Term Forecasting. Available at: http://www.forecast.ru/_Archive/analitics/Ablaev/bud20262028.pdf

Table 4. Changes in the structure of regional budget expenditures envisaged in the budget for 2026–2028, compared with the previous parameters for 2025–2027, %**

Expenditure category	2025	2026	2027	2028
Social sphere, including: *Deviation from the previous planning period*	57.9 *-0.6*	60.6 *-3.5*	60.4 *-3.2*	60.0 –
social policy *Deviation from the previous planning period*	**24.0** *-0.9*	**26,9** *-2.7*	**26.8** *-3.5*	**27.8** –
education *Deviation from the previous planning period*	**20.2** *-0.7*	**22.7** *-0.5*	**22.7** *-0.3*	**20.2** –
healthcare *Deviation from the previous planning period*	9.7 *-0.2*	7.3 *-1.4*	8.0 *-0.5*	8.0 –
culture, cinematography *Deviation from the previous planning period*	2.3 *+0.4*	2.8 *+1.2*	2.6 *+1.7*	3.7 –
physical culture and sports *Deviation from the previous planning period*	1.7 *+0.4*	0.9 *0.0*	0.4 *-0.5*	0.4 –
National economy *Deviation from the previous planning period*	**21.9** *0.0*	**18.9** *+2.9*	**21.7** *+5.5*	**20.2** –
Intergovernmental transfers *Deviation from the previous planning period*	2.1 *-5.1*	7.0 *-0.7*	3.5 *-4.1*	2.6 –
General government issues *Deviation from the previous planning period*	3.9 *-0.9*	5.8 *+0.4*	5.6 *+0.1*	5.3 –
Housing and utilities *Deviation from the previous planning period*	7.1 *+1.4*	4.6 *+1.9*	4.8 *+4.1*	5.6 –
Compiled from: data of the Federal Treasury of Russia; Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027"; Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028".				

4. Increasing the coverage of expenditure commitments from own revenue sources.

According to Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028", the growth in the volume of expenditures in 2027–2028 will be supported by the region's own revenue sources. Whereas in 2025 own revenues covered 65.4% of budget expenditures, in 2026 this indicator is projected to rise to 78.5%, with further growth to 91.0% by 2028 *(Fig. 2)*.

Covering expenditure commitments from own revenue sources depends not only on achieving planned revenue targets but also on the availability of mechanisms for maintaining socio-economic stability[19]. It is worth noting that no substantial changes in the volume of current budget expenditures, in contrast to what was built into Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027", are envisaged. However, the budget's own revenues have been reduced relative to the previous figures: 109.4 billion rubles against the initially planned 120.9 billion rubles in 2026, and 119.9 against 126.3 billion rubles in 2027. Accordingly, a slight decline is observed in the degree to which the Vologda Region's expenditure commitments are covered from its own revenue sources, along with a deviation from the previous year's parameters. Should these parameters be achieved under favorable external conditions, the level of covering expenditure commitments with own revenues (88.7%) will match the 2023 level, but will not reach the full coverage of expenditure commitments from own revenue sources observed in 2021 (101.6%).

[19] Ablaev E.Yu. (2025). On the draft federal budget for 2026–2028. Center for Macroeconomic Analysis and Short-Term Forecasting. Available at: http://www.forecast.ru/_Archive/analitics/Ablaev/bud20262028.pdf

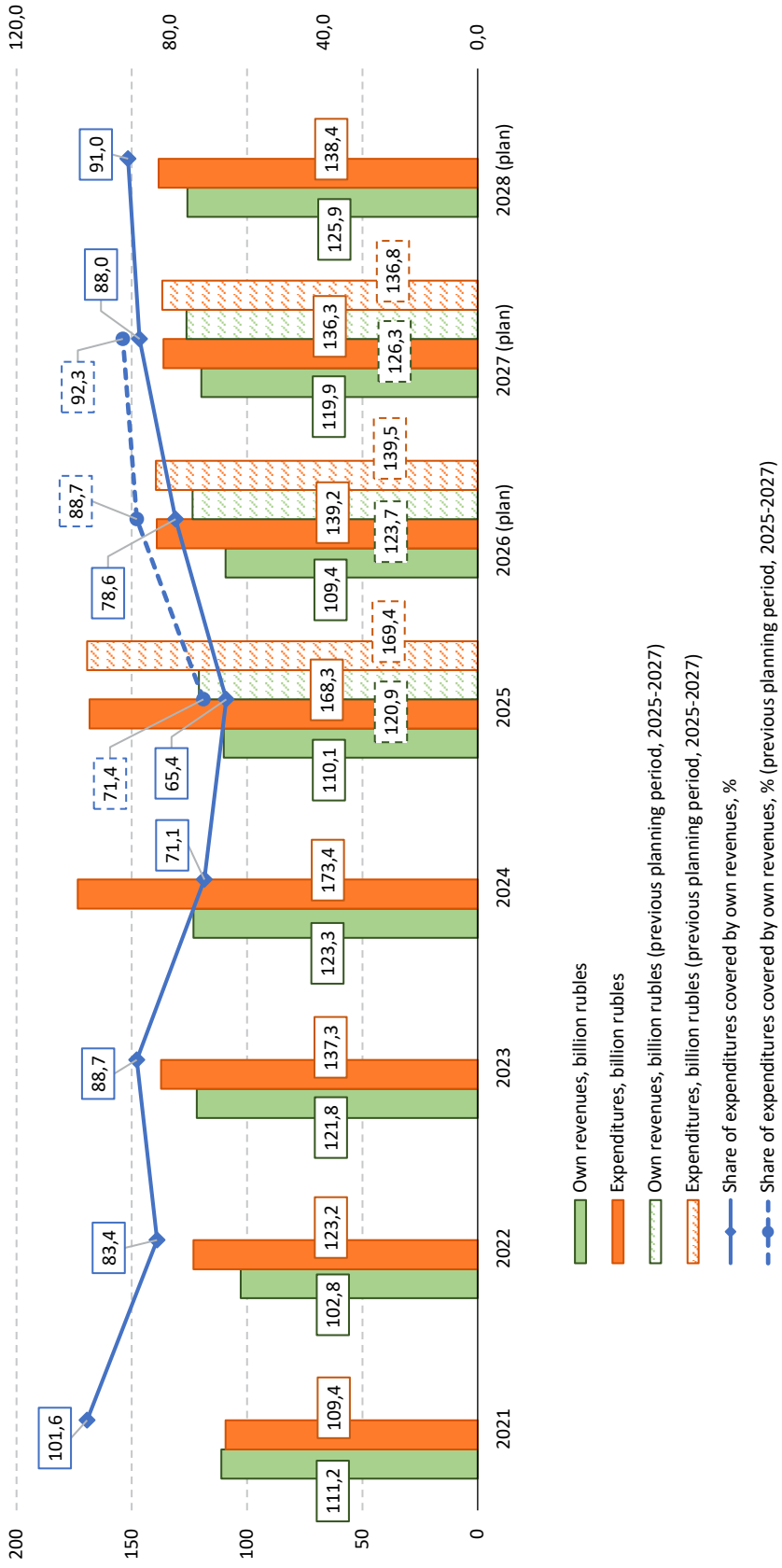

Figure 2. Degree of coverage of expenditure commitments from the Vologda Region's own revenue sources and deviation from the previous year's parameters (2025–2027)

Compiled from: data of the Federal Treasury of Russia; Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027"; Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028".

Despite the planned improvement in balance, the region's budget system remains vulnerable, which mirrors the situation in the country as a whole. Thus, given the challenges facing the country, and the need to combine budget consolidation with the continued financing of key national projects, a gap persists between the revenue base and the commitments that have been undertaken[20].

Thus, the reviewed Regional Budget Law for 2026–2028 is associated with a number of negative aspects and risks.

1. Decline in the regional budget's own revenues.

The drop in the Vologda Region's own budget revenues by 10.8 billion rubles in 2025 (from the originally planned 120.9 billion rubles to 110.1 billion rubles) is linked, first and foremost, to falling profits in the metallurgical sector due to unfavorable macroeconomic conditions and low prices on the global metals market. In 2026, a further decline in own revenues to 109.4 billion rubles is projected, and, as a consequence, a budget deficit (-10.2 billion rubles).

2. Cuts in financing of key areas of the Vologda Region's socio-economic development from the regional budget.

The deteriorating economic situation and the budget deficit that has formed entail a reduction in spending not only on the economy but also on the social sphere. In particular, spending on education in 2026 will amount to only 92.9% of the 2025 estimate; on healthcare – 62.8%; and on physical education and sport – 48.3% *(Tab. 5)*.

Table 5. Changes in the volume of financing of key areas of Vologda Region's socio-economic development from the regional budget, % of the previous year

Expenditure category	2022	2023	2024	2025	Plan		
					2026	2027	2028
Social policy	109.1	100.0	105.4	115.4	92.3	98.1	105.5
Deviation from the previous planning period					*-10.7*	*-2.5*	–
Education	115.5	112.2	126.3	95.8	92.9	97.8	90.6
Deviation from the previous planning period					*+1.8*	*-0.9*	–
Healthcare	92.4	100.9	121.0	113.1	62.8	105.8	100.9
Deviation from the previous planning period					*-9.6*	*+10.1*	–
Culture, cinematography	140.6	114.0	59.2	126.7	97.4	97.4	145.9
Deviation from the previous planning period					*+28.3*	*+39.8*	–
Physical culture and sports	161.2	74.0	77.8	103.6	48.3	35.7	100.0
Deviation from the previous planning period					*-6.0*	*-28.7*	–
National economy	114.2	119.2	113.8	78.3	73.9	112.5	94.1
Deviation from the previous planning period					*+0.4*	*+12.3*	–
General government issues	107.1	112.9	68.9	91.5	110.8	72.2	130.8
Deviation from the previous planning period					*+18.5*	*-27.5*	–
Housing and utilities	128.0	181.8	121.6	96.0	76.5	68.1	59.7
Deviation from the previous planning period					*+37.4*	*-29.5*	–
Compiled from: data of the Federal Treasury of Russia; Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027"; Vologda Region Law No. 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028."*							

[20] Ablaev E.Yu. (2025). On the draft federal budget for 2026–2028. Center for Macroeconomic Analysis and Short-Term Forecasting. Available at: http://www.forecast.ru/_Archive/analitics/Ablaev/bud20262028.pdf

It is worth noting that, in contrast to the initially planned reduction in spending on these items in the previous period (Vologda Region Law 5789-OZ of December 19, 2024), in the upcoming budget cycle the pace of their decline is even more substantial. The change in the situation regarding the financing of physical education and sport, general government issues, and the housing and utilities sector in 2027, compared with the previously planned figures, is especially critical. At the same time, higher growth rates are observed in 2026–2027 in the volume of financing for culture and cinematography, and the national economy, in contrast to what was built into Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027".

We should note the negative trend being built into expenditures on economic development: spending on the national economy in 2026 will amount to only 73.9% of 2025 spending; and on housing and utilities – 76.5%.

The reduction in spending on the national economy is especially acute in the agro-industrial complex: in 2027–2028, no support is envisaged for meat production, marketable fish, elite seed production, or selective breeding activities in pedigree livestock farming *(Tab. 6)*. At the same time, it is important to note that financing for these activities had previously been built into the budget for 2027, in accordance with Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027".

Table 6. Changes in the volume of financing of selected regional projects in the agro-industrial complex of the Vologda Region

Project name, selected expenditure items	2026		2027		2028 Current plan
	Current plan	*Previous plan*	Current plan	*Previous plan*	
Regional project "Development of Sectors and Technical Modernization of the Agro-Industrial Complex," million rubles, including:	**3107.2**	*2 584.1*	**742.0**	*2 505.6*	**912.7**
– support for meat production	**111.3**	*256.5*	**0**	*256.5*	**0**
– support for protected-ground production	**50.5**	*45.3*	**0**	*45.3*	**0**
– support for marketable fish production	**17.4**	*15.9*	**0**	*15.9*	**0**
– support for elite seed production	**4.2**	*4.9*	**0**	*5.4*	**0**
– support for selective breeding activities in pedigree livestock farming	**135.0**	*203.2*	**0**	*222.3*	**0**
– support for milk production	**1488.5**	*552.2*	**105.4**	*604.0*	**35.0**
Regional project "Improvement of Rural Areas," million rubles, including:	**12.5**	*0.0*	**0**	*0.0*	**0**
– implementation of measures for the improvement of rural areas	**12.5**	*0.0*	**0**	*0.0*	**0**
Regional project "Modern Image of Rural Areas"	**341.5**	*555.1*	**40.8**	*434.9*	**24.6**
– ensuring the integrated development of rural areas (agglomerations), excluding construction or reconstruction projects	**49.0**	*555.1*	**0**	*434.9*	**0**

Compiled from: data of the Federal Treasury of Russia; Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027"; Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028".

A similar situation is developing with regard to the regional project "Modern Image of Rural Areas": the total amount of its support has been cut more than tenfold. Expenditures on ensuring the integrated development of rural areas (agglomerations), excluding construction or reconstruction projects, are not provided for at all. In addition, starting from 2027, the financing of the regional project "Improvement of Rural Areas" is set to be halted entirely.

3. Growth of the state debt.

The region's state debt in 2025 amounted to 19.0 billion rubles. At the same time, the volume of borrowing decreased by 2.5 billion rubles compared to 2024 and consisted exclusively of budget loans. The draft regional budget for 2026–2028 envisages an increase in the volume of state debt from 19.0 billion rubles in 2025 to 22.1 billion rubles in 2026, which corresponds to 20.2% of the regional budget's tax and non-tax revenues. In 2026, the debt burden will increase from 14.2 to 20.2%, or by 6 p.p. *(Fig. 3)*. Although the value of this parameter is considered moderate under the fiscal rule, should the state debt increase further, this will threaten the region's financial stability.

It is worth noting that there are substantial changes in the volume of state debt in the adopted budget, in contrast to what was built into Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027". Its volume increased to 22.1 billion rubles, against the originally planned 17.7 billion rubles in 2026, and to 19.9 against 16.4 billion rubles in 2027. Moreover, the planned figure of 22.1 billion rubles is the highest in the last five years.

We should point out that the Vologda Region's budget adopted for the upcoming period has also radically changed the composition of the state debt. Thus, budget loans will now constitute only a portion of the total volume of debt obligations: 48.4%, or 10.7 billion rubles, in 2026; 58.3%, or 11.6 billion rubles, in 2027; and 70.3%, or 11.8 billion rubles, in 2028 (prior to 2026, the state debt had consisted exclusively of budget loans).

4. Use of commercial credit and, as a consequence, growth of the debt burden and debt service obligations.

The main aspects of the Vologda Region's budget policy with respect to the formation of state debt have long been based on the principle of refraining from using expensive debt instruments. Budget loans, which the region coordinated with the Ministry of Finance of the Russian Federation, were employed predominantly. However, the draft regional budget for 2026–2028 envisages the use of

Table 7. Parameters of the volume and composition of the state debt envisaged in the Vologda Region's budget for 2026–2028

Parameter	2026	2027	2028
State debt, billion rubles	22.1	19.9	16.8
including: **commercial credit, billion rubles**	**10.9**	**7.9**	**4.9**
treasury bonds, billion rubles	0.5	0.4	0.1
budget loans, billion rubles	10.7	11.6	11.8
State debt net of commercial credit, billion rubles	11.2	12	11.9
Projected average annual key interest rate, %	13.0–15.0	7.5–8.5	7.5–8.5
Compiled from: Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028"; Key Parameters of the Bank of Russia's Forecast under the Baseline Scenario. Available at: https://www.consultant.ru/document/cons_doc_LAW_517388/2b8d32b009eba7feba6045274900cd2cc7ef082d/			

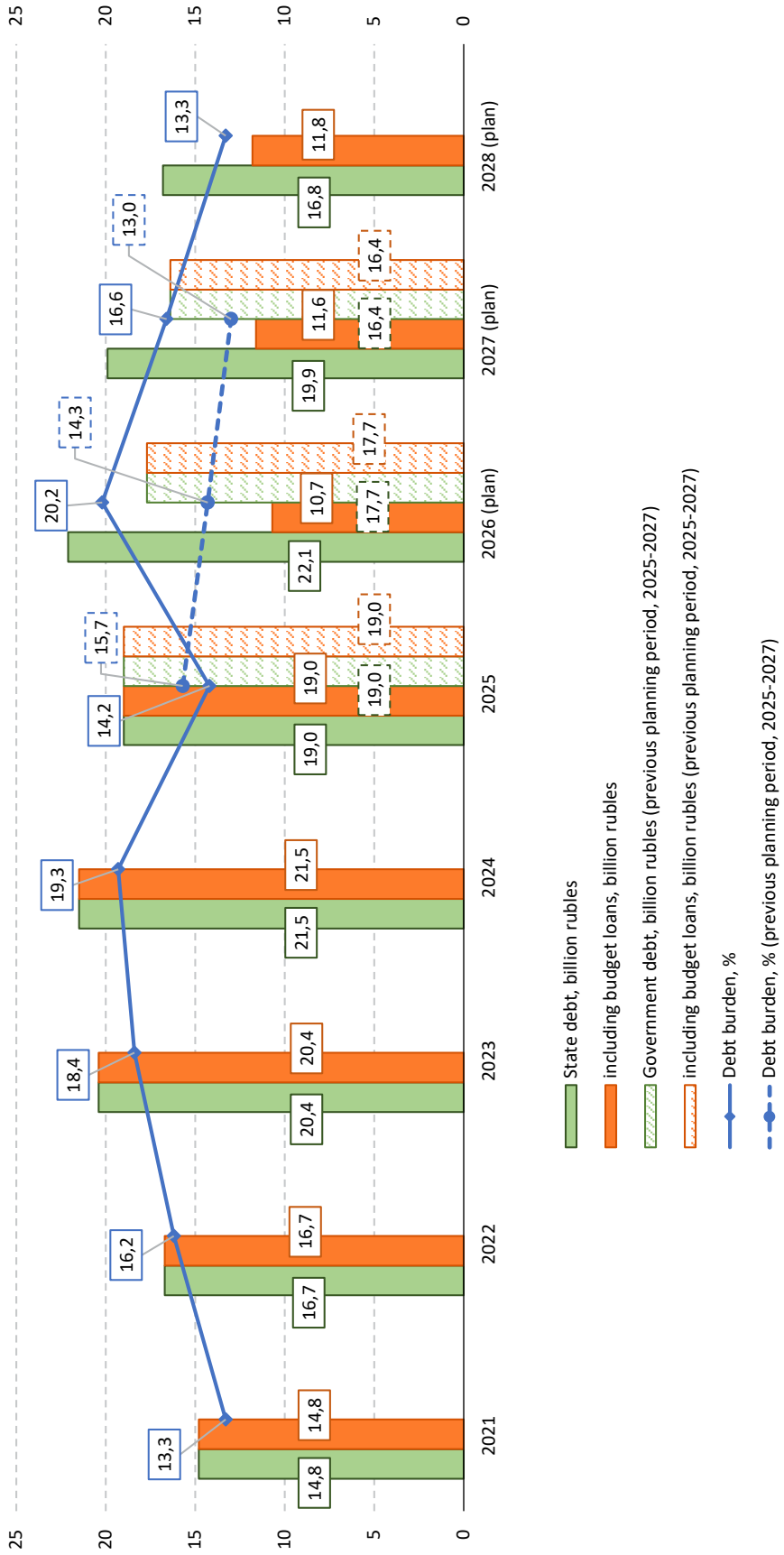

Figure 3. Volume of the state debt in the Vologda Region and deviation from the previous year's parameters (2025–2027)

Compiled from: data of the Federal Treasury of Russia; Vologda Region Law 5789-OZ of December 19, 2024, "On the Regional Budget for 2025 and the Planning Period of 2026 and 2027"; Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028".

commercial credit, whose share in the total volume of debt obligations is substantial: in 2026, commercial credit of 10.9 billion rubles is planned; in 2027, a decrease of 3.0 billion rubles, i.e., to 7.9 billion rubles; in 2028, a further decrease of 3.0 billion rubles is also planned, i.e., to 4.9 billion rubles *(Tab. 7)*.

The draft regional law justifies that these measures are necessary to cover cash gaps. However, this raises serious concerns, given the fact that the key interest rate projected by the Central Bank of the Russian Federation for 2026 will stand at 13–15%.

5. Withdrawal of financing from research and development (R&D) work.

Achieving technological leadership is currently one of the strategic national goals of the Russian Federation. According to research, countries with high R&D spending demonstrate higher rates of economic growth and better resilience to crises. In this connection, R&D funding in Russia is planned to be increased to 3% of GDP (at present, these expenditures do not exceed 1% of GDP). The share of domestic spending on research and development in the Vologda Region in 2023 was only 0.12% of GRP, which is one of the lowest values of this indicator among the subjects of the Northwestern Federal District.

The Development Strategy of the Vologda Region to 2030 had envisaged an increase in the growth rate of domestic spending on research and development from 2.98% in 2015 to 6.0% in 2030[21]. The new Strategy for the Socio-Economic Development of the Vologda Region for the Period up to 2036[22] plans to increase domestic spending on research and development from 0.11% of the gross regional product in 2023 to 0.2% of the gross regional product by 2030.

At the same time, the budget for 2026–2028 includes no support for performing R&D work. In 2025, however, expenditures on supporting R&D activities amounted to 24.2 million rubles. In the upcoming budget cycle, only support for laureates of the State Prizes and the State Youth Prize of the Vologda Region in Science and Technology is envisaged, in the amount of 730.0 thousand rubles annually *(Tab. 8)*. It is worth noting that, overall, a yearly reduction in funding for the program "Investment Attractiveness, Industry, and Science" is planned, from 897 million rubles in 2026 to 827 million rubles in 2028, or by 7.8%. This is substantially below the level of spending on its implementation in 2025, when 1,428 million rubles were channeled into the program, which is 531 million rubles, or 37.2%, less than the planned volume in 2026 (897 million rubles).

This creates a risk that the targets for introducing advanced technologies, enhancing the innovativeness of the economy, and attracting young people to the research and development sphere will not be met. It should be noted that the index of scientific and technological potential of the Vologda Region[23], calculated by VolRC RAS staff, stands at an extremely low level. The region is experiencing a significant reduction in the number of researchers, including graduate and doctoral students.

[21] On the Strategy for the Socio-Economic Development of Vologda Region for the Period up to 2030: Resolution of the Government of the Vologda Region on Amendments to Resolution of the Regional Government No. 920 of October 17, 2016, No. 1223 of October 30, 2023. Available at: http://publication.pravo.gov.ru/document/3500202311010018

[22] On the Strategy for the Socio-Economic Development of the Vologda Region for the Period up to 2036: Resolution 194 of the Vologda Region Government of February 20, 2026. Available at: http://publication.pravo.gov.ru/document/3500202602200002

[23] Scientific and Technological Potential of the Regions of the Russian Federation. 2010–2023: Status, Dynamics, Problems (2025). Information-Analytical Bulletin, Issue 1. Team of authors under the scientific supervision of V.A. Ilyin and T.V. Uskova. Vologda: VolRC RAS. 90 p.

Table 8. Volume of financial support for the program "Investment Attractiveness, Industry, and Science" and its structural components, thousand rubles

Name of the program's structural component	2026	2027	2028
Total, including	897459.4*	891396.4	827396.4
support for performing R&D work	0.0**	0.0	0.0
support for laureates of the State Prizes of the Vologda Region in Science and Technology and the State Youth Prize of the Vologda Region in Science and Technology	730.0	730.0	730.0
provision for the creation of infrastructure facilities for the special economic zone	817833. 9	817833. 9	817833. 9
implementation of measures to provide financial support to industrial enterprises	41213.7	0.0	0.0
support for entities in the industrial sector to cover part of the initial payment (advance) costs when signing equipment leasing agreements with Russian leasing organizations	8242.6	0.0	0.0
support for entities in the industrial sector for the acquisition of new equipment	20606.7	0.0	0.0
Compiled from: Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028".			

6. Declining role of corporate profit tax as the main source of regional budget financing.

Starting in 2026, the personal income tax (PIT) becomes the key source of financing for the regional budget (35.3% of own revenues; *Tab. 9*). In particular, PIT revenues are projected at 38.8 billion rubles (35.5% of own revenues) in 2026, 41.5 billion rubles (34.6% of own revenues) in 2027, and 44.3 billion rubles (35.2% of own revenues) in 2028. On the one hand, this points to a rise in household income levels. On the other hand, however, the decline in corporate profit tax revenues indicates that negative trends in the economy are becoming more entrenched.

Similar trends in the changing structure of the budget's revenue items are also observed at the Russian level. In particular, specialists from the Center for Macroeconomic Analysis and Short-Term Forecasting note that the transformation processes taking place in the budget system

Table 9. Changes in the volume of personal income tax (PIT) and corporate profit tax revenues to the regional budget for 2026–2028, compared with the previous parameters

Parameter	2023	2024	2025	Project		
				2026	2027	2028
PIT revenues, billion rubles	24.1	37.0	35.1	38.8	41.5	44.3
Deviation from the previous planning period				*+4.3*	*+4.3*	–
% of own revenues	19.8	30.0	31.9	35.5	34.6	35.2
Deviation from the previous planning period				*+7.5*	*+5.2*	–
Corporate profit tax revenues, billion rubles	53.5	36.4	29.6	28.1	34.3	35.5
Deviation from the previous planning period				*-16.6*	*-10.2*	–
% of own revenues	44.0	29.5	26.9	25.7	28.6	28.2
Deviation from the previous planning period				*-2.8*	*-0.8*	–
Compiled from: data of the Federal Treasury of Russia; Vologda Region Law 6046-OZ of December 16, 2025, "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028".						

have been prompted by an objective necessity due to the decline in resource revenues[24]. In this connection, the main instrument of fiscal policy in 2026–2028 will be aimed at increasing the tax burden on small and midsize enterprises, individual entrepreneurs, and households. However, this could serve as a factor for some enterprises to move into the shadow market or to cease operations. Therefore, ensuring budget sustainability depends not only on achieving planned revenue targets but also on maintaining conditions conducive to stimulating economic development, which forms the basis for the long-term balance of the budget system.

Conclusion

The conducted study has made it possible to substantiate that the systematic deviations of actual budget indicators from planned values, the growth of budget risks, and the decline in the efficiency of spending are predominantly determined by increasing macroeconomic uncertainty and the lag of the budget planning tools being employed behind the current challenges of the contemporary economic environment.

In this connection, within the framework of the prevailing macroeconomic conditions, the following main risks exist for the execution of the Vologda Region's budget in 2026. First, the slowing of global economic activity and the intensification of sanctions pressure, which will lead to a decline in demand for Russian exports and a reduction in imports. Second, the persistence of tight monetary policy will act as a factor reducing consumer and investment activity. Third, the shortage of qualified personnel may be a cause of the slowdown in the socio-economic, as well as scientific and technological, development of territories.

It has been established that Vologda Region Law "On the Regional Budget for 2026 and the Planning Period of 2027 and 2028" envisages the following trends:

– the maintenance of the status of a region that does not receive equalization grants and the social orientation of the budget;

– a planned improvement in budget sustainability (a projected move to a surplus budget execution in the amount of 3.9–4.2 billion rubles in 2027–2028);

– a reduction in the planned expenditures of the regional budget in 2026 by 29.1 billion rubles (from 173.4 to 139.2 billion rubles), in particular a decline in the budget's own spending on education, healthcare, and the national economy;

– an increase in the volume of state debt by 16.0% (from 19.0 billion rubles in 2025 to 22.1 billion rubles in 2026) and the inclusion of commercial credit as a form of ensuring budget balance against the backdrop of tight monetary policy;

– the absence of support for scientific research and experimental development work in the medium term against the backdrop of the region's low scientific and technological potential.

The comparison of the budget parameters planned for 2026–2028 with the previous period (2025–2027) has made it possible to demonstrate the substantial influence of the macroeconomic environment, sanctions restrictions, the decline in oil and gas revenues, and other factors. At the same time, despite the existing risks associated with the difficult economic situation, the strategic development objectives of the region must be fulfilled.

According to S.I. Shabelnikova, in order to achieve the planned parameters and the resilience of territorial economies under the conditions of economic recession and an increased burden on budgets, it is necessary to enhance the transparency and ensure real control over the spending of budget funds, in particular by making more active use of digital technologies in exercising the control function;

[24] Ablaev E.Yu. (2025). On the draft federal budget for 2026–2028. Center for Macroeconomic Analysis and Short-Term Forecasting. Available at: http://www.forecast.ru/_Archive/analitics/Ablaev/bud20262028.pdf

to improve the quality of planning indicators for the implementation of state programs, taking into account the previous year's results; to prioritize expenditures and eliminate unnecessary and ineffective spending, among other measures (Shabelnikova, 2025).

In the current year, budget risks will intensify against the backdrop of an increase in the VAT rate from 20 to 22%; the expansion of its tax base by lowering the income threshold for taxpayers of the single tax under the Simplified Taxation System (STS); the indexation of excise tax rates; and the elimination of some tax exemptions. In particular, the procedure for applying preferential rates of mandatory social insurance contributions has been tightened for IT companies; in the small and medium-sized business sector, reduced rates can now be used only by those entities that operate in priority sectors and meet certain conditions. Another change is associated with an increase in rates on a number of excisable goods: tobacco, alcohol, and alcohol-containing products, as well as sugar-sweetened beverages, automobiles, and motor gasoline (Lykova et al., 2026). In addition, starting from 2026, the tax on gambling business becomes a federal tax (previously it was classified as a regional tax). Its legal regulation has been transferred to Chapter 25.5 "Tax on Gambling Business" of the Tax Code of the Russian Federation, in connection with which Chapter 29 of the Tax Code of the Russian Federation has been repealed. Its structure has also changed: not only gaming tables and machines are subject to taxation, but also the revenues from gambling of bookmakers' offices and totalizators. Serious changes await organizations and individual entrepreneurs who apply the Simplified Taxation System (STS): the income threshold at which taxpayers are exempted from paying VAT is being gradually lowered: in 2026 – to 20 million rubles, in 2027 – to 15 million rubles, and from 2028 – to 10 million rubles.

An assessment of the positive and negative aspects of these changes will become possible in the process of budget execution, which will allow for the empirical verification of their effectiveness.

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СОСТОЯНИЕ РЕГИОНАЛЬНОГО БЮДЖЕТА ВОЛОГОДСКОЙ ОБЛАСТИ В 2021–2025 ГГ. И БЮДЖЕТНЫЕ РИСКИ НА 2026–2028 ГГ.

На фоне сохраняющегося санкционного давления, замедления темпов роста экономики территорий, снижения инвестиционной активности предприятий, высокой ключевой ставки социально-экономическое развитие регионов продолжает зависеть от их способности адаптироваться к новым условиям, эффективно использовать имеющийся потенциал и привлекать ресурсы. При этом субъекты РФ обязаны в полном объеме выполнять социальные обязательства и обеспечивать достижение национальных целей. Главным источником выполнения функций, возложенных на органы государственной власти, выступает бюджет, являющийся ведущим звеном финансовой системы и крупнейшим фондом денежных средств. Согласно Бюджетному кодексу РФ, одним из принципов бюджетной системы является его самостоятельность, которая может быть достигнута при наличии у соответствующей территории собственных источников доходов. Однако проблема заключается в низкой доле собственных доходов в структуре бюджетов большинства субъектов РФ и их высокой зависимости от межбюджетных трансфертов из федерального центра. Кроме этого, многие регионы зависят от одной отрасли (сырьевой, аграрной и т.д.), что делает их бюджеты уязвимыми к колебаниям цен и макроэкономическим шокам. В результате существует высокий риск невозможности обеспечить точность и надежность бюджетного планирования из-за высокой волатильности макроэкономических параметров. Данные проблемы на национальном уровне находятся в фокусе внимания не только ученых, но и представителей исследовательских организаций. Однако на региональном уровне эти вопросы изучаются фрагментарно и недостаточно системно, что обусловлено ограниченностью исследовательских ресурсов и отсутствием специализированных центров. В связи с этим актуальным представляется изучение особенностей формирования и реализации бюджета на региональном уровне, что и определило цель исследования. Научная новизна заключается в комплексной оценке нового бюджетного цикла регионального бюджета (на примере Вологодской области) и сопоставлении его параметров с предыдущим плановым периодом 2025–2027 гг., а также определении влияния макроэкономических факторов на структуру доходов и расходов, долговую нагрузку и перспективы развития. Обосновано, что систематическое отклонение фактических бюджетных показателей от плановых, рост

бюджетных рисков и снижение эффективности расходования средств связаны с нарастающей макроэкономической неопределенностью и отставанием применяемых инструментов бюджетного планирования от современных вызовов. В заключительной части статьи отражены изменения в законодательстве о налогах и сборах, вступившие в силу в 2026 году, касающиеся НДС, УСН, льготных тарифов и др.

Бюджет, областной бюджет, основные направления бюджетной политики, государственный долг, дефицит/профицит, налоги, льготы, Вологодская область.

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TRANSFORMATION OF FINANCIAL BEHAVIOR AND INVESTMENT POTENTIAL OF HOUSEHOLDS IN THE REPUBLIC OF BASHKORTOSTAN IN 2021–2025

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The article is devoted to the results of a study of the patterns and characteristics of the financial behavior of households in the Republic of Bashkortostan under epidemiological and sanction restrictions. The prerequisite for conducting the study was the need to find out what changes in the financial behavior of households occurred under the influence of COVID and sanctions restrictions. The experience of other countries subject to sanctions (Iran, Venezuela) was analyzed, which made it possible to identify similarities and differences in changes in the financial behavior of households in these countries and Russia that occurred as a result of the introduction of restrictions. The research presented in the article is based on the results of a sociological surveys conducted by the Institute of Social and Economic Researches UFRC RAS on the territory of one of the largest regions of Russia in terms of population – the Republic of Bashkortostan in 2021, 2024 and 2025. Through surveys and subsequent analysis of their results, factors influencing the dynamics of the population's financial behavior were identified and tools for attracting

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household finance as an investment resource for supporting regional socioeconomic development were analyzed. It was found that the main factors negatively impacting the population's willingness to invest domestically include low income, a relatively high debt burden, and the lack of savings in bank deposits among the majority of respondents. The presence of a fairly significant investment potential among a portion of the population in the form of savings in credit institutions, which could potentially be directed to the investment, the development of stock instruments for attracting funds from individuals (individual investment accounts, bonds for the population, digital financial assets), crowdfunding, as well as the potential in the area of investment readiness to invest in programs of local initiatives, were identified as positive factors. Instability in household financial behavior dynamics was identified, manifested by a shift, influenced by external factors, from a savings strategy to a higher-risk investment strategy, followed by a return to the original strategy. Urban residents exhibit the highest elasticity in financial behavior. A set of proposals has been developed in the field of improving financial literacy in the Republic of Bashkortostan as a significant factor influencing the financial behavior of households.

Households, financial resources, credit load, financial behavior, financial literacy, savings, investments, sanctions.

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Introduction

One of the most important drivers of sustainable socio-economic development for regions navigating today's turbulent conditions – shaped by COVID-19, economic sanctions, and the special military operation – is the ability to tap into a territory's internal financial resources, including household funds. In this context, research into various aspects of household financial behavior has become especially relevant. The scholarly and practical significance of such research today stems, on the one hand, from the objectively existing inequality in the distribution of income and savings across different household groups and the associated possibility of deploying the financial resources at their disposal for territorial development. On the other hand, it arises from the need to identify additional investment resources and to improve the mechanism for channeling them into the capital market – one of the promising directions for shaping the state's financial and investment policy. These circumstances make it essential to identify and analyze the financial dimensions of household social sentiment. This sentiment serves as a foundation for shaping financial behavior, for households' perceptions of their own financial and investment capacity to participate in the development of the territory where they live, and for their responses to government measures aimed at encouraging their activity in the financial and investment sphere.

In 2020, owing to the restrictions imposed in economies around the world to curb the spread of COVID-19, a substantial decline in economic activity was observed, with output volumes and territorial economic performance contracting relative to the pre-pandemic period. In Russia as a whole, GDP fell by 2.7% in 2020 (in the Republic of Bashkortostan, by 5.8%) compared with the same indicator the previous year. By comparison, the decline was 3.5% in the United States, 4.9% in Germany, and 9.8% in the United Kingdom. After a recovery-driven expansion of

the Russian economy of 5.9% in 2021 (2.8% in Bashkortostan), the country's GDP contracted by 1.2% in 2022 as Western sanctions were imposed (Bashkortostan maintained growth of 1%). The relatively rapid adaptation to sanctions enabled Russia to return to a positive development trajectory in 2023–2024. Despite the epidemiological and sanctions-related constraints, the Russian economy grew by 10.3% over the period 2020–2024 relative to 2019 (by 8.3% in Bashkortostan; GDP growth is also projected for the country and the republic at the end of 2025). However, with the exception of 2023–2024, growth rates have remained below the global average (according to the World Bank, the world economy expanded by 13.2% over the period 2020–2024).

These economic processes have undoubtedly affected the dynamics of real household incomes. An analysis of Rosstat data shows that real disposable household income across the country as a whole declined by 1.4% in 2020 (by 4.5% in Bashkortostan). At the same time, the subsequent overall economic growth over the 2020–2024 period made it possible to raise citizens' incomes by 23.0% (by 7.8% in Bashkortostan), indicating a gradual recovery in the population's financial position and the return of the national economy to pre-pandemic levels. Nevertheless, two concurrent trends can be observed: the rise of fraudulent schemes that siphon funds from the public through digital technologies, and the persistence of sanctions restrictions. The lower growth rates of real household incomes in the Republic of Bashkortostan, compared with the national average, are due to the presence of a substantial share of rural residents in the republic's population structure (37.3% in 2024, versus 25.0% for the country as a whole), a group that has lower incomes.

Against this backdrop, research into various aspects of household financial behavior under present-day conditions has become increasingly relevant. This includes, among other things, improving financial literacy in the digital environment, analyzing changes in financial behavior models, and examining opportunities to boost investment activity and the contribution of citizens to the socio-economic development of territories.

One of the most promising sources for enhancing the level of financial and investment support for the socio-economic development of the country and its regions is the attraction of household financial resources. Given the multifaceted nature of the concept of household financial behavior, this article is devoted to examining its dimensions such as saving, credit, investment, and consumer behavior, as well as the financial literacy of the working-age population. Thus, the aim of the present study is to assess – through the application of sociological and economic methods of analysis – the transformation of the financial behavior of households that include working-age individuals, and their readiness to invest the financial resources at their disposal in the economy of the territory where they live, under the conditions of sanctions restrictions. To achieve this aim, the following objectives must be pursued:

– to analyze the structure and dynamics of expenditures and the level of credit burden of households in the Republic of Bashkortostan that include working-age individuals, broken down by type of economic activity;

– to assess whether such households have financial resources (savings) at their disposal and to identify changes in their saving behavior under sanctions conditions compared with the period of COVID-related restrictions;

– to investigate the level of financial literacy and investment readiness of households that include working-age individuals in the republic as a prerequisite for raising citizens' investment activity.

We have pursued the stated aim and research objectives through an analysis of an empirical base derived from a large-scale sociological study conducted in the Republic of Bashkortostan in three waves – the first wave in 2021, the second in 2024, and the third in 2025 – and functionally designed to capture the views of households that include working-age individuals as a foundation for formulating recommendations that offer an organizational and economic response to the questions posed.

The state of research on the problem

A review of the scholarly literature devoted to the field under study shows that both foreign and Russian academics and economists take an active interest in various aspects of household financial behavior.

Household financial behavior depends on a whole range of economic, social, demographic, and psychological factors (Kumar et al., 2023) that shape the way people use their financial resources in different situations. According to foreign researchers, the most common responses to financial hardship during economic crises include cutting current expenditures (Fiksenbaum et al., 2017; French, Vigne, 2019); drawing on emergency savings (Baek, DeVaney, 2010; Wiersma et al., 2020); borrowing from relatives or friends (French, Vigne, 2019; Wiersma et al., 2020); taking out loans and consumer credit (Gamble et al., 2019; Wiersma et al., 2020); and engaging in other income-boosting activities, such as increasing work hours or selling personal belongings (Fiksenbaum et al., 2017; Wiersma et al., 2020). Some scholars also suggest that financial behavior under conditions of financial difficulty depends on a person's age and life stage (Wiersma et al., 2020). Finnish researchers, in turn, argue that individuals cannot be treated as a homogeneous group of financial agents. People adopt different strategies for coping with an economic crisis, which depend on a multitude of factors – age, social background, gender, attitudes toward consumption, preferences, and so forth – and such specificities should be taken into account when implementing state policy on financial regulation (Silinskas et al., 2021). A paper by Chicago-based researchers examined the consequences that political uncertainty has on household financial behavior (Baker et al., 2020).

A study of the financial behavior of Russian households during the pandemic showed that, on the whole, it did not undergo major changes in 2020 compared with the survey results for 2015 and 2018, and a strategy of economizing remained the most prevalent. The coronavirus-related restrictions, moreover, had a smaller impact on household economic activity than the downturn in 2015. This was attributable both to higher income growth rates during the pandemic and to state financial support and a rise in credit activity among low-income household groups (Bessonova, Tsvetkova, 2023).

Under today's conditions of an increasingly digitized society, a major factor driving the transformation of household financial behavior is the active deployment of digital instruments in the financial sector to attract household savings. This brings both advantages – such as the simplified arrangement of banking products and the ability to conduct transactions around the clock without having to visit a bank branch in person – and risks, including a shift in decision-making influences from financial risks to behavioral, technological, and informational ones, which raises the bar for users' digital financial literacy (Skalaban, 2025).

Although the principal asset held by Russian households is funds in deposit accounts, the extent of the use of such accounts remains lower than in other countries. This stems primarily from low household incomes (as a result, more than half of the country's citizens have no savings or investments) as well as from a general distrust of the banking sector and a preference for holding savings in cash (Bogomolov, 2020). In addition, under conditions of high economic uncertainty and low incomes, the financial planning horizon shrinks. As research from the Higher School of Economics shows, the majority of the country's residents have no long-term financial goals and limit their planning horizon to no more than one year (Kuzina, Moiseeva, 2021).

Of considerable interest are the publications devoted to the impact of sanctions on household financial behavior. For example, the tightening of the sanctions policy against Iran in 2018 led, on the one hand, to a decline in purchasing power across all household groups and a rise in food expenditure. The households most at risk of falling into poverty, meanwhile, were urban households headed by women or composed of elderly people. On the other hand, income inequality increased, as the mechanisms for circumventing sanctions reduced the transparency of economic activity and allowed a narrow circle of individuals to accumulate wealth thanks to the growing influence of informal relationships (Salehi-Isfahani, 2023). Other researchers likewise point to sanctions as a factor that alters household economic behavior, driving activity into the informal economy in order to evade sanctions (Early, Peksen, 2019).

Partly similar changes in household financial behavior were observed in Venezuela following the imposition of sanctions there. Because of a less diversified economy, however, the consequences of sanctions were sharper and more palpable for households: nearly 90% of them lacked sufficient income even to cover their food needs. This forced more than 20% of Venezuelans to choose migration as a survival strategy (Garcia, 2024).

An analysis of studies by Russian authors (Korchagina, Prokofieva, 2024) shows that, under sanctions, Russian households on the whole display some of the same patterns of economic behavior as the households in the countries discussed above (a growing share of food in their consumption mix, a shift to a strategy of economizing), since the effects of sanctions pressure on a national economy are, to a certain degree, similar (a weakening of the local currency, rising inflation, and falling purchasing power). Yet there are also distinguishing features:

1) relative to other countries subject to sanctions – the Russian economy adapted to the 2022 sanctions fairly quickly, GDP and real household incomes returned to growth in 2023–2025, and the trends toward a decline in income inequality and a fall in unemployment were maintained;

2) relative to the pandemic period – while the strategy of economizing has persisted, an increasingly important influence on household financial behavior has been the readiness to take active steps to improve one's financial position by seeking additional employment. This has been facilitated by enterprises' competition for scarce labor resources, which opens up new opportunities for choosing where to work. The shift to this strategy was noted by more than 50% of those surveyed (Korchagina, Prokofieva, 2024).

An important component of financial behavior is the ability to use modern investment instruments (Jiao et al., 2024). In particular, a study of Chinese households (Shen et al., 2022) concludes that the introduction of digital financial assets has a positive effect on investment behavior and enables a larger share of households to invest in risky financial assets, partly because digital

channels simplify access to securities transactions compared with traditional methods. Similarly, the financial behavior associated with the use of digital financial assets as long-term investment instruments is influenced by the development of digital financial literacy, especially when it comes to aspects concerning the inheritance of rights to such assets in the event of the owner's death or incapacitation. A survey of 840 respondents from Australia and Singapore revealed that only one-third of them had looked into these matters (Steen et al., 2024).

In Russia, the actual interest of households in digital financial assets is far higher than experts had anticipated. Whereas the forecast for the digital financial asset market in 2023 stood at 25 billion rubles (the year-end figure was 80 billion rubles[1]), and the forecast for 2024 was 125 billion rubles (with actual investments reaching 550 billion rubles[2]), the volume of issuance in 2025 could grow to 1 trillion rubles[3] (the volume for the first 11 months of 2025 already stood at 952 billion rubles[4]).

Another investment instrument actively employed in various countries is the issuance of retail bonds (Klimova et al., 2020). In Japan, up to 50% of household funds are placed in government debt securities (Nozdreva, 2019). Chinese researchers, using the example of Chinese households, have identified a dependence of citizens' investment preferences on their level of financial literacy. Specifically, at the average level, bonds serve as the principal investment instrument. A rise in the level of household financial literacy leads to a shift in emphasis toward the use of riskier – but also higher-yielding – instruments, such as company shares and other stock-market assets (Wei, 2023). Other researchers note that more financially literate citizens tend to carry a higher level of debt but are, at the same time, less likely to fall behind on debt service payments (Fong, 2025). Retail bonds are not a very widespread but nevertheless quite a long-standing debt instrument in the practice of a number of subjects of the Russian Federation (in the Tomsk Region, for instance, they have been in use for over 20 years). The positive impact retail bonds have on improving the population's financial literacy – with the result that 80% of investors reinvest their funds in subsequent issues of retail bonds – testifies to the importance of further developing this instrument across Russia's regions[5].

Another actively developing avenue for household investment is crowdfunding (the raising of funds through online platforms), which is highly popular in European countries. Researchers in the Netherlands, on the basis of a sociological survey of 2,633 people, found that 83.7% of respondents are aware of crowdfunding, of whom 11.3% (or 9.4% of all those surveyed) have taken part in it at least once (Ciobotaru et al., 2021). The probability of participating in crowdfunding, meanwhile, is higher among women, as well as among those who invest in socially oriented assets. Among the main factors driving the financial behavior of those who participate in crowdfunding are the desire to contribute to the betterment of society and a distrust of traditional financial institutions.

[1] News of the Project-Educational Laboratory of Economic Journalism, HSE University. Available at: https://economics.hse.ru/ecjourn/news/892070793.html (accessed: 20.01.2025).

[2] The Volume of Digital Financial Assets Grows to 684 Billion Rubles. Key Points from Sber's Report. RBC. Available at: https://www.rbc.ru/crypto/news/67bc5afa9a7947ab102a475a (accessed: 26.09.2025).

[3] The Volume of DFA Issuance in 2024 Could Exceed 500 Billion Rubles, and in 2025 – 1 Trillion Rubles. Expert RA. Available at: https://raexpert.ru/ (accessed: 20.01.2025).

[4] The Russian DFA Market Reaches 952 Billion Rubles over 11 Months – Sber. Cbonds Platform. Available at: https://cbonds.ru/news/3717697/ (accessed: 14.01.2026).

[5] The Domestic Investor: How to Attract and Win Trust (2019). Analytical Bulletin of the Federation Council of the Russian Federation, No. 21 (735), p. 10. Available at: http://council.gov.ru/media/files/LliUwKs0VGTQImK5J0Xo3WTkfbld4Ohs.pdf (accessed: 13.05.2026).

Research results

The study conducted by the Institute of Social and Economic Research of the Ufa Federal Research Centre of the Russian Academy of Sciences (ISER UFRC RAS) is based on the findings of sociological surveys of residents across various municipalities in the Republic of Bashkortostan. The dynamics of financial behavior were tracked across three waves (2021, 2024, and 2025). The number of respondents was 2,274, 1,100, and 2,216, respectively. The respondents were employed and working-age adult citizens of the Russian Federation permanently residing in the republic. The resulting sample is balanced by gender, age, and type of economic activity, making it possible to study in greater detail the specific features of household financial behavior in the Republic of Bashkortostan.

The findings of the sociological surveys indicate that a high share of the incomes of the republic's households continues to be channeled toward current consumption, which points to a relatively low standard of living. Overall, the dynamics are unstable. Whereas in 2021, almost half of their income was directed to current consumption by 53.6% of respondents, the figure rose to 56.9% in 2024 and fell to 49.7% in 2025. More than 60% of all income was spent on these purposes by 27.6, 33.2, and 25.3%, respectively *(Fig. 1)*.

This situation has been driven by intense competition among employers for labor resources amid a shortage of personnel in the economy, which has led to a substantial rise in wages (according to Rosstat, across the country as a whole, 17.4% of employees at large and midsize enterprises received an accrued monthly wage of over 100,000 rubles in April 2023, rising to 31.9% in April 2025). In 2024, only 20.7% of survey participants were satisfied with their level of pay, whereas in 2025 their share nearly doubled, reaching 38.2%.

Nevertheless, practically every other working-age resident of the republic still finds themselves in a state of limited financial means, which is to some extent due to the presence of a substantial share of the rural population in the republic (37.3%), whose income level is lower than that of urban residents.

As for types of economic activity, more than 60% of all income was spent on current consumption in 2021 by workers employed in construction (42.5%) and trade (33.3%); in 2024, by employees of social services and public support agencies (43.6%) and workers in industrial production (36.4%); and in 2025, by those employed in transport and communications (30.2%).

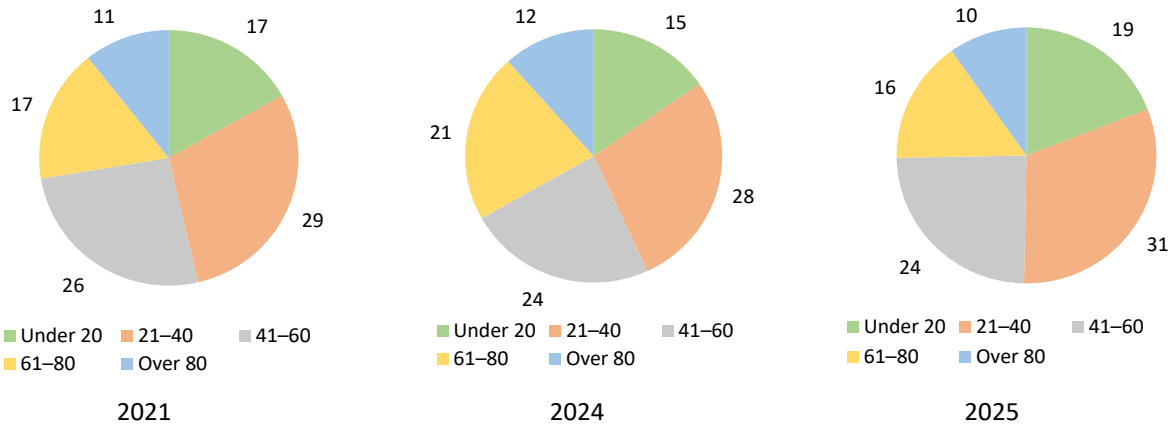

Figure 1. Distribution of answers to the question "What share of your total average monthly income does your family spend on current consumption?", % of respondents

Source: results of surveys conducted by ISER UFRC RAS.

At the same time, the share of household spending on current consumption tends to vary with the number of children in the family. For example, in 2021, 15.6% of families with three children spent more than 80% of their income on basic needs (10.0% in 2024 and 9.6% in 2025). Among childless households, the corresponding share was lower – 8.9% in 2021 (10.5% in 2024 and 8.8% in 2025). Although the expenditure structure had become more even by 2024–2025, the overall level of spending in large families remains lower than in childless families.

It was also established that men, on average, have a higher level of income than women. Among the male respondents in 2025, 40.3% had a monthly income above 50,000 rubles, whereas among women this share stood at only 22.5%.

The survey showed that, when households lack sufficient own funds, durable goods (other than clothing) are, as a rule, purchased with the help of bank loans. For instance, even for the purchase of a smartphone, more than 40% of households resort to credit (40.7% in 2021, 48.0% in 2024, and 47.1% in 2025). On the whole, the share of households purchasing goods on credit is rising across all the groups of goods examined *(Fig. 2–5)*.

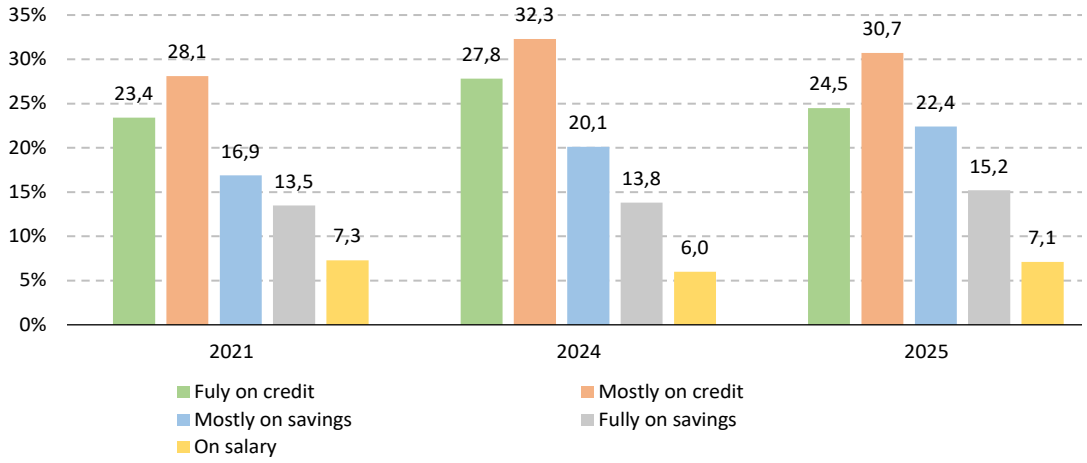

Figure 2. Distribution of answers to the question "How do you usually purchase durable goods... (household appliances and computer equipment)?",% of respondents

Source: results of surveys conducted by ISER UFRC RAS.

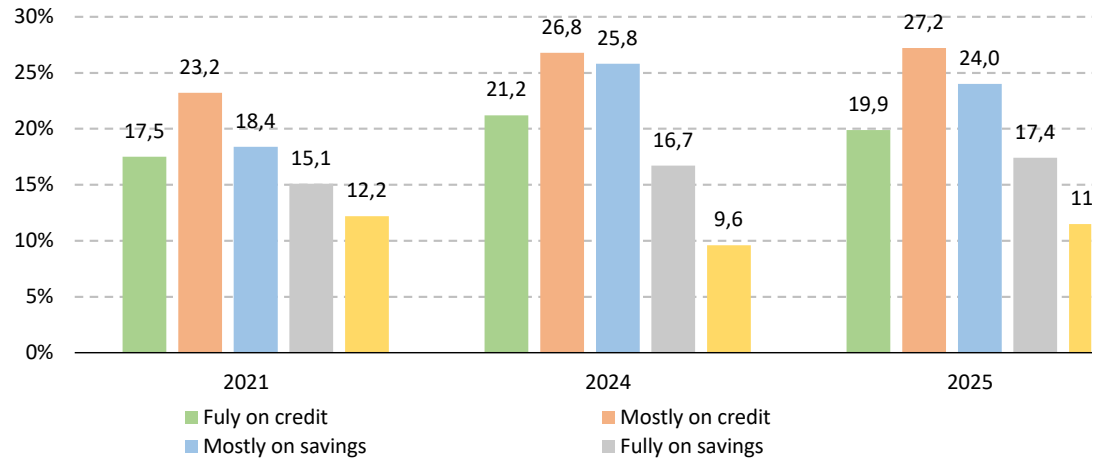

Figure 3. Distribution of answers to the question "How do you usually purchase durable goods... (mobile phones)?", % of respondents

Source: results of surveys conducted by ISER UFRC RAS.

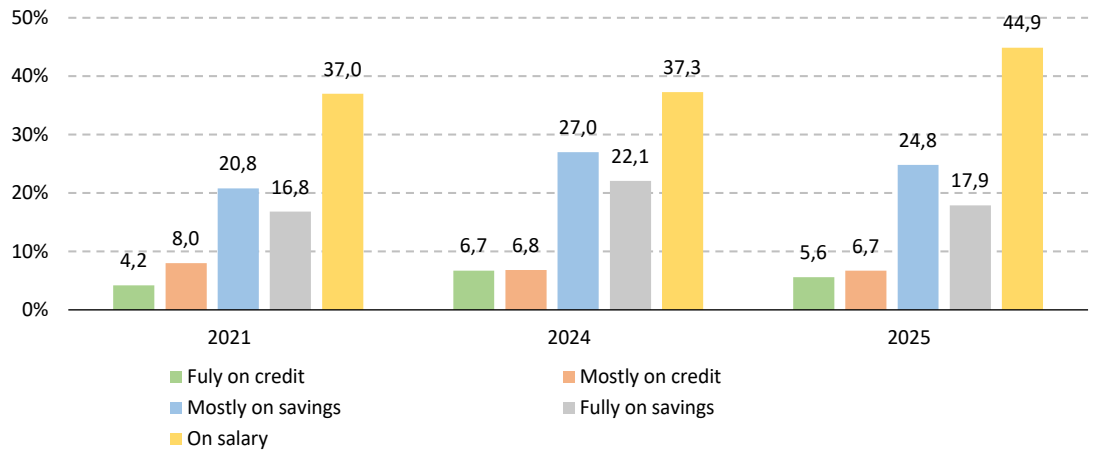

Figure 4. Distribution of answers to the question "How do you usually purchase durable goods... (clothing)?", % of respondents

Source: results of surveys conducted by ISER UFRC RAS.

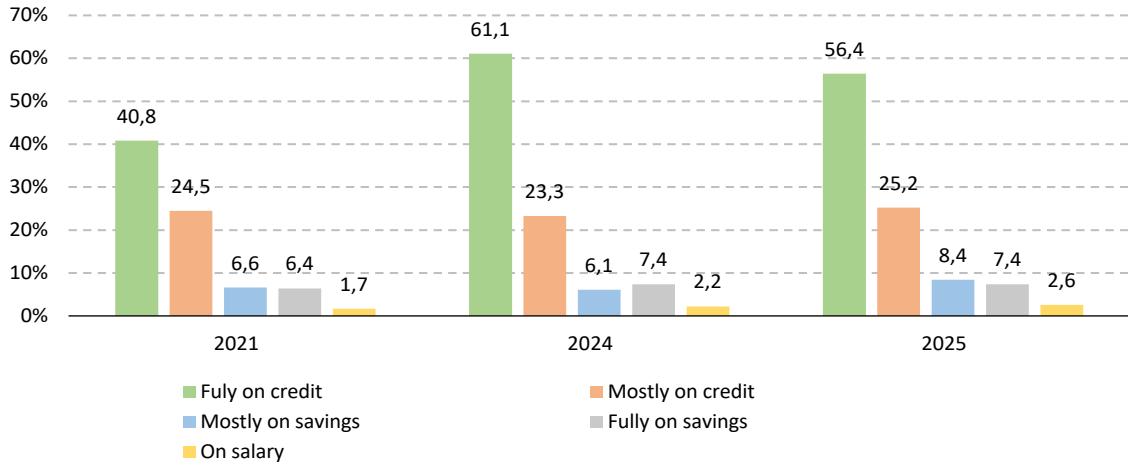

Figure 5. Distribution of answers to the question "How do you usually purchase durable goods... (a car)?", % of respondents

Source: results of surveys conducted by ISER UFRC RAS.

The sociological surveys showed that the financial behavior of residents of large cities is more flexible than that of rural residents. In 2021, the highest level of indebtedness was observed among rural dwellers (64.9% of the total number of rural respondents surveyed). The urban residents of the republic had credit obligations in only 61.8% of cases (in the region's largest settlement, the city of Ufa – 59.4%). In 2024, the share of rural residents holding loans remained practically at the same level (64.5%), while the indebtedness of urban residents rose to 66.6% (in the city of Ufa – 69.9%), which may be linked to the higher creditworthiness of households living in the capital and other cities of the republic. The results of the 2025 survey are similar to those for 2021: the share of respondents who had loans ranged from 64.4% among residents of villages and rural settlements to 57.0% among Ufa residents *(Fig. 6)*. Thus, the greatest elasticity in financial behavior is displayed by residents of Ufa, who possess greater financial capacity than the rural population to maintain their standard of living:

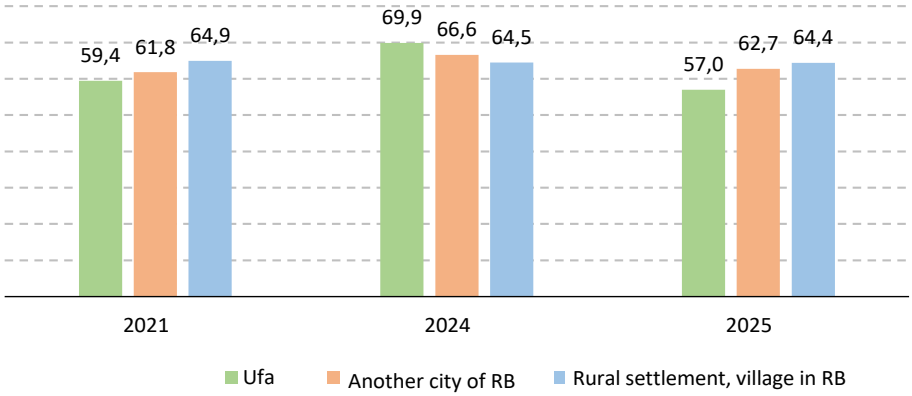

Figure 6. Distribution of answers to the question "Do you currently have a loan?", % of respondents

Source: results of surveys conducted by ISER UFRC RAS.

according to data from Bashkortostanstat[6], in the fourth quarter of 2024, the gap in the level of disposable financial resources between the urban and rural populations of the republic was more than twofold (81.4 thousand rubles and 39.7 thousand rubles per household member per month).

In addition, the credit burden correlates fairly clearly with the number of children in the family and the respondents' age. In 2025, in childless families, an average of 51.5% of those surveyed had loans, whereas in families with one child the figure was 64.8%, with two children – 70.8%, with three children – 76.8%, and with four or more – 77.3%. In terms of age, the highest share of loans is observed among those aged 25 to 44 (71.2%). At the same time, there is practically no gender gap – 60.8% of men and 61.9% of women have a loan.

When broken down by type of economic activity, the use of credit products was most frequent among workers in the trade sector (62.2% in 2021, 83.3% in 2024, and 57.5% in 2025), transport and communications (70.4, 66.7, and 60.4%), construction (69.0, 58.8, and 68.1%), industry (68.1, 57.6, and 65.2%), healthcare (67.1, 74.1, and 65.9%), and housing and utilities (66.8, 75.0, and 68.9%). It was less frequent among military personnel, employees of the Ministry of Internal Affairs, and other law enforcement agencies (53.3, 60.0, and 63.6%), IT sector workers (56.7, 53.8, and 44.4%), and those employed in culture and the arts (54.7, 58.6, and 56.9%).

In 2024, compared with 2021, the share of households holding loans increased (from 62.4 to 66.2%), which led to a rise in the credit burden (the share of those who spent more than half of their total family income on servicing debt grew from 11.3% to 18.1%). A similar dynamic is observed across the country as a whole[7]. In response, the Bank of Russia is pursuing a policy aimed, on the one hand, at reducing the share of consumer loans issued by banks to individuals with a high credit burden[8], and, on the other, at developing mechanisms for restructuring household loans under sanctions conditions[9].

[6] Disposable Resources of Households in the Republic of Bashkortostan. Bashkortostanstat. Available at: https://02.rosstat.gov.ru/storage/mediabank/Raspolagaemye_resursy_domashnih_hozyajstv.pdf (accessed: 01.10.2025).

[7] Analysis of Trends in the Retail Lending Segment Based on Credit Bureau Data. Bank of Russia. Available at: https://www.cbr.ru/Collection/Collection/File/49059/inf-material_bki_2023sh.pdf (accessed: 12.09.2024).

[8] The Bank of Russia Introduced Stricter Limits on Lending to Borrowers with a High Debt Burden and Raised Macroprudential Mark-Ups on Non-Earmarked Consumer Loans Secured by a Vehicle. Bank of Russia. Available at: https://www.cbr.ru/press/pr/?file=63860619770335352 8dsd.htm#highlight=долговой%7Снагрузкой%7Снагрузки%7Снаселения (accessed: 12.09.2024).

[9] Dynamics of the Restructuring of Household and Business Loans. Bank of Russia. Available at: https://www.cbr.ru/Collection/Collection/File/49427/drknb_35_2024.pdf (accessed: 12.09.2024).

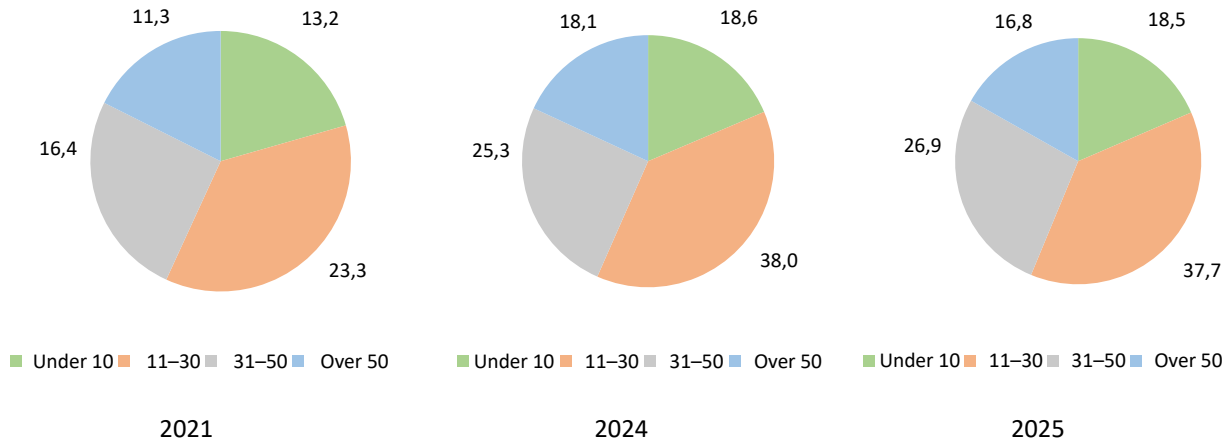

Figure 7. Distribution of answers to the question "What share of your total average monthly income currently goes toward servicing your loan?", % of respondents

Source: results of surveys conducted by ISER UFRC RAS.

As a result, the 2025 survey registered a decline in the share of respondents who hold loans, to 61.4%. At the same time, the share of people with a high credit burden also fell somewhat (to 16.8%). Nevertheless, 43.7% of those who currently use borrowed funds to meet their needs channel more than 30% of their income toward servicing these loans *(Fig. 7)*. In the end, 73.4% of respondents experience, to one degree or another, difficulties in covering their daily expenses.

The investment capacity of households is characterized by the availability of surplus financial resources and savings. In 2021, 18.7% of respondents had savings in the form of deposits with credit institutions. In 2024, their share increased slightly to 19.3%, which is comparable with the findings of other studies. In particular, according to a report by the Russian Ministry of Finance and the World Bank devoted to the study of the financial behavior of the population of the Republic of Bashkortostan, 23% of those surveyed had savings[10]. The sharp rise in deposit interest rates in 2024 made this form of saving more attractive and, according to the 2025 survey data, raised the share of respondents who hold a deposit to 26.2%. At the same time, whereas among residents of the city of Ufa this share reaches 29.3%, and among residents of other towns in Bashkortostan – 29.5%, among rural residents no more than 20% have bank deposits *(Fig. 8)*.

The survey findings made it possible to identify the dynamics of the saving behavior of the republic's households, which reacts sensitively to changes in external factors. For example, during the period of COVID-related restrictions, nearly 80% of respondents who had savings in bank deposits opted for a conservative strategy, keeping their funds in conventional deposits (which guarantee the payment of accrued interest and the return of the deposit up to the insured amount of 1.4 million rubles; *Fig. 9*). This choice of financial behavior was influenced by the sharp decline in economic activity at that time, both in Russia and across the global economy, which led to an overall increase in uncertainty and investment risks.

[10] NAFI Analytical Center. The Level of Financial Literacy of the Population of the Republic of Bashkortostan. Report on the Results of the Sociological Study "Assistance in Improving the Level of Financial Literacy of the Population and the Development of Financial Education in the Russian Federation", Moscow, 2020. Ministry of Finance of the Republic of Bashkortostan. Available at: https://minfin.bashkortostan.ru/documents/other/343302/ (accessed: 25.06.2021).

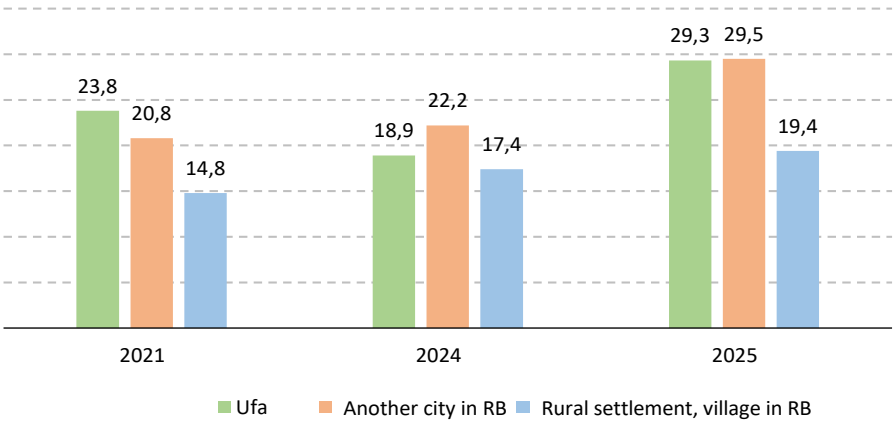

Figure 8. Distribution of answers to the question "Do you have money savings in bank accounts and deposits?", % of respondents

Source: results of surveys conducted by ISER UFRC RAS.

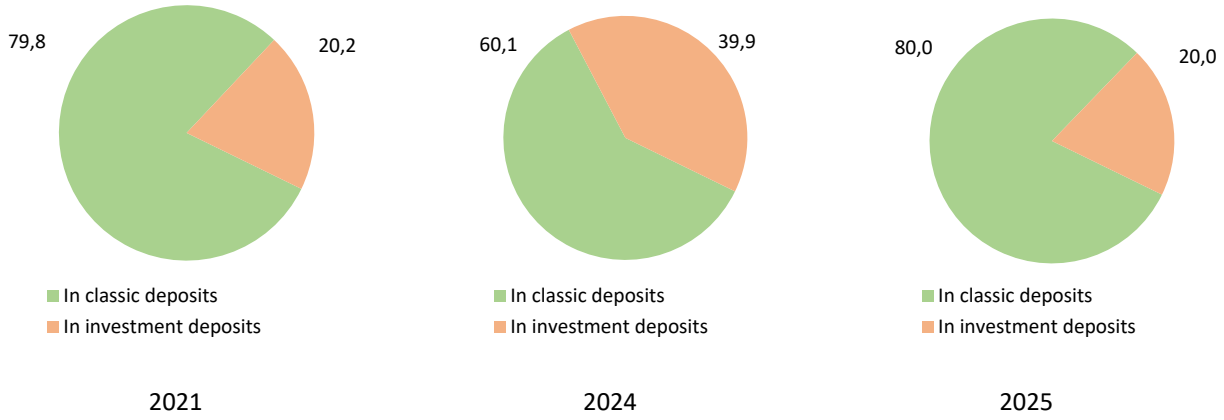

Figure 9. Distribution of answers to the question "What types of deposits do you hold your savings in?", % of respondents

Source: results of surveys conducted by ISER UFRC RAS.

However, with the imposition of sweeping sanctions[11] against the Russian economy in 2022 – characterized, among other things, by restricted access to relatively cheap foreign loan capital and the withdrawal of a substantial share of foreign investors (whose share in trading volumes on the Russian stock market fell from 60% to 20%) – households increasingly began to choose investments in financial products with a higher risk/return ratio as their main financial behavior strategy. As a result, by 2024, investment-type deposits (which offer a higher level of return compared to conventional deposits, but without a full guarantee of obtaining it) were held by nearly 40% of respondents in the Republic of Bashkortostan, a shift driven by the desire to protect savings from depreciation amid intensifying inflationary processes[12]. Experts note that similar trends – households investing in domestic financial products in order to preserve savings from

[11] Although Western sanctions against individual Russian individuals and legal entities have been in effect since 2014, they took on a mass character, affecting virtually all sectors of the Russian economy, in 2022, after the start of the special military operation.

[12] Self-Assessment of Financial Literacy: The Share of "Good" and "Excellent" Ratings Has Doubled over 16 Years. NAFI Analytical Center. Available at: https://nafi.ru/analytics/samootsenka-finansovoy-gramotnosti-dolya-khoroshistov-i-otlichnikov-vyrosla-v-dva-raza-za-16-let/ (accessed: 13.09.2024).

depreciation caused by high inflation and the devaluation of the local currency – have been observed in the economy of Iran, which has been under Western sanctions pressure for a long time[13].

With the persistence of high deposit interest rates in 2025, the survey revealed a return of financial behavior to the conservative strategy: the share of respondents holding savings in conventional deposits returned to the 2021 level of 80.0%. By way of explanation, it should be noted that since the surveys of the second (2024) and third (2025) waves were conducted in April–June of the respective year, this study reflects the dynamics of financial behavior that had taken shape under the trends prevailing at that time. Before June 2024, deposit rates barely rose[14], making a return to the conservative strategy inadvisable before that point. After rates increased in the second half of 2024, the yield on deposits in the spring of 2025, despite an emerging downward trend, was still high (around 20% per annum), and it was only in the summer of 2025 that the attractiveness of this instrument declined to a level where switching to a riskier financial strategy using other savings instruments, discussed below, once again became advantageous.

The share of women holding savings is somewhat higher than that of men (27.4% versus 24.8%), which may partly be linked to women's longer life expectancy and their larger share among pensioners, who are more inclined to accumulate savings. In terms of age distribution, among those aged 65 and over, 33.3% of respondents had money savings in bank accounts and deposits in 2025. A higher result was posted only by the youngest group (18–24 years), where the share of respondents with savings reached 36.5%. The survey results are consistent with the findings of other similar studies[15]. This age group includes students, who are the most financially active segment of the population thanks to their strong digital technology skills, including in the area of banking products. However, because young people generally possess only a small volume of savings, they tend to place their funds not in deposits (where the minimum contribution is usually from 50,000 rubles) but rather in savings and investment accounts.

In addition to bank deposits, households are showing active interest in stock market instruments. Over the past six years, the volume of household assets held in individual investment accounts has more than tripled, reaching over 750 billion rubles by October 2025[16] (the Republic of Bashkortostan consistently ranks among the top ten regions in terms of household stock market activity). The main driver of growth has been the bond market (both corporate and government securities), in which the volume of investments has doubled over the past year. The crowdfunding market is also developing actively, having grown from 7 billion rubles to 33.4 billion rubles over the period 2020–2023[17]. The leading regions in terms of the use of this investment instrument are concentrated in the Central and Volga federal

[13] In Isolation: How Investors Have Spent a Year and a Half Since the Start of the "Special Operation". Forbes. Available at: https://www.forbes.ru/investicii/495694-v-izolacii-kak-investory-proveli-poltora-goda-posle-nacala-specoperacii (accessed: 10.01.2025).

[14] Dynamics of the Maximum Interest Rate (on Ruble Deposits) of the Ten Credit Institutions. Bank of Russia. Available at: https://www.cbr.ru/statistics/avgprocstav/ (accessed: 30.09.2025).

[15] Study of the Central University: Students' Savings Grow Two- to Fivefold by Graduation. Central University. Available at: https://cu.ru/tpost/melm3xor21-issledovanie-tsentralnogo-universiteta-s (accessed: 13.05.2026).

[16] Time Series of the Main Indicators of the Individual Investment Account (IIA) Segment. Bank of Russia. Available at: https://www.cbr.ru/statistics/rcb/iis_stat/ (accessed: 13.09.2024).

[17] Russians Are Improving Their Investment Skills. Finmarket. Available at: http://www.finmarket.ru/main/article/5534342 (accessed: 24.08.2021).

districts[18]. By the end of 2024, the volume of the crowdfunding market had already reached 54 billion rubles[19]. All of this indicates that, despite the low level of real incomes and the absence of bank deposits among the majority of households, a certain portion of households (about 15%) that have financial resources surplus to consumption needs is showing growing interest in seeking out new avenues for investing their funds. Thus, in 2024, 15.5% of those surveyed had an income that allowed them to purchase a car and/or real estate without harming their current consumption; in 2025, their share declined to 14.1%.

The growth of household investment activity is importantly influenced by the implementation of various programs to improve financial literacy, which serves as a basis for making more considered decisions when choosing the most advantageous directions for investing one's financial resources. According to sociological surveys conducted both at the level of the Republic of Bashkortostan[20] and across Russia as a whole[21], this aspect is the one most in demand among participants in financial literacy improvement programs. An analysis of the data obtained through the surveys carried out by ISER UFRC RAS also points to a rise in the degree of participation by the republic's population in acquiring new knowledge and skills in the field of financial literacy. Over the past four years, the share of respondents who have attended financial literacy courses has grown from 19.2% in 2021 to 32.8% in 2025 *(Fig. 10)*. At the same time, it should be understood that financial literacy is an ongoing process of improving one's financial knowledge and skills, not a one-off attendance of educational courses. Otherwise, excessive self-confidence in one's financial knowledge (Kawamura et al., 2021; Karimov et al., 2025) can lead to substantial financial losses.

The first-wave survey showed that only 15% of respondents participate in projects to improve the amenities of the territory where they live. At the

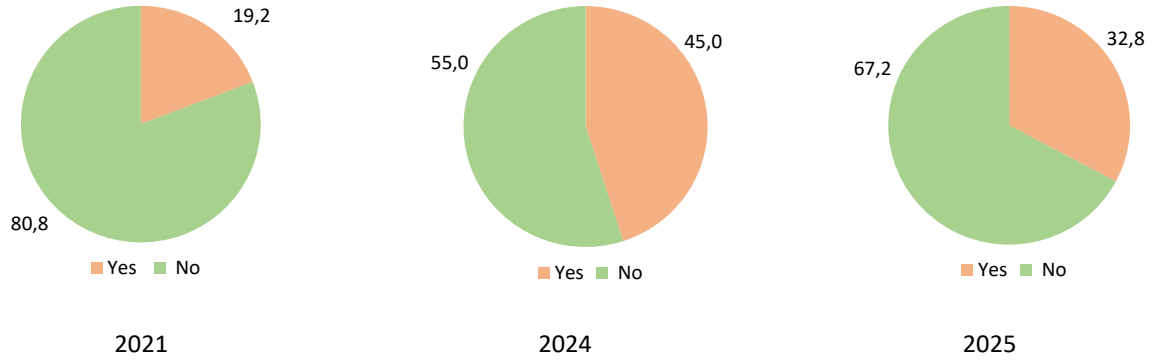

Figure 10. Distribution of answers to the question "Have you taken part in financial literacy courses (programs)?", % of respondents)

Source: results of surveys conducted by ISER UFRC RAS.

[18] Review of Platform Services in Russia. Bank of Russia. Available at: https://www.cbr.ru/Collection/Collection/File/49243/platform_services_2024-1.pdf (accessed: 13.09.2024).

[19] Russians Have Found an Alternative to Deposits That Are Losing Their Appeal. Banki.ru. Available at: https://www.banki.ru/news/lenta/?id=11016830 (accessed: 29.09.2025).

[20] Sociologists Assess the Level of Financial Literacy in Bashkiria. Bashinform. Available at: https://www.bashinform.ru/news/social/2024-06-28/sotsiologi-otsenili-uroven-finansovoy-gramotnosti-v-bashkirii-3827578 (accessed: 13.09.2024).

[21] Self-Assessment of Financial Literacy: The Share of "Good" and "Excellent" Ratings Has Doubled over 16 Years. NAFI Analytical Center. Available at: https://nafi.ru/analytics/samootsenka-finansovoy-gramotnosti-dolya-khoroshistov-i-otlichnikov-vyrosla-v-dva-raza-za-16-let/ (accessed: 13.09.2024).

same time, 26.6% are willing to take part if they have surplus financial resources at their disposal, which lends urgency to the state's task of boosting citizens' interest in participating in various territorial development programs (for example, through tax incentives). The predominance of the social component over the commercial one in the implementation of projects has remained the main priority for citizens throughout the entire period under study. Support for projects of this type was expressed by 19.3% (2021), 22.1% (2024), and 13.7% (2025) of respondents *(Fig. 11)*.

At present, one of the most widespread forms of public participation in the improvement of amenities in their territories is the Local Initiatives Support Program (LISP). For example, in 2024, 223 projects were supported within the framework of the program's implementation in the urban okrugs of the Republic of Bashkortostan. The most popular areas were projects in the sphere of education (44% of the total number of projects) and the development of road infrastructure (30%)[22]. The LISP operates in many other subjects of the Russian Federation, particularly in the Kirov Region, where projects in the sphere of construction and the renewal of the territory's road network are likewise the most in demand (33%)[23]. In the Nizhny Novgorod Region, a similar project, "Vam reshat!" ("You Decide!")[24], is being implemented.

At the same time, the main factor limiting the growth of household investment activity, in the opinion of those surveyed by ISER UFRC RAS, is the low level of incomes (44.4% in 2021, 46.6% in 2024, and 35.9% in 2025). The second most important factor, according to the survey participants, was low financial literacy (34.9, 10.6, and 14.7%, respectively), which testifies to the relevance of further expanding the population's coverage with educational programs in this sphere *(Fig. 12)*.

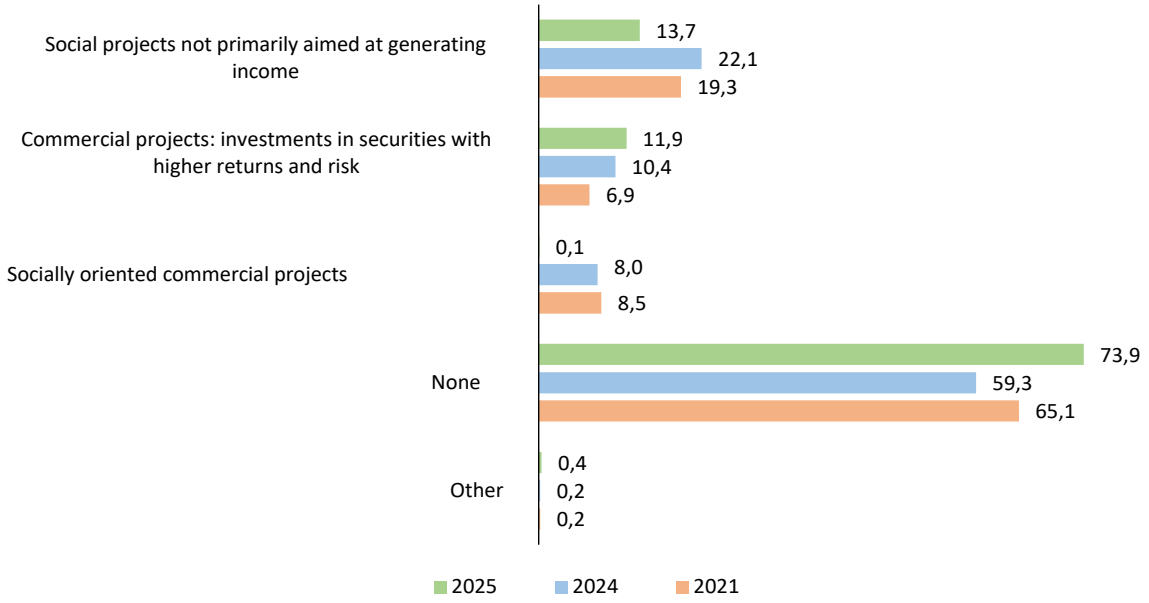

Figure 11. Distribution of answers to the question "What types of investment projects are most preferable for you to invest in?", % of respondents

Source: results of surveys conducted by ISER UFRC RAS.

[22] Local Initiatives Support Program 2024. Eurasian Research and Education Center. Available at: https://nocrb.ru/ppmi24 (accessed: 13.01.2025).

[23] Portal of Social Services of the Kirov Region. Available at: https://socialkirov.ru/social/root/ppmi/Info.htm (accessed: 13.01.2025).

[24] The Governor's Participatory Budgeting Project "You Decide!". Available at: https://vam.golosza.ru/ (accessed: 13.01.2025).

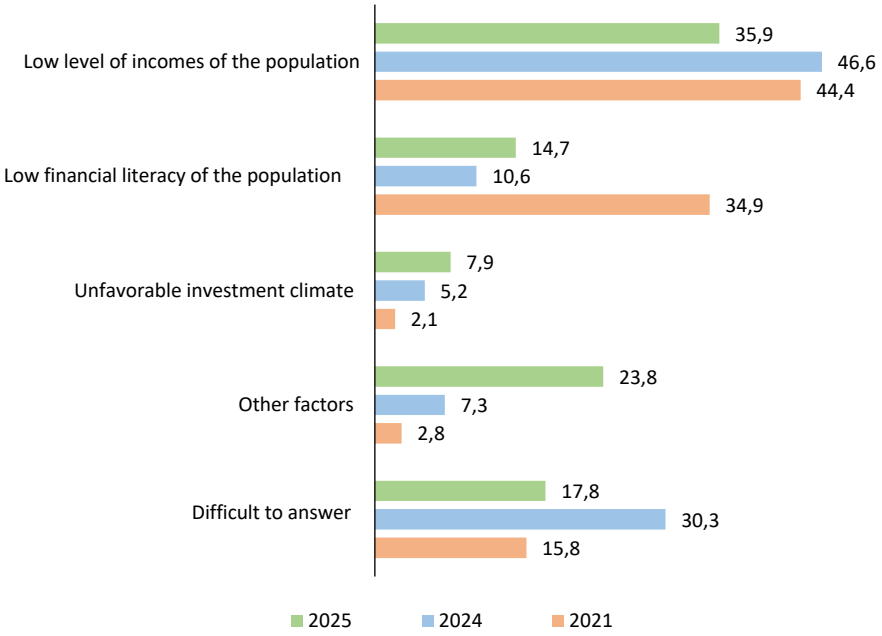

Figure 12. Distribution of answers to the question "Which factors, in your view, hold back the investment of household financial resources in the territory's economy?", % of respondents)

Source: results of surveys conducted by ISER UFRC RAS.

Thus, raising the level of household incomes in the Republic of Bashkortostan is a necessary condition for increasing not only the quality of life but also the population's investment activity, as well as for broadening the forms of its participation in solving problems at the local level. At the same time, an additional investment resource that has yet to be tapped to the proper extent is the bank savings held by every fourth respondent (according to the Bank of Russia, as of December 1, 2025, the republic's population as a whole had placed 851.5 billion rubles in deposits, excluding escrow accounts). One instrument for channeling household financial resources into the regional economy could be retail bonds (Klimova et al., 2020), whose potential – despite their lengthy period of use in individual subjects of the Russian Federation (for example, over 20 years in the Tomsk Region) – remains underappreciated in regional practice, both in terms of the number of regions involved and the volumes of funds attracted[25].

The survey findings indicate that, despite the overall improvement in the level of household financial literacy, weak spots persist that create risks for financial well-being, especially when it comes to choosing the optimal saving strategy against a backdrop of a continued significant overestimation by citizens themselves of their own level of financial literacy. Further improvement of measures in this area therefore appears advisable.

With the adoption at the federal level of the Strategy for Improving Financial Literacy and Shaping Financial Culture up to 2030[26] (hereinafter referred to as the Strategy), which has been in effect since January 1, 2024, the

[25] Placement of Chukotka's Retail Bonds on the Finuslugi Platform to Begin on September 30. Moscow Exchange PJSC. Available at: https://www.moex.com/n93973 (accessed: 29.09.2025).

[26] Strategy for Improving Financial Literacy and Shaping Financial Culture up to 2030 (approved by Resolution of the Government of the Russian Federation 2958-r of October 24, 2023). Ministry of Finance of the Russian Federation. Available at: https://minfin.gov.ru/common/upload/library/2023/11/main/2958-r.pdf (accessed: 13.05.2026).

authors propose the following measures as recommendations for improving financial literacy and financial culture among the population of the Republic of Bashkortostan, in alignment with the goals and objectives of the Strategy.

1. The program documents of the Republic of Bashkortostan need to be updated to reflect the provisions of the Strategy concerning the improvement of the population's digital financial security and international cooperation in sharing experience in the field of financial literacy.

2. In the context of improving information and outreach activities, it would be advisable to raise the level of representation of social advertising on financial literacy issues in the regional mass media.

3. It is advisable to introduce financial-literacy practices aimed at implementing the Strategy's objective of disseminating and consolidating the population's positive experience of using financial products and services. To this end, it is proposed that the possibility be considered of the Ministry of Finance of the Republic of Bashkortostan issuing retail bonds as a more advantageous instrument for long-term household investments, compared with bank deposits, which would contribute to the development of participatory budgeting. Furthermore, in the context of the active development of digital technologies, the use of digital financial assets – already employed by development institutions in other regions (Sverdlovsk Region, Republic of Tatarstan) – constitutes a relevant tool for attracting household investments.

Conclusion

Thus, compared with the pandemic period, under the sanctions pressure – accompanied by rising inflation and the risk of savings depreciation – the financial behavior of households in the Republic of Bashkortostan has exhibited unstable dynamics. This instability, driven by the need to adapt to sharply changing conditions and to respond to them (which can be viewed as a positive factor), is characterized by a shift from a conservative strategy to a riskier investment strategy, followed by a return to the original approach.

The investment readiness of the republic's households is at a relatively low level, owing to the negative influence of the factors identified – a low level of income, substantial indebtedness among the population, the absence of deposit savings among the majority of those surveyed, and the predominance of consumer-oriented spending in the overall expenditure structure, among others. This does not, however, mean that the direction is unpromising, given the presence of other contributing factors.

Despite the fact that only about a quarter of the residents of the Republic of Bashkortostan are bank depositors, the total volume of the republic's household funds held in deposits is considerable (more than 850 billion rubles as of December 1, 2025) and can be regarded as investment potential to be channeled into the economy (for example, through government bonds of the subjects of the Russian Federation for the public, a practice that exists in a number of regions, or through digital financial assets).

Relative to rural residents, urban dwellers (especially those in the city of Ufa) display more flexible financial behavior thanks to their higher level of income (and, correspondingly, greater financial reserves) and higher financial literacy. This is reflected in a stronger reaction (visible in the dynamics of the level of indebtedness and of deposit and stock market activity) to external factors such as changes in deposit rates and rising inflation.

A promising avenue for unlocking the investment potential of the population – given the fairly high level of interest among those surveyed in providing financial support for social infrastructure and community improvement projects – could be the introduction of tax

incentives for participants in local initiative support programs and other similar programs. To this end, in our view, it would be advisable to consider, at the state level, the inclusion of the sums (or a portion of them) paid by citizens as co-financing under the Local Initiatives Support Program and other analogous programs in the list of social tax deductions.

Bearing in mind the recommendations presented in the study, further work is needed to improve the financial literacy of households in order to realize their investment potential. The effectiveness of regional and municipal-level policies aimed at raising the level of public trust in the initiatives proposed by the authorities will be of great importance, as this will serve as the foundation for increasing citizens' investment activity and achieving the ultimate goals of the socio-economic development of RF constituent entities.

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ТРАНСФОРМАЦИЯ ФИНАНСОВОГО ПОВЕДЕНИЯ И ИНВЕСТИЦИОННОГО ПОТЕНЦИАЛА ДОМОХОЗЯЙСТВ РЕСПУБЛИКИ БАШКОРТОСТАН В 2021–2025 ГОДАХ

Статья посвящена результатам исследования закономерностей и особенностей финансового поведения домохозяйств Республики Башкортостан в условиях эпидемиологических и санкционных ограничений. Предпосылкой для проведения исследования стала необходимость выяснить, какие изменения в финансовом поведении домохозяйств произошли под влиянием COVID-19 и санкционных ограничений. Был проанализирован опыт других стран, подвергшихся санкциям (Иран, Венесуэла), что позволило выявить сходства и различия в изменениях финансового поведения домохозяйств этих государств и России, произошедших в результате введения ограничений. В основу анализа положены итоги социологических опросов, проведенных Институтом социально-экономических исследований УФИЦ РАН в 2021, 2024 и 2025 гг. на территории одного из крупнейших по численности регионов России – Республики Башкортостан. В ходе опросов и последующей обработки их итогов определены факторы, влияющие на динамику финансового поведения населения, проанализированы инструменты привлечения финансов домохозяйств как инвестиционного ресурса обеспечения социально-экономического развития регионов. Установлено, что в числе основных факторов, оказывающих негативное влияние на готовность населения выступить внутренним инвестором, находятся низкий уровень доходов жителей, относительно высокая кредитная нагрузка, отсутствие у большинства респондентов сбережений на банковских депозитах. В качестве положительных факторов выявлено наличие достаточно значимого инвестиционного потенциала у части домохозяйств в виде сбережений в кредитных организациях, которые в перспективе могли бы быть направлены в сферу инвестирования, на развитие фондовых инструментов привлечения средств физических лиц (индивидуальные инвестиционные счета, краудфандинг), а также потенциала в области инвестиционной готовности к вложению средств в программы местных инициатив. Выявлена неустойчивость динамики финансового поведения домохозяйств, выражающаяся в переходе под влиянием факторов внешней среды от сберегательной стратегии к проведению более высокорисковой стратегии вложения сбережений с последующим возвратом к первоначальной стратегии. Наиболее высокую эластичность в финансовом поведении демонстрируют городские жители. Сформирован комплекс предложений в области повышения финансовой грамотности населения в Республике Башкортостан.

Финансовые ресурсы домохозяйств, кредитная нагрузка, финансовое поведение, финансовая грамотность, сбережения, инвестиции, санкции.

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ИНФОРМАЦИЯ ОБ АВТОРАХ

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SUSTAINABLE DEVELOPMENT OF TERRITORIES, BRANCHES, AND PRODUCTION COMPLEXES

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SPATIAL SELF-ORGANIZATION OF INDUSTRY CLUSTERS: METHODOLOGY AND APPROBATION

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Understanding the dynamics of cluster process measurement is impossible without relying on the fundamental developments of the Russian scientific school, which has shaped the modern scientific paradigm of spatial analysis in Russia. Therefore, this study addresses the pressing issue of spatial cluster analysis from the perspective of the theory of self-organization of complex adaptive systems. The aim of the study is to develop and test a methodology for identifying and assessing spatial patterns of self-organization using the example of the shipbuilding and ship repair industry in the Kaliningrad Region. Analysis of the spatial distribution of clusters requires an interdisciplinary synthesis of economic geography, regional economics, and network theory, as it is at the intersection of these fields that the most productive tools for identifying patterns in the localization of cluster formations emerge. The methodological framework is based on the integrated application of spatial statistics tools in a geographic information systems environment. Using the example of shipbuilding and ship repair in the Kaliningrad Region, it was demonstrated that the traditional view of a cluster as a simple geographic agglomeration is insufficient. The use of a combination of spatial statistics methods has proven effective for multi-level diagnostics. The study's results demonstrate that, at the regional scale, the distribution of enterprises is statistically indistinguishable from random. However, at the level of the Kaliningrad urban district, statistically significant spatial clustering was identified, forming

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the core of a potential self-organizing cluster. It was established that enterprise concentration gravitates toward key infrastructure and manifests itself at specific spatial scales, i.e., radii, confirming the operation of agglomeration effects and the existence of conditions for synergistic interactions. The results also demonstrate that the proposed methodological approach enables a qualitative shift from the recognition of geographic concentration to the diagnosis of self-organization processes, which has important practical implications for the development of targeted territorial policies aimed at the targeted development of clusters at the regional scale.

Space, distribution, industry, cluster, location, shipbuilding, ship repair, self-organization.

Introduction

The spatial dimension of cluster processes cannot be understood without drawing on the foundational studies that have shaped the modern scientific paradigm of spatial analysis in Russia (Shirov et al., 2025). Of particular importance in this respect is the three-year cycle of fundamental research programs of the Presidium of the Russian Academy of Sciences, completed in 2011. A central place among these was occupied by the program "Fundamental Problems of the Spatial Development of the Russian Federation: An Interdisciplinary Synthesis", coordinated by Academician A.G. Granberg (Granberg, 2009). This program laid the theoretical and methodological foundations for viewing space not as a static geographical backdrop but as an active, dynamic, and multi-dimensional factor of socio-economic development – an approach that fully aligns with the ecosystem logic of cluster self-organization.

In the subsequent cycle of 2012–2014, the program "The Role of Space in Russia's Modernization: Natural and Socio-Economic Potential" was approved, building on the ideas of its predecessor but with a focus on the geographical aspects of the transformation of the country's spatial structure in the context of nationwide modernization. The monograph summarizing the results of the first program (Avksent'ev et al., 2013) presents an interdisciplinary synthesis encompassing the conceptual foundations of the spatial approach, the influence of the natural and socio-cultural environment, the transformation of economic and innovation space (Yu et al., 2025), as well as the methodology for analyzing and forecasting territorial structure. Particularly significant for our study is the proposition that the concept of space in economics goes beyond the traditional boundaries of its predominantly geographical definition. Regional economics research is acquiring new features precisely because of the inclusion in the analysis of a broader range of factors – social, political, legal, and technological (Fetisov et al., 2012; Mikheeva, 2025).

The experience of the interdisciplinary synthesis and of research on Russia's space served as the foundation that was integrated into the development of the "Strategy for the Spatial Development of the Russian Federation for the Period up to 2025"[1], the "Strategy for the Spatial Development of the Russian Federation for the Period up to 2030, with a Forecast up to 2036"[2] and related documents (Shirov et al., 2024; Kuznetsova, Druzhinin, 2024).

[1] On the Approval of the Strategy for the Spatial Development of the Russian Federation for the Period up to 2025: Resolution of the Government of the Russian Federation 207-r of February 13, 2019.

[2] On the Approval of the Strategy for the Spatial Development of the Russian Federation for the Period up to 2030, with a Forecast up to 2036: Resolution of the Government of the Russian Federation 4146-r of December 28, 2024.

This approach, which broadens the content of "space" as a scientific category, makes it possible to view cluster ecosystems not only as geographically localized entities but also as complex adaptive systems whose self-organization is shaped by the interplay ofnumerous non-linear, often intangible, factors – ranging from the density of network ties to the level of institutional trust and the cognitive proximity of participants. It is precisely in this context that the application of spatial analysis tools, capable of capturing not only the physical concentration of actors but also the hidden factors of their interdependence, becomes methodologically justified (Shirov et al., 2025; Foutakis, 2025).

At the same time, the analysis of the spatial distribution of clusters requires an interdisciplinary synthesis of economic geography, regional economics, and network theory, since it is at the intersection of these fields that the most productive tools for identifying the patterns of localization of cluster formations emerge (Park et al., 2019). Contemporary approaches to studying the geographic location of clusters increasingly rely not only on traditional statistical and cartographic methods but also on geographic information technologies (QGIS, ArcGIS, etc.), spatial econometrics, and the analysis of big data on the locations of enterprises and infrastructure nodes (Park et al., 2019; Zeng et al., 2023). This makes it possible not only to record existing patterns of concentration but also to model potential scenarios of their transformation under the influence of technological, institutional, and global economic shifts (Qi et al., 2024).

Materials and methods

Within the ecosystem approach to the analysis of cluster self-organization, one of the key methodological challenges is working with multidimensional data that reflect the complex, nonlinear interrelationships among economic, technological, institutional, and spatial factors (Popov et al., 2021; Popov, 2023). Although an adequate description of cluster dynamics objectively requires taking into account a broad range of variables – from the density of innovation activity to the level of network cooperation and infrastructure accessibility – the growth in the dimensionality of the feature space inevitably gives rise to serious analytical difficulties (Purbasari et al., 2023).

To minimize these difficulties, the author has developed an algorithm for conducting a comprehensive analysis of a cluster ecosystem *(Fig. 1)*. This algorithm visualizes the linear model and reflects the sequential research process, beginning with the collection and preparation of data, followed by stages of spatial analysis and network analysis, the integration of the results, and concluding with the formulation of conclusions and recommendations.

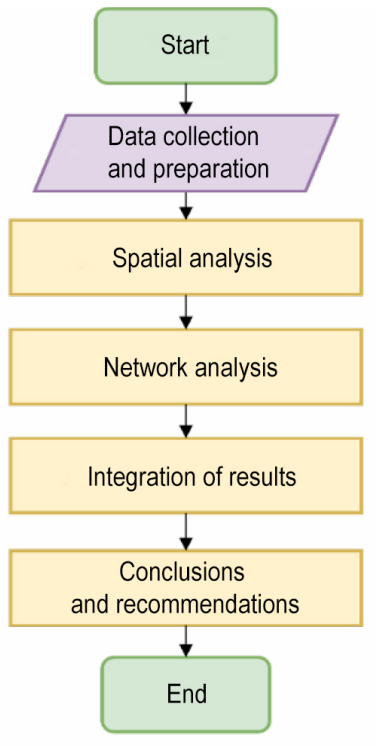

Figure 1. Algorithm for the comprehensive analysis of a cluster ecosystem
Source: own compilation.

The central tool for the quantitative assessment of these processes is the analysis of spatial autocorrelation, based on the application of the global Moran's I statistic (Krasnykh, 2025). This method makes it possible to assess the degree of spatial dependence among entities (for example, enterprises, research centers, or infrastructure nodes), taking into account both their geographic location and the values of associated attributes, such as the volume of investment, the level of innovation activity, the density of cooperation, and so on. Moran's I formalizes the hypothesis that "like attracts like" – a principle that, within the ecosystem approach, is interpreted as a manifestation of the self-organizing forces that promote the concentration of resources, knowledge, and competencies in specific territorial nodes (Sun et al., 2022).

Formally, Moran's I is calculated using formula (1) (Griffith, 1987):

$$I = \frac{n}{S_0} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{i,j} z_i z_j}{\sum_{i=1}^{n} z_i^2}, \quad (1)$$

where:

z_i is the deviation of the attribute for feature i from its mean value $(x_i - \overline{X})$;

$w_{i,j}$ is the spatial weight between features i and j;

n is the total number of features;

S_0 is the sum of all spatial weights.

Within the approach to the analysis of cluster self-organization we describe, a key role is played by the identification of local "anchor zones" – territorial nodes where high (or, conversely, low) values of innovation activity, investment, or network density are concentrated. To this end, the High/Low Clustering tool (the Getis-Ord General G statistic, calculated in ArcGIS) is employed (Mitchell, 2005), a statistical instrument designed to detect anomalous clusters of extreme values in space.

The degree of clustering is determined on the basis of the General G index, which is calculated using the following formula:

$$G = \frac{\sum_{i=1}\sum_{j=1} w_{i,j} x_i x_j}{\sum_{i-1}^{n}\sum_{j-1}^{n} x_i x_j}, \forall j \neq i, \quad (2)$$

where:

x_i and x_j are the attribute values for features i and j;

$w_{i,j}$ is the spatial weight for the pair of features i and j;

n denotes the total number of features in the dataset;

$\forall j \neq i$ indicates that features i and j cannot be the same entity.

The next method we examined is incremental spatial autocorrelation, which makes it possible to identify the optimal spatial scale at which clustering processes manifest themselves. The tool successively applies Moran's I at increasing distances, recording the corresponding z-scores. Z. Zhao and N. Levine recommend using these "critical distances" in other analytical tools – for example, when setting the search radius for neighbors, which is calculated on the basis of the standard deviational ellipse. The presence of one or more peaks reflects the multi-level structure of the cluster ecosystem, ranging from local nodes to interregional networks (Levine, 2004; Zhao et al., 2023).

The quantitative patterns presented in this section acquire profound meaning only in the context of the evolutionary dynamics of clusters as adaptive systems (Mitchell, 1999; Martin, Sunley, 2020). Indeed, within the paradigm of regional economic development, clusters have become firmly established as key drivers of innovation growth, enhanced competitiveness, and the resilience of national economies, demanding the development of new approaches to their identification and analysis (Shirov, 2020; Smorodinskaya, Katukov, 2019).

Today, the formation and development of clusters is recognized as an effective tool for stimulating economic growth and enhancing the international competitiveness of any country. The proliferation of cluster initiatives across various sectors and geographic zones around the world testifies to the high effectiveness of this development model. At the same time, the functioning of a mature cluster creates a favorable environment for the development of small and medium-sized enterprises, contributing to the formation of a comprehensive ecosystem that includes new opportunities and infrastructure solutions.

Thus, an analysis of data from the State Information System of Industry (GISP) of the Russian Ministry of Industry and Trade shows that industrial parks currently occupy a dominant position in Russia, numbering 380 units as of June 2025, while technology parks number 137 units and entry-level clusters number only 43 units, indicating the early stages of the formation of an innovation base in the country. At the same time, only 8 units have reached a medium level of development, pointing to the difficulties of scaling up initial projects and the relevance of the problem under study.

The consideration of production clusters within the structure of economic planning is of great importance for optimizing the allocation of resources and for building sustainable regional competitive advantages. At the same time, under the conditions of mounting turbulence in the global environment, sanctions pressure, and the industrial revolution in the field of artificial intelligence, traditional deterministic approaches to managing economic systems are revealing their limitations. This, in turn, makes it especially urgent to study clusters that exhibit the properties of self-organizing systems – complex, open, nonlinear structures capable of spontaneous ordering, adaptation, and co-evolution in response to the challenges of the external environment (Polyakov, Brizhak, 2023).

Research results

In addressing the methodological problem outlined above, particular interest attaches to the study of specific industry complexes (Druzhinin et al., 2025) that display signs of self-organization. A vivid example for such an analysis is the shipbuilding and ship repair industry. The empirical basis for identifying cluster potential in the country rests on data on the spatial distribution of enterprises in the sector (Polyakov, Brizhak, 2024).

Ship repair and shipbuilding enterprises form one of the most important sectors of the Russian Federation's economy. This sector creates jobs, generates tax revenues, and makes a substantial contribution to the economic future of the region concerned. Despite all these advantages, however, shipbuilding and ship repair enterprises face major difficulties associated with the high cost of equipment and resources (especially under sanctions), complicated certification and licensing procedures, and insufficient funding and support (Polyakov, Brizhak, 2024).

In order to address the current problems, measures are being taken within the framework of state economic development policy to provide support to enterprises in the shipbuilding and ship repair sector. Shipbuilding, as an integral part of Russia's machine-building complex and its military-industrial complex, plays a strategically important role in ensuring national security and economic sovereignty. Today, the largest centers of shipbuilding in the Russian Federation are Saint Petersburg, Severodvinsk, Nizhny Novgorod, and the Kaliningrad Region. According to data for 2024, more than 180 large shipbuilding enterprises were operating in the country, of which about 87 were state-owned. This structure reflects the state's significant role in the development and regulation of the shipbuilding industry.

Table 1 presents the dynamics of the output of selected types of shipbuilding products and equipment.

The analysis of the data in Table 1 reveals a number of ambiguous trends in the river passenger vessel segment. Since the beginning of the period under review, an overall positive dynamic has been observed, with a peak value reached in 2020, after which output declined and then stabilized. The output of mixed river-sea vessels exhibits volatility, with a sharp increase in 2022, followed, however, by a return to minimal values.

In the cargo vessel segment, the production of sea-going tankers is marked by instability. The output of sea-going dry cargo vessels shows an upward trend over the period under review. The production of pleasure and sporting vessels is experiencing steady growth. The data point to the development potential of the small-tonnage shipbuilding sector.

At the same time, many companies in the sector are engaged not only in shipbuilding and ship repair but also in related fields, such as the production of propulsion, hydroacoustic, navigation, auxiliary, deck, and other equipment; materials and components for vessels; and scientific research in the area of shipbuilding and marine technology.

Table 2 presents the distribution of shipbuilding and ship repair enterprises across the federal districts of the Russian Federation.

An analysis of the distribution of shipbuilding and ship repair enterprises across the federal districts of the Russian Federation in 2023 reveals a pronounced territorial unevenness. The highest concentration is observed in the Northwestern Federal District, which accounts for 625 enterprises (35% of the total). These enterprises generated 48% of total revenue – amounting to 146.7 billion rubles – and employed 54% of the workforce in the sector

Table 1. Output of major product types in physical terms, 2017–2023

Product type	Year						
	2017	2018	2019	2020	2021	2022	2023
River passenger vessels, units	12	9	17	29	19	23	22
Mixed river-sea passenger vessels, units	1	2	2	1	1	7	1
Sea-going tankers, units	2				1		
River tankers, units		7	1				
Mixed river-sea tankers, units	7	3					14
Sea-going dry cargo vessels, units	1		8		2	3	4
Sea-going cargo-passenger vessels, units	1				1		
River dry cargo vessels, units	2	1	1	2	1	6	1
Mixed river-sea dry cargo vessels, units		5	9	18	15	5	8
Sea-going tugboats, units	8	1	1	4	36		1
Pleasure and sporting vessels, thousand units	76.3	74.2	79.7	88.3	117.4	132.5	167.4
Other pleasure or sporting vessels; rowing boats, dinghies, and canoes, thousand units	10.9	7.8	6.9	4.9	7.0	12.8	15.3

Compiled from: Output of major product types in physical terms from 2017. Available at: https://fedstat.ru/indicator/58636; Industrial production in Russia. 2023. Federal State Statistics Service. Available at: https://rosstat.gov.ru/storage/2024/03-21/99jTVCc9/Sbornik_prom_proiz_2023/Prom_proiz_06-02-2023.xlsx; Output of major product types in physical terms. Federal State Statistics Service. Available at: https://rosstat.gov.ru/storage/mediabank/Proizvodstvo_god_s_2017.xlsx

Table 2. Distribution of shipbuilding and ship repair enterprises by federal district of the Russian Federation, 2023

Federal district	Number of firms, units	Revenue, thousand rubles	Number of employees, persons
Far Eastern Federal District	290	21563228	22042
Volga Federal District	252	98703026	19997
Northwestern Federal District	625	146715235	66006
North Caucasus Federal District	10	91377	50
Siberian Federal District	83	3438417	892
Ural Federal District	27	1743301	764
Central Federal District	164	14650194	4959
Southern Federal District	337	18669752	7585
Total	1788	305574530	122295
Compiled from: data from the List-Org counterparty verification service. Available at: https://www.list-org.com/			

(66,000 people). This is due to the presence of a developed industrial infrastructure and key shipbuilding centers located in the Leningrad, Kaliningrad, Arkhangelsk, and Murmansk regions, as well as in the city of Saint Petersburg. The remaining districts (especially the North Caucasus) play a negligible role. The sectors under study clearly display a high degree of geographic concentration that is contingent on historically formed industrial clusters and on access to maritime routes of communication.

Figure 2 shows the geography of the location of shipbuilding and ship repair enterprises in the Russian Federation. According to the data presented, these enterprises are mainly concentrated in locations that are geographically situated near major bodies of water, rivers, and seas.

Table 3 presents the output data from the analysis of the spatial concentration of shipbuilding and ship repair enterprises in the Russian Federation.

Figure 2. Location of shipbuilding and ship repair enterprises in the Russian Federation
Compiled from: data from the List-Org counterparty verification service. Available at: https://www.list-org.com/

Table 3. Analysis of the spatial concentration of shipbuilding and ship repair enterprises in the Russian Federation

Concentration / dispersion measure	OKVED2			
	30.1	30.11	30.12	33.15
Gini	0.969345	0.95515	0.935518	0.920427
Gini n	0.972936	0.95869	0.938983	0.923836
Gini w	0.957014	0.96046	0.930128	0.921742
Gini w n	0.960558	0.96402	0.933573	0.925156
HHI	0.210652	0.17050	0.088742	0.061625
HHI n	0.207729	0.16743	0.085367	0.058150
HHI eq	4.747162	5.86508	11.268654	16.227133
Hoover	0.888081	0.85717	0.826128	0.810508
Hoover w	0.003934	0.00426	0.004719	0.003763
Coulter	0.324674	0.29208	0.204714	0.175447
Atkinson	0.931474	0.87999	0.862611	0.812610
SD	40.532619	2466.03171	33.739741	288.821821
SD w	32.672611	1952.23772	44.440551	256.802381
CV	7.502964	6.73596	4.809821	3.969707
CV n	0.456616	0.40994	0.292716	0.241589
Williamson	7.317183	6.39616	4.174318	4.110894
Compiled from: data from the List-Org counterparty verification service. Available at: https://www.list-org.com/				

The results of the analysis point to a pronounced tendency toward spatial concentration in the shipbuilding and ship repair industries. The high values of the Gini coefficients, ranging from 0.92 to 0.97, indicate a considerable degree of inequality in the distribution of enterprises across the subjects of the Russian Federation. This suggests that the bulk of the existing economic activity in the industries under study is confined to a relatively small number of regions, which is fully consistent with the cartographic picture of the enterprises' location. At the same time, it should be noted that such a configuration carries risks for the long-term resilience not only of the industries in question but also of the national economy as a whole.

The high values of the other coefficients presented in Table 3 confirm the conclusion that a very limited number of regions accumulate the lion's share of economic activity in the sectors under study. At the same time, the elevated values of the Williamson coefficient further highlight the depth of interregional contrasts in levels of economic development – for all the industries without exception – and once again point to the existing regional asymmetry of current industrial development.

Figure 3 presents a chart that reflects the level of spatial concentration of shipbuilding and ship repair enterprises in the Russian Federation, using Lorenz curves and Gini coefficients (G and G*).

The analysis of the spatial concentration of shipbuilding and ship repair enterprises in the Russian Federation shows that most segments of the industry exhibit a high degree of territorial concentration. This means that enterprises engaged in the construction and repair of vessels are concentrated in a relatively small number of the country's regions. A particularly high degree of concentration is observed in the

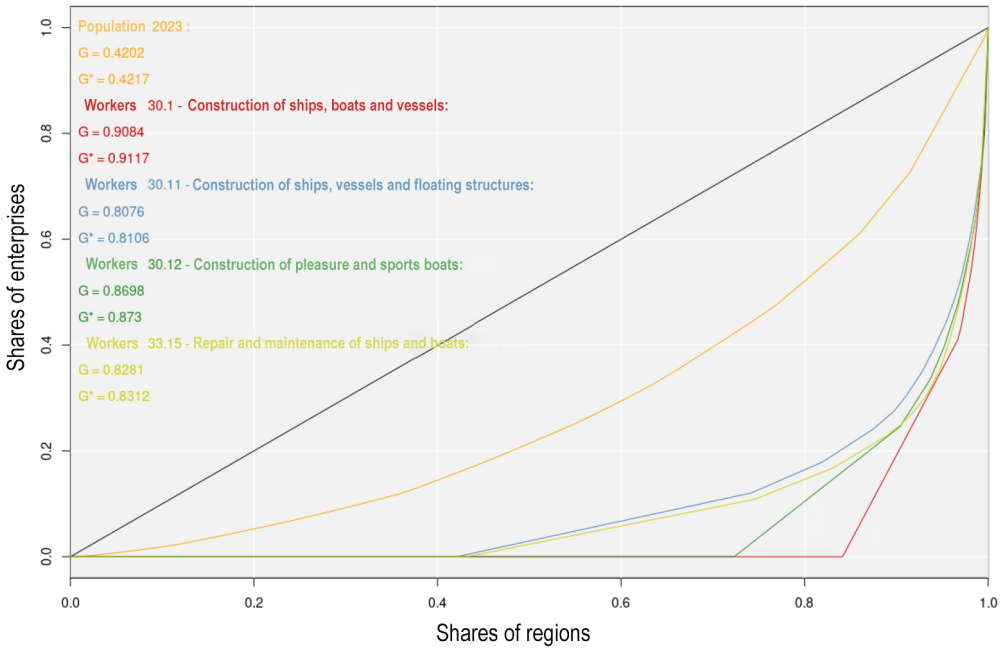

Figure 3. Spatial concentration of shipbuilding and ship repair enterprises in the Russian Federation

Compiled from: data from the List-Org counterparty verification service. Available at: https://www.list-org.com/

segment of the construction of ships, vessels, and boats (30.1), as well as in the construction of pleasure and sporting boats (30.12) and in ship repair (33.15). This may be attributable to historical, infrastructural, or resource factors, as well as to the presence of shipbuilding clusters (for example, in Saint Petersburg, Kaliningrad, and the Russian Far East) and to the logistical advantages enjoyed by coastal regions.

Thus, according to data for 2023 *(Tab. 4)*, a pronounced territorial concentration of specialized enterprises is observed in the Kaliningrad Region. This distribution not only makes it possible to register the fact of geographic agglomeration (Strano et al., 2021) but also serves as a starting point for a deeper analysis of the manifestations of self-organization – an analysis of cooperative ties, value chains, and institutional interactions among geographically proximate enterprises, which forms the basis for identifying a self-organizing cluster in the region's shipbuilding sector.

An analysis of the data in Table 4 shows that the regional center – the City of Kaliningrad Urban Okrug – is the clear leader across all indicators. It accounts for the largest number of employees – 1,658 persons, or 59.5% of the total number employed in the sector; the largest number of firms – 63 units; and 83.4% of all revenue, which points to the concentration of the industry's main production capacities and economic resources in the regional center.

The structure of the distribution of shipbuilding and ship repair enterprises across the cities of the Kaliningrad Region in 2023 is presented in *Figure 4*. According to this figure, the Svetly and Baltiysk Urban Okrugs are also important centers of the shipbuilding industry beyond the regional center, specializing mainly in ship repair in the port zone.

At the same time, a substantial share of the municipal okrugs show zero values for both revenue and the presence of enterprises in the industry under study. This indicates that beyond Kaliningrad, industry activity is dispersed in a fragmentary fashion, lacking stable spatial structures, which may limit the synergistic potential of the regional cluster ecosystem.

Table 4. Distribution of shipbuilding and ship repair enterprises by municipal okrug in the Kaliningrad Region, 2023

Okrug No.	Municipal okrug	Revenue, thousand rubles	Number of firms, units	Number of employees, persons
0	Ozersk Municipal Okrug	0	0	0
1	Nesterov Municipal Okrug	499	1	5
2	Yantarny Urban Okrug	0	0	0
3	Gusev Urban Okrug	0	0	0
4	Krasnoznamensk Municipal Okrug	0	0	0
5	Ladushkin Urban Okrug	0	0	0
6	Svetlogorsk Urban Okrug	8118	2	4
7	City of Kaliningrad Urban Okrug	15113538	63	1658
8	Pionersky Urban Okrug	0	0	0
9	Zelenogradsk Municipal Okrug	0	0	0
10	Svetly Urban Okrug	1520079	11	401
11	Gvardeysk Municipal Okrug	0	0	0
12	Bagrationovsk Municipal Okrug	0	0	0
13	Chernyakhovsk Municipal Okrug	0	1	1
14	Neman Municipal Okrug	0	0	0
15	Polessk Municipal Okrug	0	0	0
16	Sovetsk Urban Okrug	6707	1	7
17	Slavsk Municipal Okrug	0	0	0
18	Pravdinsk Municipal Okrug	0	0	0
19	Baltiysk Urban Okrug	1330958	5	684
20	Guryevsk Municipal Okrug	134310	3	28
21	Mamonovo Urban Okrug	0	0	0
Compiled from: data from the List-Org counterparty verification service. Available at: https://www.list-org.com/				

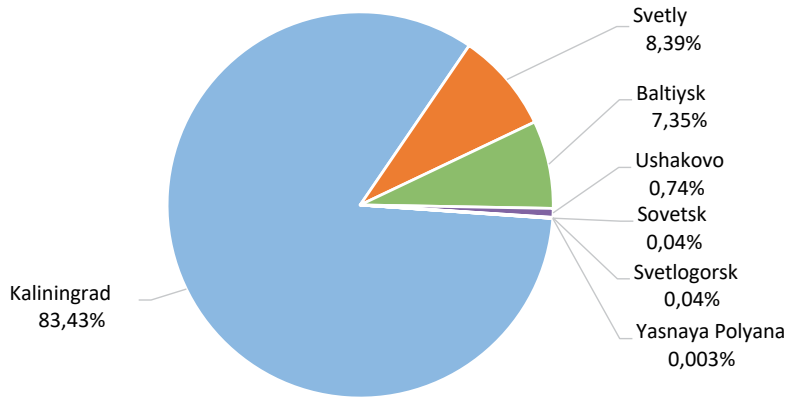

Figure 4. Structure of the distribution of shipbuilding and ship repair enterprises across the cities of the Kaliningrad Region, 2023, %
Source: own compilation.

Spatial analysis of the Kaliningrad Region

Let us now draw on the author's dataset DatsetOKVED, which contains information on 1,788 companies in the shipbuilding and ship repair industry of the Russian Federation (OKVED 30.1, 30.11, 30.12, 33.15), and carry out a comprehensive spatial analysis of these industries using the example of the Kaliningrad Region. To do this, we plot the data on a map and analyze the distribution of shipbuilding and ship repair enterprises across the districts of the Kaliningrad Region *(Fig. 5)*.

The distribution of shipbuilding and ship repair enterprises in the Kaliningrad Region corroborates the data analyzed earlier and demonstrates pronounced local clustering within the City of Kaliningrad Urban Okrug, which once again testifies to the concentration of production and innovation potential in the regional center. At the same time, these enterprises give rise to the dominance of agglomeration effects, which are manifested in the developed infrastructure, the availability of skilled personnel, and a favorable investment climate.

However, the data in Figure 5 point to the absence of statistically significant spatial autocorrelation in the distribution of shipbuilding and ship repair enterprises across the territory of the Kaliningrad Region, with the pattern being essentially random. The values obtained for Moran's I, the z-score, and the p-value likewise indicate that the spatial distribution of the enterprises displays no pronounced clustering or dispersion, leaning rather toward a random pattern, since there are no statistically significant signs of spatial autocorrelation. This may be attributable to several factors. First, at the scale of the Kaliningrad Region – which encompasses a large territory with diverse economic and geographic conditions – the local clusters observed within the city are leveled out. Second, the presence of the enterprises under study in locations outside the city may be shaped by other factors that are unrelated to the agglomeration effects typical of the city – for instance, proximity to the ports of Kaliningrad (the commercial and fishing ports), Svetly, Baltiysk, and Pionersky, to ship repair bases, to raw-material sources, or to logistical nodes. Third, the analysis covers the entire territory of the region, including districts where shipbuilding and ship repair enterprises are either present in single instances or entirely absent, a fact that affects the overall picture of spatial distribution.

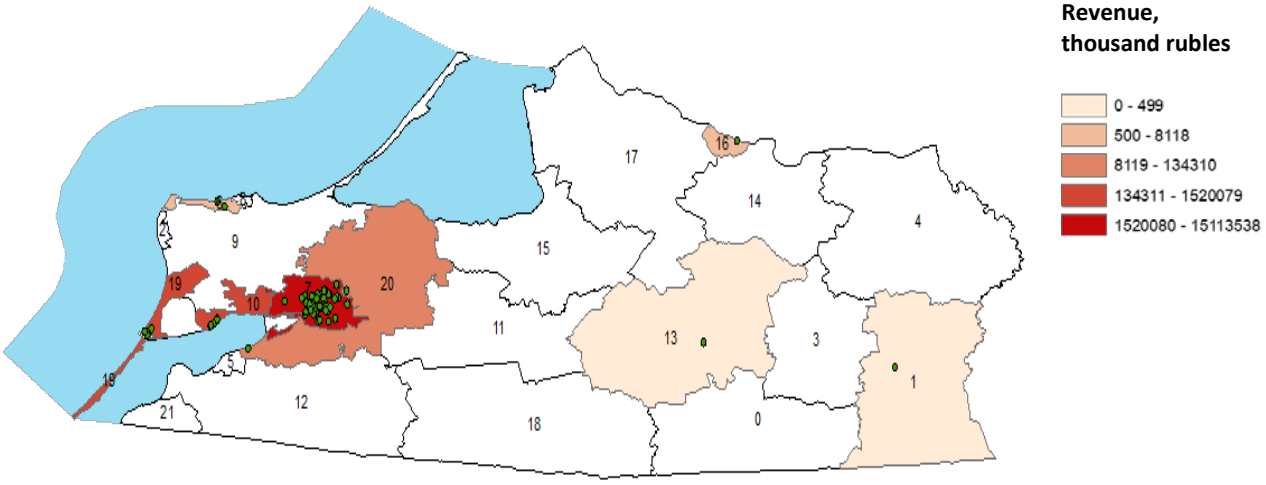

Figure 5. Distribution of the revenue of shipbuilding and ship repair enterprises across the districts of the Kaliningrad Region, 2023

Source: own compilation using ArcMap software (Esri Inc. (2019). ArcMap 10.8. Available at: https://www.esri.com/en-us/arcgis).

Given the identified concentration of industry activity within the City of Kaliningrad Urban Okrug, the subsequent study will focus on its territorial boundaries. This stage envisages a detailed spatial analysis aimed at identifying the key factors that give rise to the formation and functioning of the cluster ecosystem in the urban environment, with a particular emphasis on the specificities of the shipbuilding and ship repair industries. Such an approach will make it possible to uncover the local mechanisms of self-organization, the institutional and infrastructural conditions, and the spatial patterns of interaction among economic agents that either facilitate or, conversely, constrain the development of the sector's potential at the micro level (Druzhinin et al., 2025; Chen et al., 2024).

Spatial analysis of the City of Kaliningrad Urban Okrug

Using the data in *Table 5*, let us analyze the concentration indicators for shipbuilding and ship repair enterprises across the districts of the City of Kaliningrad Urban Okrug. This analysis will make it possible to identify the specific features of the sector's location within the city, to assess the contribution of each district to the overall picture, and to pinpoint possible development trends.

Moskovsky District exhibits an overwhelming superiority across all three indicators: revenue, costs, and number of employees. The values of these indicators point to the concentration of the industry's main production capacities and employment in this district. It is here that the Yantar Baltic Shipyard (hereinafter referred to as PSZ Yantar JSC) is located – the leading enterprise in the sector, which specializes in military and civil shipbuilding, ship repair, as well as the production of metal structures and products in the sphere of machine building. In addition, Moskovsky District is home to the key transport and logistical infrastructure: the Kaliningrad Commercial Sea Port, which handles freight and passenger traffic; the Kaliningrad Sea Fishing Port; and the Kaliningrad River Port, situated on the Pregolya River and servicing inland freight transportation.

The combination of a favorable geographic location – at the mouth of the river and at the junction of sea and river routes – together with the developed infrastructural base, forms the spatial core of attraction for enterprises in the sector, promoting the concentration of production capacities, logistical links, and human resources. This, in turn, reinforces the agglomeration effects and has a substantial influence on the self-organization of the ecosystem of this industry cluster.

Next, the map *(Fig. 6)* pinpoints the locations of the enterprises in the sector, while the aggregate revenue by district is marked in color. The concentration of objects in Moskovsky District, as well as the high revenue values in this zone, testify to the formation of an economic core of the cluster that brings together production capacities and infrastructural nodes.

Table 5. Concentration indicators for shipbuilding and ship repair enterprises across the districts of the City of Kaliningrad Urban Okrug, 2023

District ID	District name	Total revenue, thousand rubles	Total costs, thousand rubles	Number of employees, persons
0	Leningradsky District	95983	67737	18
1	Tsentralny District	279559	128240	182
2	Moskovsky District	14737996	1697620	1458
Total		15113538	1893597	1658
Compiled from: data from the List-Org counterparty verification service. Available at: https://www.list-org.com/				

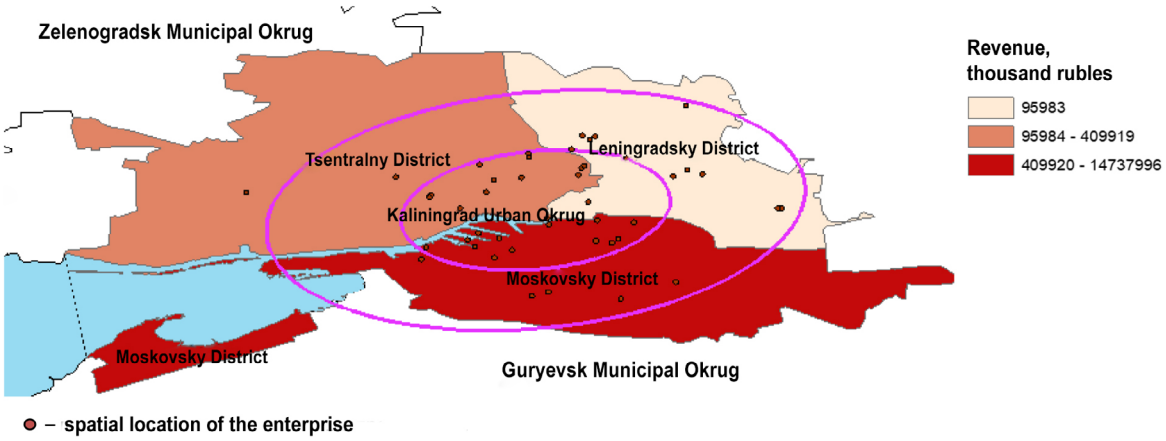

Figure 6. Standard deviational ellipse reflecting the spatial concentration and direction of the distribution of shipbuilding and ship repair enterprises in the City of Kaliningrad Urban Okrug, 2023

Source: own compilation using ArcMap software (Esri Inc. (2019). ArcMap 10.8. Available at: https://www.esri.com/en-us/arcgis).

Tsentralny District ranks second in terms of revenue (279,559 thousand rubles), costs, and number of employees (182 persons). It plays a substantial role, although it trails Moskovsky District considerably in terms of the scale of activity. Research shows that Tsentralny District in Kaliningrad – on Pravaya Naberezhnaya Street – hosts a concentration of enterprises that perform functions such as design, repair, and supply, as well as smaller-scale enterprises likewise specializing in shipbuilding and ship repair (for instance, Baltiyskaya Sudoremontnaya Kompaniya LLC and other ship repair companies).

A standard deviational ellipse has also been constructed on the map around the enterprises' locations, showing the dominant direction and degree of dispersal of the objects. The elongation of the ellipse along the coastline points to an anisotropy in the distribution that is shaped by transport, logistical, and infrastructural factors of importance to the sector.

By default, the size of the ellipse is set to 1, which corresponds to the cluster core. In addition, a second ellipse was constructed covering two standard deviations, which supports the hypothesis advanced regarding the homogeneity of the input class of all the spatial objects selected. These geometric characteristics of the distribution find quantitative confirmation in the results of the nearest neighbor analysis.

The author then carried out an analysis of the spatial distribution of shipbuilding and ship repair enterprises in the City of Kaliningrad Urban Okrug using the nearest neighbor method *(Tab. 6)*.

Table 6. Nearest neighbor summary for shipbuilding and ship repair enterprises in the City of Kaliningrad Urban Okrug, 2023

Indicator	Value
Observed mean distance	423.4645 m
Expected mean distance	673.6942 m
Nearest neighbor ratio	0.628571
z-score	-5.639976
p-value	0.000000
Source: own compilation using ArcMap software (Esri Inc. (2019). ArcMap 10.8. Available at: https://www.esri.com/en-us/arcgis).	

The results of the nearest neighbor analysis confirm the presence of statistically significant spatial clustering of shipbuilding and ship repair enterprises in Kaliningrad. The nearest neighbor ratio, which stands at 0.629 (substantially below one), points to a tighter clustering of the enterprises than would be observed under a random distribution. The high negative z-score (–5.64) and a p-value close to zero (0.001) testify to the presence of stable local agglomeration effects and the functional interconnectedness of the industry's participants, which form the core of the cluster ecosystem.

The observed mean distance between each enterprise and its nearest neighbor is 423.46 m, which is substantially below the expected value of 673.69 m under a random distribution. The corresponding nearest neighbor ratio is 0.6286, which unequivocally points to a tendency toward the concentration of objects in space. The clustering identified reflects not only geographic concentration but also the functional interdependence of the industry's participants, which forms the basis for the self-organization of the cluster ecosystem at the local level.

The results of the spatial autocorrelation analysis for the shipbuilding and ship repair enterprises in the City of Kaliningrad Urban Okrug, using the Global Moran's I summary by distance, are presented next *(Fig. 7)*.

The results show that at short distances (400 to 1,000 m), Moran's I takes low positive values – from 0.0227 to 0.0247. The high p-values, however, which lie in the range of 0.24 to 0.32, point to the absence of statistically significant autocorrelation. At the same time, at intermediate distances of 1,200 to 2,000 m, a clear and statistically reliable clustering is observed: Moran's I reaches a maximum of 0.1245 at 1,200 m ($p = 0.0002$), and the values at the remaining distances in this range are also significant ($p < 0.01$).

These findings indicate that enterprises in the sector show a tendency toward localization and tend to group within a radius of 1.2 to 2.0 km around key infrastructural centers – port zones, industrial clusters, or transport arteries. At a distance of 2,200 meters, the index drops to 0.0339 but retains statistical significance at $p = 0.0344$, which points to a weakening of the spatial ties, though by no means to their complete disappearance.

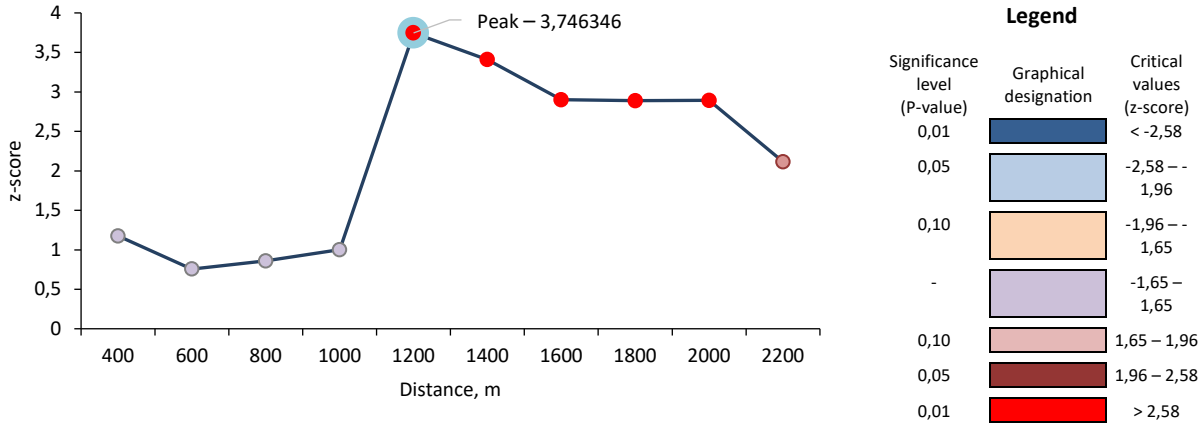

Figure 7. Result of the spatial autocorrelation analysis using the global Moran's I summary for shipbuilding and ship repair enterprises in the City of Kaliningrad Urban Okrug, 2023

Source: own compilation using ArcMap software (Esri Inc. (2019). ArcMap 10.8. Available at: https://www.esri.com/en-us/arcgis).

To verify the quantitative estimates obtained, the author performed an analysis of the spatial distribution of the enterprises in the industry under study using the General G statistic (Getis-Ord). The calculation showed that the observed value of G is 0.0888, which is noticeably higher than the expected value under a random distribution (0.0162). Consequently, a purposeful concentration of enterprises in certain urban zones is taking place.

The spatial concentration and the direction of the distribution of shipbuilding and ship repair enterprises in the cluster within the City of Kaliningrad Urban Okrug are presented in *Figure 8*.

An analysis of the results shows that the threshold distance (3,948.92 m) defines the radius within which enterprises are treated as spatial neighbors when calculating the index. Thus, shipbuilding and ship repair enterprises are not randomly distributed but are concentrated in local clusters, which is consistent with the hypothesis of the territorial agglomeration of the sector, driven by the presence of infrastructure, logistical, and production factors.

It is worth noting that the "high-low" (HL) outlier clearly points to an area with a high level of concentration / productivity. The region's largest enterprise, PSZ Yantar JSC, is located here, yet it is surrounded by territories with low concentration/productivity. The value identified also points to a local center of activity that has so far not exerted a substantial positive influence on neighboring enterprises owing to its low cooperative activity.

The second outlier, "low-high" (LH), reflects an opposite site, where an area with a low concentration of enterprises is surrounded by areas with a high concentration. This is a depressed area within a developed cluster, which points to the heterogeneity of the development of the territory under study.

A graphical analysis of the spatial clustering of shipbuilding and ship repair enterprises in the City of Kaliningrad Urban Okrug, using the General G statistic, is presented next *(Fig. 9)*.

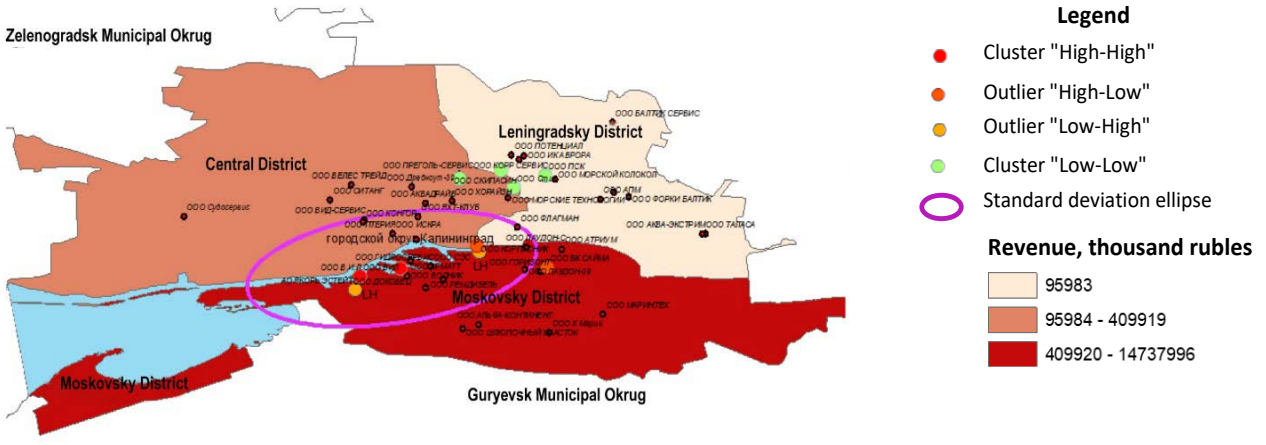

Figure 8. Spatial concentration and direction of distribution of shipbuilding and ship repair enterprises in the cluster in the City of Kaliningrad Urban Okrug, 2023

Source: own compilation using ArcMap software (Esri Inc. (2019). ArcMap 10.8. Available at: https://www.esri.com/en-us/arcgis).

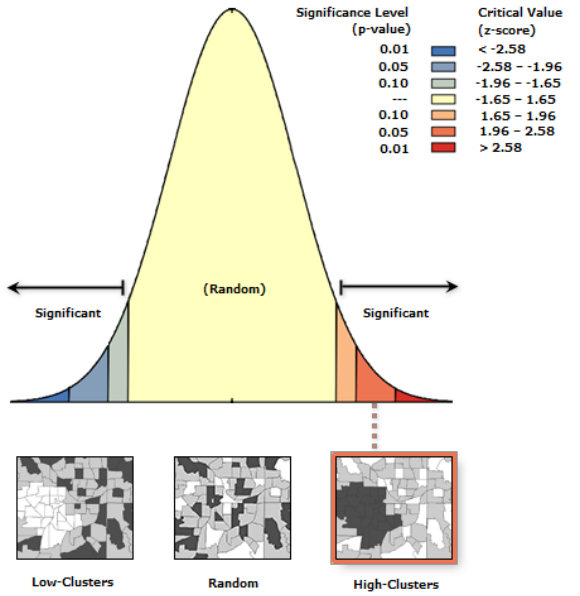

Figure 9. Analysis of the spatial clustering of shipbuilding and ship repair enterprises in the City of Kaliningrad Urban Okrug using the General G statistic, 2023

Source: own compilation using ArcMap software (Esri Inc. (2019). ArcMap 10.8. Available at: https://www.esri.com/en-us/arcgis).

The results in Figure 9 are consistent with the conclusions drawn earlier in the nearest neighbor analysis and confirm the tendency toward the concentration of enterprises in certain districts of the city. Further research can be directed toward a more detailed analysis of the factors influencing the spatial clustering of shipbuilding and ship repair enterprises, as well as toward an assessment of the consequences of this clustering for the economy of the city and of the region under study.

To conclude our investigation, we make use of the Trend Analysis tool in ArcGIS to visualize the spatial dynamics of the coordination of ties among shipbuilding and ship repair enterprises in the City of Kaliningrad Urban Okrug *(Fig. 10)*.

The figure depicts a three-dimensional surface on which the X and Y axes plot the geographic coordinates of the spatial location of the enterprises in the industry under study, while the Z axis plots an integral coordination indicator that accumulates the number of enterprises, their revenue, and the number of employees.

This analysis serves, on the one hand, as a basis for the subsequent study of network interconnections among the enterprises – an investigation the author plans to present in

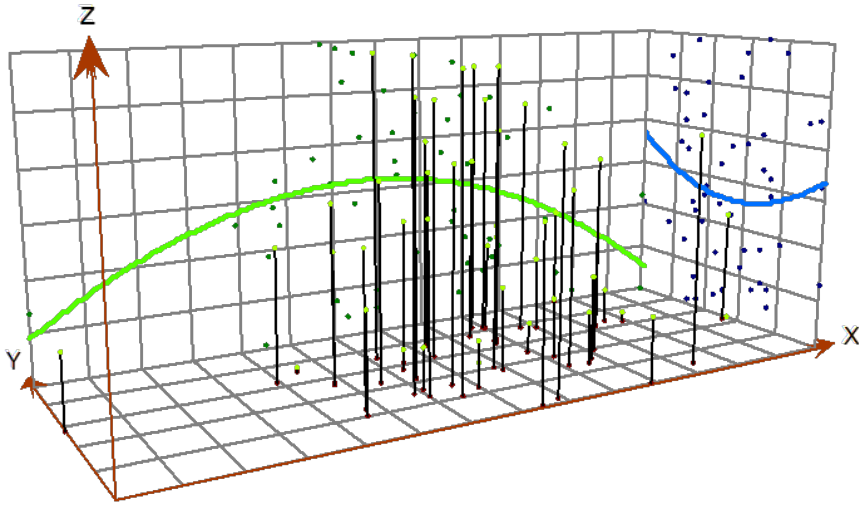

Figure 10. Three-dimensional trend surface analysis reflecting the spatial dynamics of the coordination of ties among shipbuilding and ship repair enterprises in the City of Kaliningrad Urban Okrug, 2023

Source: own compilation using ArcMap software (Esri Inc. (2019). ArcMap 10.8. Available at: https://www.esri.com/en-us/arcgis).

the next cycle of works – and, on the other, for identifying the potential factors that shape their location. Among such factors are access to infrastructure, logistical nodes, skilled personnel, and the institutional environment, which together create the conditions for the self-organization of the cluster ecosystem.

Conclusion

Drawing on an interdisciplinary synthesis of economic geography, regional economics, and network theory, the present study has not only tested the author's methodology of spatial analysis but has also yielded a number of substantive conclusions of both theoretical and applied significance.

First and foremost, it has been empirically confirmed that the traditional interpretation of an industrial cluster as a simple geographic agglomeration of enterprises is insufficient for understanding the processes that actually take place in space. Using the example of the shipbuilding and ship repair industry of the Kaliningrad Region, it has been convincingly demonstrated that the key characteristic of the emerging cluster ecosystem is not so much the very fact of territorial proximity as the presence of statistically significant spatial patterns of self-organization – that is, of ordered structures that can be revealed only through the multi-level application of spatial statistics instruments.

One of the most substantial findings is the opposing directionality of the spatial dynamics, depending on the chosen scale of analysis. At the level of the whole of the Kaliningrad Region, the distribution of enterprises is statistically indistinguishable from random, pointing to the fragmentation of the industrial landscape and the absence of stable inter-municipal cooperative ties. When the level is shifted to that of the City of Kaliningrad Urban Okrug, however, the picture changes fundamentally: here, a stable and statistically significant spatial clustering is registered, forming a compact core with a high density of enterprise location.

Of particular note is the "critical" clustering radius that was identified – between 1.2 and 2.0 km – within which the enterprises display the greatest spatial interdependence. This interval most likely reflects the actual radius of economic interaction, which is shaped by transport and logistical accessibility, the possibility of the prompt exchange of services and components, and the shared use of port and industrial infrastructure. The fact that, at a distance of 2.2 km, spatial autocorrelation, while weakening, nonetheless retains its statistical significance, points to the gradual, rather than abrupt, nature of the attenuation of the agglomeration effects.

It is important to stress that the spatial concentration of enterprises does not in itself constitute sufficient evidence of the existence of a cluster in the ecosystem sense of the term. The results obtained in the paper – the high values of the Gini coefficients, the statistically significant indicators of the General G statistic, the confirmed clustering at the level of the nearest neighbor analysis – provide a necessary but not a sufficient basis for a definitive conclusion regarding the presence of a self-organizing ecosystem. It is noted that the next cycle of research should be devoted to the analysis of the network interconnections among enterprises, since it is the density of cooperative ties, the intensity of knowledge exchange, and the level of institutional trust that transform a geographic agglomeration into a genuine cluster.

From a practical perspective, the methodology proposed here – which combines quantitative GIS methods with ecosystem logic – can be viewed as a tool for the targeted adjustment of regional industrial policy. The spatial core that was identified within the boundaries of Moskovsky District of

Kaliningrad, coinciding with the zone where PSZ Yantar JSC and the key port facilities are located, represents a natural proving ground for targeted institutional and infrastructural interventions. In contrast to the "diffuse" support of the entire industry across the region, the concentration of measures precisely within the boundaries of the identified cluster core is capable of yielding a higher multiplier effect.

In a broader context, the present paper contributes to the debate on the limits of the applicability of spatial analysis in regional economic research. It has been demonstrated that the absence of clustering at one territorial level by no means precludes its presence at another, more local level – a fact that requires both the researcher and the practitioner to forego the search for a single "correct" scale of analysis in favor of a multi-level diagnostic approach. It is precisely in this capacity to capture the heterogeneity of spatial processes that, in our view, the main value of the proposed approach lies.

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ПРОСТРАНСТВЕННАЯ САМООРГАНИЗАЦИЯ ОТРАСЛЕВЫХ КЛАСТЕРОВ: МЕТОДОЛОГИЯ И АПРОБАЦИЯ

Осмысление динамики измерения кластерных процессов невозможно без опоры на фундаментальные разработки российской научной школы, в рамках которой сформировалась современная научная парадигма пространственного анализа России. В связи с этим данное исследование посвящено актуальной проблеме пространственного анализа кластеров с позиции теории самоорганизации сложных адаптивных систем. Его цель состоит в разработке и апробации методологии выявления и оценки пространственных паттернов самоорганизации на примере судостроительной и судоремонтной отрасли Калининградской области. Анализ пространственного распределения кластеров требует междисциплинарного синтеза экономической географии, региональной экономики и теории сетей, поскольку именно при пересечении этих направлений возникают наиболее продуктивные инструменты для выявления закономерностей локализации кластерных образований. Методологический аппарат базируется на комплексном применении инструментов пространственной статистики в среде геоинформационных систем. На примере судостроения и судоремонта Калининградской области было продемонстрировано, что традиционный взгляд на кластер как на простую географическую агломерацию является недостаточным. Применение комплекса методов пространственной статистики показало свою эффективность для многоуровневой диагностики. Результаты исследования демонстрируют, что в региональном масштабе распределение предприятий статистически не отличается от случайного, однако на уровне городского округа «Город Калининград» выявлена статистически значимая пространственная кластеризация, формирующая ядро потенциального самоорганизующегося кластера. Установлено, что концентрация предприятий тяготеет к ключевой инфраструктуре и проявляется на определенных пространственных масштабах, т. е. радиусах, что подтверждает действие агломерационных эффектов и наличие условий для синергетического взаимодействия. Полученные результаты показывают, что предлагаемый методический подход позволяет осуществить качественный переход от констатации географической концентрации к диагностике процессов самоорганизации. Это имеет важное практическое значение для формирования адресной территориальной политики целенаправленного развития кластеров в региональном масштабе.

Пространство, распределение, промышленность, кластер, местоположение, судостроение, судоремонт, самоорганизация.

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ELECTRICITY CONSUMPTION AND THE GROWTH OF REGIONAL ECONOMIES

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The relevance of the research topic is due to the need to determine a scientifically sound approach to the sustainable development of the Russian Federation and its subjects, whose economies are constantly influenced by many different factors, including latent influence on it. One of these factors is electricity, or rather its consumption, which is characterized in linear correlation models by the dependence between variables: electricity consumption and gross regional product. In turn, electricity consumption is influenced by prices set by government authorities, which can both stimulate and reduce electricity consumption in the region, and hence the growth rate of regional economies. Unlike other publications on this topic, the article uses a territorial approach, the grouping method, and correlation and regression analysis to determine whether authorities can make incident decisions to increase or decrease the cost of electricity in a region (typological group of regions), which represents certain elements of novelty. As a result of the study, three main groups of regions were formed: two with a positive correlation between the region's electricity consumption and the gross regional product, and one with a negative one. Conclusions have been drawn for each group and practical recommendations regarding tariff policy have been given. Confidence intervals (with a confidence level of 99%) are used to assess the accuracy of the results obtained and to test them. Theoretically,

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the research results make an estimated contribution to the sustainable development of the region, taking into account the use of electricity as one of the factors of economic growth; in practical terms, the conclusions and recommendations can be useful to regional authorities in implementing their tariff policy.

Gross regional product, demand for electricity, tariff policy, energy saving, correlation, territorial and sectoral balance, regions of Russia, regression analysis.

Introduction

A steady growth in electricity consumption is a pronounced global trend. According to forecasts by the International Energy Agency, global electricity consumption could rise by roughly 4% in 2026, driven by growing demand: in the United States consumption may grow by about 2%, and in European countries by around 2.5%. Expert estimates suggest that electricity demand in Russia could increase by the same 2.5% in 2026. Overall, Rosstat data[1] indicate that electricity consumption in Russia has grown by 13.31% over the past ten years (from 2014 to 2024).

Both in theory and in practice, a certain relationship exists between economic growth and the use of energy resources (including electricity consumption). An analysis of the productive economic activity of Russia's federal subjects shows that, over the period from 2008 to 2022, the gross regional product (GRP) of the Kaluga Region rose by 461.42% (from 150,394.4 million to 693,947.6 million rubles), while electricity consumption increased by 182.5% (from 4,250.5 million to 7,757.2 million kWh); in the Republic of Adygea, GRP grew by 545.1% (from 36,134.4 million to 197,082.0 million rubles), and electricity consumption rose by 199.1% (from 992.5 million to 1,975.2 million kWh); and in the Republic of Ingushetia, GRP expanded by 428.87% (from 19,172.9 million to 82,227.3 million rubles), with electricity consumption up by 189.78% (from 495.1 million to 939.6 million kWh)[2].

On the other hand, in several regions of the country, growth in GRP over the same period has been accompanied by a decline in electricity consumption. In the Tomsk Region, for instance, a 325.26% increase in GRP was recorded alongside a drop in electricity consumption (to 83.05% of the earlier level); a similar picture is observed in the Kurgan Region, Ulyanovsk Region, and other constituent entities of the Russian Federation: GRP growth (of 319.64 and 390.78%, respectively) went hand in hand with falling electricity consumption (down to 88.46 and 86.77% of the earlier level). This heterogeneity in electricity consumption – characterized by both positive and negative dynamics – gives rise to uneven rates of regional economic growth, which may be attributable to the differing electricity prices that result from each region's energy policy.

Theoretical studies by foreign authors (Escribano, Sucarrat, 2018; Wang et al., 2018; Dong et al., 2019; Yilmaz et al., 2019; Haluzan et al., 2020; He et al., 2020; Richstein, Hosseinioun, 2020; Zhang et al., 2020; Lu et al., 2021; Uniejewski, Weron, 2021) and the multivariate economic-mathematical models built upon them demonstrate that the pricing mechanism does influence economic growth. In developing and transition economies, "the causal relationship between electricity consumption and economic growth manifests

[1] Regions of Russia. Socio-Economic Indicators. 2023. Available at: https://rosstat.gov.ru/folder/210/document/13204 (accessed: 21.03.2026).

[2] Electricity production and consumption in the Russian Federation. Available at: https://fedstat.ru/indicator/33942?ysclid=mbkyzl51ja648798770 (accessed: 21.03.2026); Electricity consumption by subjects of the Russian Federation. Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Frosstat.gov.ru%2Fstorage%2Fmediabank%2Felbalans_2023.xlsx&wdOrigin=BROWSELINK (accessed: 21.03.2026).

itself in linear direct-dependence models in which the main argument is energy elasticity: the more energy resources are drawn into productive economic activity, the higher the rate of economic growth" (Belov, 2025).

At the same time, one important fact should be noted: the demand for electricity is inelastic (owing to the vital necessity of this "commodity" and the absence of a full-fledged alternative), whereas the supply of electricity should be regarded as elastic (given the availability of production capacity in many regions of the country), with producers that not only aim to maximize profits but are also capable of responding promptly to changing market conditions and needs. This means that permanent demand will be met by the requisite supply of electricity, a situation which, in principle, contradicts the concept of energy conservation and the relevant documents adopted in the country[3]. Consequently, price regulation in different regions of the country should lead to the necessary territorial-sectoral balance between electricity production and consumption – a balance that, on the one hand, ensures regional economic growth and, on the other, the implementation of energy conservation policy. It follows that electricity consumption – or, more precisely, its price – acts as one of the factors promoting a region's economic growth. In this connection, an analysis of regional electricity consumption appears essential in order to develop and apply an effective pricing mechanism capable of fostering regional economic growth under conditions of sustainable development.

Literature review

The Russian periodical press contains a substantial number of contemporary publications devoted to the study of energy consumption (including electricity consumption) both in individual regions and across the country as a whole. The pricing mechanism (tariff policy) is regarded by many authors as a key component in regulating economic development. For example, the authors (Temnaya, Agafonov, 2024) investigate the dependence of the electricity intensity of gross regional product on electricity prices and conclude that lowering electricity prices leads to an increase in GRP electricity intensity. This conclusion is drawn on the basis of a calculated linear dependence coefficient that takes a negative value. In another paper (Nekrasov, 2023), by contrast, the author proposes stimulating electricity consumption in lagging regions with low electric power availability as a means of raising the profitability of goods produced and boosting labor productivity. In yet another article, the same author likewise suggests increasing electricity consumption by reducing electricity prices. The author concludes that this should be done for "new non-household electricity consumers in regions where per capita electricity consumption is below the level of developing countries" (Nekrasov, 2022) – that is, for industrial and agricultural production. This, it is argued, would help preserve the "structural resilience" of the Russian economy. One may add here another paper that proposes the same instrument of state regulation – lowering tariffs for electricity transmission services – in order to "enhance

[3] On Certain Measures to Improve the Energy and Environmental Efficiency of the Russian Economy: Decree of the President of the Russian Federation No. 889 of June 4, 2008. Available at: http://www.kremlin.ru/acts/bank/27565 (accessed: 21.03.2026); On Energy Conservation and Improvement of Energy Efficiency and on Amendments to Certain Legislative Acts of the Russian Federation: Federal Law No. 261-FZ of November 23, 2009 (latest version). Available at: https://www.consultant.ru/document/cons_doc_LAW_93978/?ysclid=lq5fnxxfr5684472709 (accessed: 21.03.2026); On Approval of the Comprehensive State Program of the Russian Federation "Energy Conservation and Improvement of Energy Efficiency": Resolution of the Government of the Russian Federation No. 1473 of September 9, 2023. Available at: https://docs.cntd.ru/document/1302984058?ysclid=lova6gywsu596227627 (accessed: 21.03.2026); On Approval of the Strategy for the Spatial Development of the Russian Federation for the Period up to 2030, with a Forecast up to 2036: Resolution of the Government of the Russian Federation No. 4146-r of December 28, 2024. Available at: https://docs.cntd.ru/document/1310767692?section=status (accessed: 21.03.2026).

the investment attractiveness of depressed and less developed regions" (Afanas'ev et al., 2023). In a further article (Petrov, Serkov, 2024), causal relationships are identified between economic growth and the electricity consumption of industrial enterprises (using the examples of two subjects of the Russian Federation – Sverdlovsk Region and Chelyabinsk Region). The authors conclude that electricity consumption in the Sverdlovsk Region "depends solely on the rate of economic growth", whereas in the Chelyabinsk Region, which has a similar industrial potential, it depends on the volume of industrial output.

Another study defines the outlook for electricity demand in the country's regions over the period 2025–2040. The authors note differences in electricity consumption across regions "due to substantial specificities in sectoral specialization and the standard of living of the population" (Mazurova et al., 2022) and conclude that the existing trend will persist – demand will increase by an average of 1.4–1.8% per year, primarily in the Siberian and Far Eastern federal districts. The article by I.G. Akhmetova, E.M. Mainaksky, and A.E. Popov also addresses the dependence of the socio-economic development of territories (municipal formations) on electricity consumption, which is not fully reflected in the "indicative system for assessing the economic development of municipal formations of a subject of the Russian Federation on the basis of electricity consumption" (Akhmetova et al., 2024).

There are other publications on the research topic as well (Gorbacheva, 2020; Ishchuk, 2019; Kareva, 2017; Maslova, Daneev, 2019; Nigmatulin, 2019; Yurkov, 2018; Yashchenko, 2022). However, a number of important considerations prompt further investigation in this area. First, it is apparent that authors frequently adhere to one of two approaches – either a sectoral or a territorial one – whereas the relationship between economic growth and regional electricity consumption calls for an integrated territorial-sectoral approach. Second, the authors' studies tend to conclude with recommendations aimed either at entire sectors of the Russian economy or at the classification status of a region, which makes it difficult for regional authorities to arrive at sound decisions, since their actions are confined to a specific territorial unit and a specific sector. In other words, the decisions that can be taken can be implemented only within a territorial-sectoral framework. Third, the partly contradictory nature of the measures proposed regarding electricity consumption (whether to increase or to reduce it) gives rise to the need to group the subjects of the Russian Federation in order to formulate not generic but typological solutions for regions characterized by the application of similar development models. Fourth, any decision taken by regional authorities must rest on data analysis and on the identification of cause-and-effect relationships that can be established empirically. It is precisely for these reasons that systematic additional research is required, and that is what the present article is devoted to.

Research aim and methodology

This study aims to assess the extent to which electricity consumption across Russia's constituent entities drives regional economic growth, viewed through the lens of sustainable development, and to provide a basis for informed decisions on regional tariff policy.

The empirical base includes official data from the Federal State Statistics Service (Rosstat) covering the period 2008–2023 and spanning three indicators: gross regional product, electricity consumption by federal subject, and the electricity balance disaggregated by broad consumer categories. All 85 federal subjects for which Russian statistics provide data are covered in the analysis, with the exception

of four recently incorporated regions – the Lugansk and Donetsk people's republics and the Kherson and Zaporozhye regions – for which comprehensive statistical data are unavailable.

The study proceeds through several stages. The first stage involves calculating three sets of indicators. The first is Pearson's pairwise correlation coefficient (r), derived from the dynamics of GRP and electricity consumption in each region. The second is the electricity intensity of gross regional product, computed as the ratio of the region's mean electricity consumption over the period under study to its mean GRP. The third is the share of electricity consumed in the region in 2023 accounted for by the three largest end-users, whose combined consumption exceeds 50% of the total. These end-users are: (a) mining and quarrying; manufacturing; electricity, gas, steam, and air conditioning supply; water supply; sewerage, waste management, and remediation activities (Sections B, C, D, and E are aggregated in the official statistics and cannot be decomposed further); (b) urban and rural households; and (c) losses in electricity networks.

In the second stage, the federal subjects are grouped into unequal intervals, defined in line with the study's aim and objectives. The first group comprises regions where the correlation coefficient is negative. A second group is formed of regions where r exceeds 90%, indicating a very high correlation between the two variables (on the Chaddock scale). The remaining regions, where the correlation coefficient falls between 0% and 90%, make up the third group. The fourth stage is designed to verify the precision of the results. Confidence intervals are calculated at a 99% confidence level (left and right bounds), and a typical federal subject is identified within each of the three groups. Beyond their role in precision assessment, the confidence bounds, together with the chosen confidence level, define the band within which the indicator is expected to fluctuate with the specified reliability. A deviation beyond these bounds – to either the left or the right – is treated as a critical signal and requires heightened attention from government authorities in managerial decision-making. The fifth stage draws conclusions and puts forward policy recommendations.

Research results

The second stage of the study established that 17 subjects of the Russian Federation (20%) exhibit a negative linear correlation, with the strength of the association between the variables differing quite considerably – by a factor of 12.5 – from r = –6.39% in the Sverdlovsk Region to r = –80.48% in the Republic of North Ossetia – Alania *(Tab. 1)*.

This group of regions is characterized by large outliers and heterogeneity. In addition to the substantial differences in the correlation coefficient, there are also significant differences among the subjects in the following indicators: Sections B, C, D, and E, where the values differ by a factor of 11.5 between the Khanty-Mansi Autonomous Area – Yugra and the Ivanovo Region; urban and rural population, with a 3.3-fold difference between the Khanty-Mansi Autonomous Area – Yugra and the Republic of North Ossetia – Alania; and losses in electricity networks, where a 4.8-fold gap separates the Republic of Khakassia from the Republic of North Ossetia – Alania. All these data point to an abnormal, multimodal distribution with several peaks.

The very presence of a negative correlation, as indicated by the coefficient, allows a definitive conclusion to be drawn for this entire group: to enhance economic growth in the context of sustainable development, electricity consumption in the region must be reduced. This conclusion is further corroborated by the fact that the highest GRP electricity intensity in Russia is observed precisely in the Republic of Karelia, the Republic of Khakassia, and the Kemerovo Region – all of which rank among the top 10 subjects with the highest values. Accordingly, the tariff policy pursued by regional authorities should be "tight" and aim at

Table 1. Russian Regions with a negative correlation between electricity consumption and GRP (Group 1)

No.	RF constituent entity	Correlation coefficient, %	GRP electricity intensity, %	Sections B, C, D, E, %	Urban and rural population, %	Losses in electricity networks, %
1	Republic of North Ossetia – Alania	-80.48	1.41	30.03	**36.99**	13.15
2	Ulyanovsk Region	-77.04	**1.77**	32.55	**22.75**	**7.50**
3	Tomsk Region	-64.58	**1.91**	**57.68**	**16.01**	**9.05**
4	Ivanovo Region	-61.08	**1.86**	32.28	**26.19**	**10.32**
5	Murmansk Region	-57.63	**2.53**	**71.18**	8.13	**7.05**
6	Kurgan Region	**-55.21**	**2.22**	26.48	**23.36**	12.38
7	Republic of Mari El	**-47.47**	**1.87**	31.20	**21.70**	**8.76**
8	Bryansk Region	**-45.97**	1.33	32.47	**27.01**	11.58
9	Volgograd Region	**-44.85**	**2.25**	**51.34**	**18.02**	12.25
10	Republic of Karelia	**-33.29**	**3.45**	**56.91**	**13.59**	4.65
11	Kemerovo Region	**-33.14**	**3.52**	**72.84**	8.80	4.90
12	Republic of Khakassia	**-32.16**	8.95	**86.07**	6.41	2.73
13	Saratov Region	-26.85	**2.06**	**43.72**	**20.79**	**9.30**
14	Khanty-Mansi Autonomous Area – Yugra	-20.96	**2.11**	**88.41**	3.20	3.62
15	Altai Territory	-9.67	**2.09**	33.83	**23.48**	**9.50**
16	Nizhny Novgorod Region	-7.49	**1.83**	**53.01**	**15.02**	**8.90**
17	Sverdlovsk Region	-6.39	**2.50**	**59.20**	12.29	**6.45**
	Left bound of CI	-55.81	1.48	37.97	12.43	6.40
	Right bound of CI	-27.05	3.66	63.11	23.30	10.32

Note: the first 10 subjects of the Russian Federation with the lowest values in the entire set of regions are highlighted in green; the last 10 subjects with the highest values are highlighted in yellow.
Calculated from: Rosstat data.

raising the cost of electricity. In other words, it can be concluded that, for this group of regions, electricity consumption is not the main factor driving their sustainable development.

The reason is that the above-mentioned regions of the country continue to follow a development model typical of the past – a "brown" economy – in which economic growth is underpinned by rising energy consumption. The old, unsustainable development model is thus being reproduced, whereas current regulatory documents call for precisely the opposite: reducing energy consumption and improving energy efficiency. Moreover, a substantial share of enterprises in this group of regions still rely on outdated, energy-intensive equipment in need of modernization or complete replacement. To achieve these goals, the authorities have a sufficient "arsenal" of instruments at their disposal. One such instrument within the framework of tariff policy is raising the cost of electricity. This measure can produce different outcomes. On the one hand, it may lead to a contraction in output volumes as production costs and prices rise, which is unacceptable. On the other, it may spur the adoption of modern, advanced, and less energy-intensive equipment, which is simply indispensable. In order to sustain the required output volumes and provide support to economic entities, regional authorities can stimulate the uptake of more energy-efficient equipment at energy-intensive enterprises by lowering regional and local tax rates. In this

scenario, the expected consequences are a reduction in the amount of energy resources drawn into productive activity and, at the same time, an increase in the quantity of output through the deployment of new equipment. Further growth of the regional economies could thus be ensured.

The second group of regions consists of 23 RF subjects that are homogeneous in terms of the correlation coefficient. Differences in the other indicators persist, however. Thus, for the "Sections B, C, D, and E" indicator, the gap between the Chechen Republic and the Chukotka Autonomous Area is 9.3-fold; for "urban and rural population", there is a 5.9-fold difference between the Republic of Tyva and the Chukotka Autonomous Area; and for "losses in electricity networks", a 12.4-fold gap separates the Belgorod Region from the Republic of Ingushetia *(Tab. 2)*.

Table 2. Russian regions with a positive correlation between electricity consumption and GRP (r > 90%) (Group 2)

No.	RF constituent entity	Correlation coefficient, %	GRP electricity intensity, %	Sections B, C, D, E, %	Urban and rural population, %	Losses in electricity networks, %
1	Krasnodar Territory	99.11	1.11	25.53	28.23	**11.10**
2	Kamchatka Territory	97.82	0.91	**28.34**	26.51	**10.74**
3	Voronezh Region	97.79	**1.45**	**46.44**	**19.80**	**9.02**
4	Republic of Sakha (Yakutia)	97.78	0.94	49.29	10.14	**12.24**
5	Kabardino-Balkarian Republic	97.62	1.15	21.34	27.24	20.91
6	Republic of Tyva	97.22	**1.37**	20.96	37.16	**17.98**
7	Chechen Republic	97.16	**1.53**	8.14	34.21	34.07
8	Primorye Territory	96.45	**1.61**	26.26	29.55	10.42
9	Republic of Tatarstan	96.29	**1.38**	61.36	12.19	5.34
10	Rostov Region	**95.82**	**1.47**	**42.11**	**21.70**	**11.57**
11	Smolensk Region	**94.91**	2.31	63.68	13.91	8.12
12	Ryazan Region	**94.67**	1.92	40.56	15.30	6.16
13	Amur Region	**93.88**	2.60	28.23	13.71	7.73
14	Magadan Region	**93.85**	**1.57**	70.64	6.68	10.21
15	Republic of Ingushetia	**93.70**	**1.38**	10.33	**18.06**	48.58
16	Republic of Altai	91.85	1.32	8.35	30.30	**13.83**
17	Jewish Autonomous Region	91.62	2.64	**38.77**	**15.72**	7.11
18	Republic of Adygea	91.52	**1.48**	**29.54**	25.91	**10.35**
19	Republic of Crimea	91.12	**1.43**	17.56	36.96	**12.40**
20	Chukotka Autonomous Area	90.94	0.89	76.00	6.29	**10.39**
21	Belgorod Region	90.84	2.07	63.78	8.46	3.93
22	Leningrad Region	90.60	2.26	**46.95**	12.54	**8.65**
23	Novgorod Region	90.49	1.90	49.52	14.85	**9.54**
	Left bound	92.94	1.32	27.19	15.06	7.74
	Right bound	96.02	1.87	48.78	25.41	18.38

Note: the first 10 subjects of the Russian Federation with the lowest values in the entire set of regions are highlighted in green; the last 10 subjects with the highest values are highlighted in yellow.
Calculated from: Rosstat data.

A direct correlation between electricity consumption and GRP suggests a conclusion opposite to that for Group 1: growth in electricity consumption in the region should lead to growth in GRP. This conclusion holds true, however, under only one condition: that electricity consumption cannot be increased in those sectors and branches of the regional economy that have already reached a critical level – in our case, those highlighted in yellow in Table 2. This condition rests on the regulatory documents on energy conservation and energy efficiency improvement adopted in the Russian Federation. Only if this condition is met can the sustainable development of the subject be ensured. Consequently, the tariff policy pursued by regional authorities with respect to this group of regions should be "soft", stimulating electricity consumption by lowering electricity tariffs in those sectors and spheres where it is needed.

The third group of regions is the most numerous, comprising 45 subjects of the Russian Federation. Like Group 2, it is characterized by a positive correlation between electricity consumption and GRP, but it is the most heterogeneous of all, with substantial differentiation across every indicator. Thus, the correlation coefficients calculated for the Arkhangelsk Region (excluding the autonomous area) and for the Kaluga Region differ by a factor of more than 180. GRP electricity intensity shows an 8.3-fold difference between Moscow and the Chelyabinsk Region. For the "Sections B, C, D, and E" indicator, the gap between the Republic of Kalmykia and the Nenets Autonomous Area is 15.6-fold; for "urban and rural population", a 17.8-fold difference separates the Pskov Region from the Nenets Autonomous Area; and for "losses in electricity networks", a staggering 2524-fold gap exists between the Nenets Autonomous Area and the Republic of Kalmykia *(Tab. 3)*.

The conclusion and recommendations drawn for Group 2 are, on the whole, also relevant for Group 3. For Group 3, however, one qualification applies, and it is this that distinguishes Group 2 from Group 3. According to the Chaddock scale, for regions with a weak, moderate, or noticeable correlation between electricity consumption and GRP – that is, regions where $r \leqslant 70\%$ – an increase in electricity consumption in sectors and spheres with high or critical electricity consumption is permissible, but only on condition that the GRP electricity intensity is not at a critical level. In the Komi Republic, for instance, it is permissible to ramp up electricity consumption in the industries that correspond to Sections B, C, D, and E, whereas in the Perm Territory it is not, owing to the high GRP electricity intensity, which has reached a critical level.

In this group, tariff policy does not lend itself to one-size-fits-all solutions and requires further subdivision of the regions in order to adopt typological decisions on electricity pricing. For example, an additional subgroup could be distinguished comprising regions where electricity consumption under the "urban and rural population" indicator is high or critical (Kaliningrad Region, Pskov Region, and others). For these regions, in order to improve energy efficiency and ensure economic growth, electricity tariffs should be raised, thereby encouraging energy conservation. It is assumed that a price increase for the population, in the case of elastic demand, could be an effective instrument for implementing energy conservation policy in the region.

A similar subgroup could be formed of regions where network losses are high (Karachayevo-Circassian Republic, Republic of Kalmykia, and others). Here, however, the pricing mechanism is hardly applicable: raising the cost of electricity would be passed on to the end consumer, as is common in everyday economic practice, while lowering it would lead to even greater waste, which is unacceptable. In this case, therefore, other instruments of state regulation are needed to compel electricity producers and distributors to close the gap represented by unjustifiable power losses.

At the fourth stage, the confidence intervals were calculated (left and right bounds) at a 99% confidence level. It is worth noting that

Table 3. Russian regions with a positive correlation between electricity consumption and GRP (0% < r < 90%) (Group 3)

No.	RF constituent entity	Correlation coefficient, %	GRP electricity intensity, %	Sections B, C, D, E, %	Urban and rural population, %	Losses in electricity networks, %
1	Arkhangelsk Region (excluding the autonomous area)	0.49	**1.69**	53.14	14.72	**8.40**
2	Perm Territory	0.72	2.28	63.71	11.66	**7.18**
3	Chuvash Republic	11.82	**1.89**	34.96	21.41	**9.03**
4	Karachayevo-Circassian Republic	15.70	**1.87**	**40.99**	25.97	17.36
5	Komi Republic	19.64	**1.60**	67.71	9.38	6.98
6	Republic of Buryatia	33.78	2.48	30.65	**18.22**	**9.62**
7	Pskov Region	47.54	1.43	25.88	31.15	**10.79**
…	…					
16	Samara Region	**60.98**	**1.94**	**43.45**	**20.26**	**7.27**
17	City of Saint Petersburg	**64.43**	0.61	22.83	**18.85**	**10.65**
18	Astrakhan Region	**65.50**	1.12	**46.91**	21.37	**11.81**
19	Irkutsk Region	**65.72**	5.01	61.06	**15.88**	**10.46**
20	Kursk Region	**71.53**	2.31	61.52	13.02	**8.09**
21	Omsk Region	**71.66**	**1.75**	**43.83**	**16.79**	**7.80**
22	Republic of Mordovia	**74.59**	**1.69**	**41.07**	**19.13**	**8.23**
…	…					
32	Republic of Kalmykia	81.05	0.92	6.08	21.69	25.24
33	Moscow Region	81.63	1.22	36.46	21.44	15.01
34	Nenets Autonomous Area	84.58	0.83	94.76	1.75	0.01
35	Krasnoyarsk Territory	84.68	2.95	75.66	6.13	5.05
36	Chelyabinsk Region	84.88	2.98	70.50	10.55	5.09
37	Tula Region	85.13	**1.97**	64.89	13.68	**8.20**
38	Lipetsk Region	85.29	2.57	67.87	8.93	6.42
39	Novosibirsk Region	85.43	**1.58**	26.40	23.91	**9.29**
40	Tyumen Region (excluding the autonomous areas)	85.51	1.07	**51.64**	**16.81**	**8.06**
41	Trans-Baikal Territory	85.90	2.71	28.01	11.55	**9.15**
42	Kaliningrad Region	86.08	1.12	26.53	30.35	**10.23**
43	City of Sevastopol	86.29	**1.55**	25.75	25.93	**8.14**
44	City of Moscow	86.41	0.36	19.54	21.06	5.10
45	Kaluga Region	88.85	**1.69**	**41.09**	22.26	6.91
	left bound	56.28	1.45	37.65	15.56	7.14
	right bound	74.65	2.08	52.55	20.95	12.44

Note: the first 10 subjects of the Russian Federation with the lowest values in the entire set of regions are highlighted in green; the last 10 subjects with the highest values are highlighted in yellow.
Calculated from: Rosstat data.

in Group 1, not a single subject of the Russian Federation fell within the bounds of the confidence interval, for the reasons outlined above – large outliers, heterogeneity of the sample, multimodality, and so forth. For this reason, when selecting a typical region, we will be guided by the mean correlation coefficient for this group (–41.43%). The subject closest

in value for this parameter is the Volgograd Region. Using the method of regression analysis, we can construct a regression equation and form a model for the Volgograd Region *(Fig. 1)*.

In contrast to Group 1, in Group 2 the bounds of the confidence interval (highlighted in bold in the tables) fully "envelope" one subject of the Russian Federation, which can unconditionally be regarded as the typical representative of Group 2 *(Fig. 2)*.

A notable fact here is that both regions (Volgograd and Rostov regions) not only belong to the same federal district, the Southern Federal District, but are also neighboring subjects in which, in order to ensure sustainable development, the regional energy policies should be diametrically opposed.

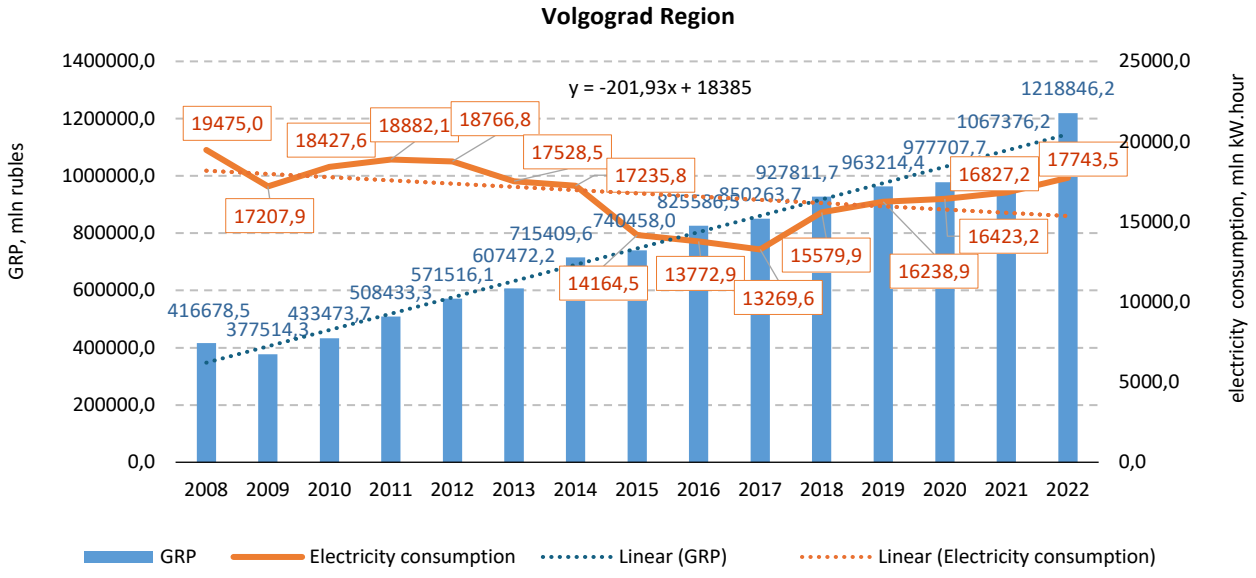

Figure 1. Regression model of electricity consumption for the Volgograd Region

Compiled from: Rosstat data.

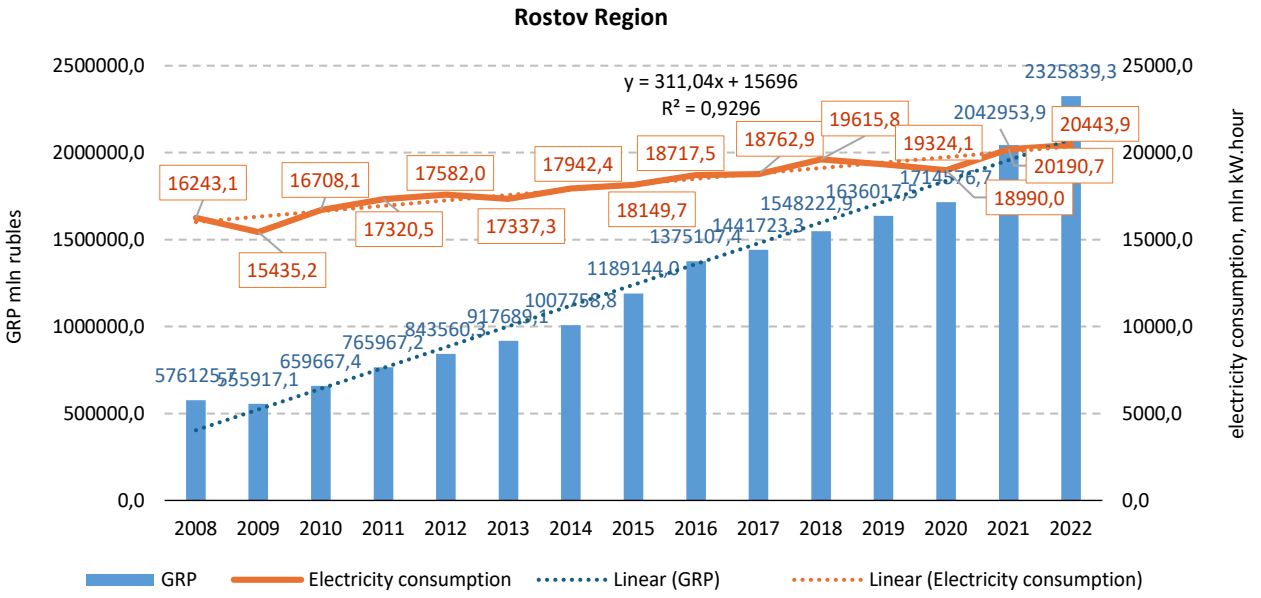

Figure 2. Regression model of electricity consumption for the Rostov Region

Compiled from: Rosstat data.

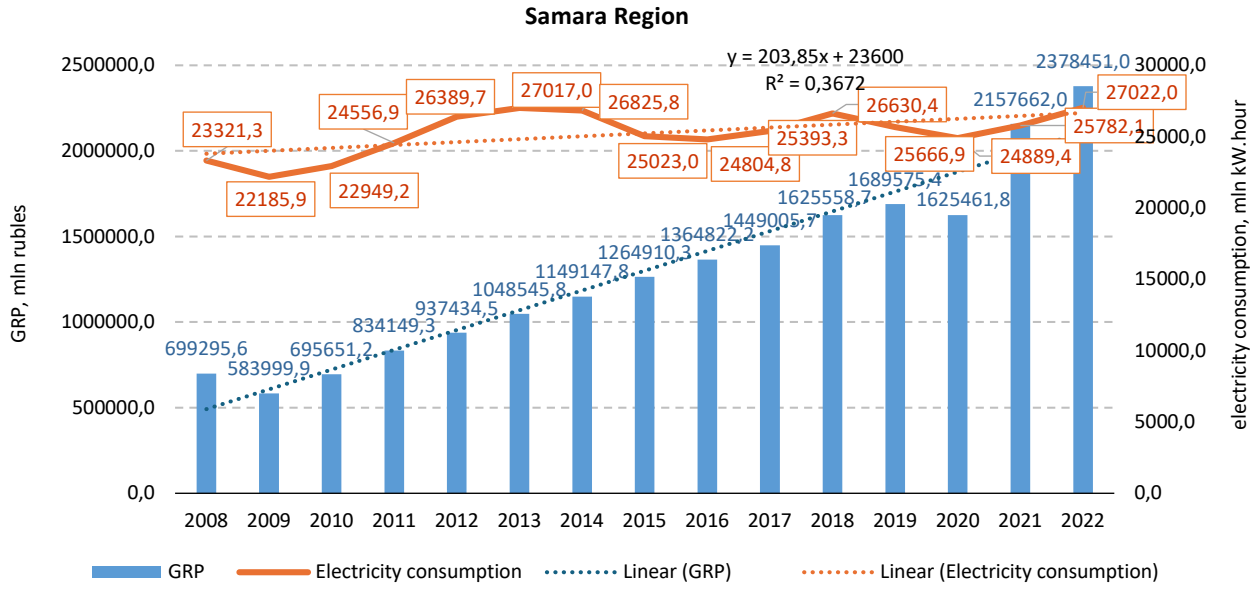

Figure 3. Regression model of electricity consumption for the Samara Region
Compiled from: Rosstat data.

In the third group of regions, the confidence interval "envelopes" three subjects of the Russian Federation simultaneously – the Samara Region, the Omsk Region, and the Republic of Mordovia. The choice of the typical region was made in favor of the Samara Region for the same reasons as in the case of Group 1: the mean value for the set (the correlation coefficient) stands at 65.74%, whereas the Samara Region's figure is 60.98%. The regression model for the Samara Region is presented in *Figure 3*.

Findings and discussion

The conclusions drawn for Group 1 (see above) find confirmation in the practical activity of the authorities: the regional authorities raise the cost of electricity for consumers each year (see, for example, the documents relating to the Volgograd Region[4]). However, the stated objectives of such actions are different – above all, to compensate the energy companies for the costs they have borne when investing in the sector using the RAB method – and this is not linked to the established dependence between electricity consumption and economic growth in the context of the region's sustainable development. Yet tariff policy can, and should, be an effective instrument for regulating the development of the regional economy. Consequently, for Group 1, it is both feasible and necessary to raise the cost of electricity substantially in order to encourage industrial consumers to incorporate less energy-intensive and more productive equipment into their production processes, thereby fostering the growth of regional economies.

The conclusions drawn for Group 2 envisage reducing electricity tariffs, but Russian economic practice provides no evidence of such a move. The analysis we have conducted shows that this needs to be done for industrial consumers (Sections B, C, D, and E), especially in regions such as the Kabardino-Balkarian Republic, the Chechen Republic, the republics

[4] On Amendments to the Order of the Tariff Regulation Committee of the Volgograd Region No. 47/1 of December 10, 2024, "On Setting Prices (Tariffs) for Electric Energy for the Population and Equivalent Categories of Consumers in the Volgograd Region" and Order of the Tariff Regulation Committee of the Volgograd Region No. 47/1 of December 10, 2024, "On Setting Prices (Tariffs) for Electric Energy for the Population and Equivalent Categories of Consumers in the Volgograd Region" for 2025: Order of the Tariff Regulation Committee of the Volgograd Region No. 7 of February 28, 2025. Available at: https://energosale34.ru/fizperson/tarify/deystvuyushchie-tarify/ (accessed: 21.03.2026).

of Tyva, Ingushetia, and Altai, in order to stimulate direct investment, raise the volume of industrial output (thanks to cheaper electricity and consequently lower production costs), and thus ensure the growth of regional economies in the context of sustainable development. In addition, in certain subjects of the Russian Federation – the Kamchatka Krai, the Republic of Sakha (Yakutia), and the Chukotka Autonomous Area – the creation of energy-intensive production facilities is deemed permissible, since at present the GRP electricity intensity of these regions is the lowest in the country.

The conclusions drawn for Group 3, as already set out above, correspond to those drawn and the recommendations made for Group 2, subject to the conditions and qualifications identified. A synthesis of these allows us to conclude that state regulation of electricity prices – whether stimulating or curbing electricity consumption – depends on the GRP electricity intensity: if the GRP electricity intensity is high, electricity tariffs should be high and should be raised; if the GRP electricity intensity is low, lowering tariffs should lead to regional economic growth and sustainable development of the region.

Conclusion

Current trends in the electric power industry are characterized by a steady growth in the consumption of electrical energy, both throughout the world and in Russia. Each constituent entity of the Russian Federation, having its own distinct structure of electricity consumers, differs in the volumes of electricity it produces and consumes, and this is reflected in its economic growth. At the same time, the regional authorities, in implementing their tariff policy, do not fully take into account the specific features of sustainable development of the territory.

The correlation coefficient between electricity consumption and GRP, which we have calculated and analyzed, establishes the existence of a relationship between the two, while its value determines the degree to which electricity consumption (the regressor) influences GRP (the regressand). The price of electricity is here viewed as one of the important factors that can either reduce or boost electricity consumption. In other words, the authorities' tariff policy represents an instrument for regulating the rate of growth both of individual sectors and branches of the economy and of the regional economy as a whole:

a) where a negative correlation exists (Group 1), raising the price of electricity should lead to the sustainable development of the regional economy, while lowering it would appear inadvisable, since the effect of such a step is unlikely to be positive.

b) where a positive correlation exists (Groups 2 and 3), lowering the price of electricity – accompanied by a rise in energy consumption – should lead to the sustainable development of the regional economy. For the regions belonging to Group 3, it should be noted that increasing electricity consumption is possible even in energy-intensive sectors and spheres, but only on condition that the GRP electricity intensity is not at a critical level. Raising prices, on the contrary, would most probably fail to yield a positive effect.

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ЭЛЕКТРОПОТРЕБЛЕНИЕ И РОСТ РЕГИОНАЛЬНЫХ ЭКОНОМИК

Актуальность темы исследования обусловлена необходимостью определения научно обоснованного подхода к устойчивому развитию Российской Федерации и ее субъектов, экономика которых находится под постоянным воздействием множества различных факторов, оказывающих на нее в том числе и латентное влияние. Одним из таких факторов является электроэнергия, точнее ее потребление, характеризующееся в корреляционных моделях линейной связи зависимостью между переменными: электропотреблением и валовым региональным продуктом. В свою очередь на потребление электроэнергии оказывают влияние устанавливаемые органами власти цены, которые могут как стимулировать, так и снижать электропотребление в регионе, а значит, и темп роста региональных экономик. В статье в отличие от иных публикаций по данной теме посредством территориального подхода, метода группировок и корреляционно-регрессионного анализа определяется возможность принятия органами власти инцидентных решений в части повышения или снижения стоимости электроэнергии в регионе (типологической группе регионов), что представляет собой определенные элементы новизны. В результате проведенного исследования были сформированы три основные группы регионов: две – с положительной корреляционной связью между электропотреблением в регионе и валовым региональным продуктом и одна – с отрицательной. По каждой группе сделаны выводы и даны практические рекомендации в отношении тарифной политики. Для оценки точности полученных результатов и их апробации используются доверительные интервалы (с уровнем доверия 99%). Результаты исследования в теоретическом плане вносят свой оценочный вклад в устойчивое развитие региона с учетом использования электроэнергии как одного из факторов экономического роста, в практическом плане выводы и рекомендации могут быть полезны органам региональной власти при осуществлении ими тарифной политики.

Валовой региональный продукт, спрос на электроэнергию, тарифная политика, энергосбережение, корреляционная связь, территориально-отраслевой баланс, регионы России, регрессионный анализ.

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CULTURAL RESILIENCE IN THE REGIONS: FROM PANDEMIC SHOCK TO RECOVERY

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The aim of the study is to assess the cultural resilience of the regions (subjects of the Northwestern Federal District) to crises using the example of the COVID-19 pandemic. The scientific novelty lies in the substantiation and empirical confirmation that budget-funded cultural institutions can be characterized by resilience similar to commercial organizations, regions and national economies, which expands the boundaries of the applicability of the concept of resilience to the non-entrepreneurial sector. We developed a methodology for quantifying the cultural resilience of regions based on the aggregation of four indicators: volume of paid services, budget expenditures, number of employees, and attendance at cultural institutions. The information base was compiled by data from Rosstat, the Federal Treasury, AIS of the Ministry of Culture of the Russian Federation and EMISS for 2018–2023. We highlighted three levels of cultural resilience in the regions (low, medium, and high). We found that five regions of the Northwestern Federal District turned out to be the most resistant: the Kaliningrad, Pskov, Novgorod,

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Leningrad regions, and the Republic of Karelia (high level). The Vologda, Murmansk, Arkhangelsk regions, and the Komi Republic have an average level of resistance; Saint Petersburg is the only region with low resistance. The paper identified the geographical pattern: the western regions of the Northwestern Federal District demonstrate higher stability in the development of the cultural sphere compared to the eastern and northern regions. We established that the high resilience of the cultural sphere is achieved not only through budget financing, but also through the adaptation of paid services, while the personnel component has demonstrated the greatest stability in all regions, with the exception of the Vologda Region and the Komi Republic. Future research areas include expanding the set of indicators, taking into account the digital transformation of cultural services, and comparative analysis with other federal districts. The practical significance of the work lies in the possibility of using the results obtained to improve the mechanisms for managing the cultural sphere, developing targeted measures to support cultural institutions, as well as shaping cultural policy at the regional and federal levels.

Culture, regions, cultural policy, resilience, resilience, pandemic, COVID-19.

Introduction

The concept of resilience came to economics from ecology as a reflection of the ability of any system to recover from shocks and adapt to a changed environment (Walker, Cooper, 2011; Smorodinskaya, Katukov, 2021). In turn, the COVID-19 pandemic demonstrated the internal weaknesses of the cultural sphere and at the same time stimulated adaptation processes (Kosygina, Leonidova, 2025). Decree of the Government of the Russian Federation 434, dated April 3, 2020 classified the cultural sector as one of the most affected sectors of the Russian economy during the spread of coronavirus infection. The main problems were financial difficulties, provision of jobs for employees of cultural institutions, as well as cancellation and postponement of organized events. Organizations aimed at a wide audience, including museums, theaters, and concert venues, have been particularly affected (Muzychuk, 2021).

Regional cultural institutions have found themselves in a position of increased vulnerability, as cultural institutions in the Russian regions, especially in small towns and rural areas, have a more modest level of technical equipment and digital development compared to large cities (Kondakova, 2023a). This situation made it difficult to quickly switch to remote operating models, as many organizations experienced a lack of necessary equipment and difficulties in providing reliable Internet access, and their employees were characterized by insufficient digital literacy (Galkin and Parfenova, 2022). The transition to online formats was accompanied not only by technical but also organizational difficulties: in some cases, state and municipal assignments did not provide for remote forms of work, which created additional barriers.

The dependence of cultural financing on regional and municipal budgets also proved to be a risk factor. During the pandemic, the subjects of the Russian Federation and municipalities experienced a significant shortage of funds for culture due to their redistribution to other life-supporting areas. At the same time, cultural organizations perform an important socio-economic function, acting as drivers of tourism development, sources of jobs and centers of social life, especially in small towns, where they often remain one of the few platforms for social interaction (Muzychuk, 2021). In addition, a sharp decline in attendance due to forced restrictions on mass events and self-isolation has led to a significant drop in extra-budgetary

revenues needed by many organizations (Kosygina, Mikhalko, 2025).

Institutions were forced to optimize their staff by introducing a part-time employment regime, which negatively affected the incomes of employees and the long-term prospects of the human resources potential of the cultural sector. In Russia as a whole, in the first quarter of 2020, there was a significant increase in the number of employees on the payroll who were idle due to the fault of the employer and for reasons beyond the control of the employer and employee, by 17.5 times (+6,029 people) compared to the first quarter of 2019[1].

The scientific problem of the study is the lack of quantitative methods for assessing the ability of the regional cultural sphere to recover from external shocks, which makes it difficult to develop targeted support measures. The hypothesis of the study is that regions with high cultural potential (for example, Saint Petersburg) do not necessarily demonstrate high resilience, while less developed territories in terms of infrastructure may show more successful recovery.

Thus, the aim of the study is to assess the cultural resilience of the regions (subjects of the Northwestern Federal District) to crisis phenomena using the example of the COVID-19 pandemic.

Theoretical framework of the research

The studies adapted the concept of resilience to analyze the socio-economic systems of regions as a whole and individual sectors of the national economic complex (Romanova et al., 2022; Ionova et al., 2022). In the works of J. Simmie and R. Martin, the resilience of regional economies includes four components: resilience – the ability to withstand a shock; recovery – the speed and completeness of a return to pre-crisis parameters; reorientation – the ability to adapt structurally; renewal – the transition to a new development trajectory (Simmie, Martin, 2010; Martin, Sunley, 2015).

The distinction between the concepts of "resilience" and "resistance" is of great methodological importance. If resistance (in the narrow sense) emphasizes the dynamic ability of the system to recover from deformation, then resilience (resistance) focuses on maintaining structural parameters during the period of shock (Rose, 2007). In the context of analyzing the post-pandemic recovery of the cultural sphere, it is advisable to use a broader understanding of resilience, including the ability to withstand crisis phenomena (resilience) and the ability to adapt and recover (the author's interpretation based on the synthesis of approaches described in (Simmie, Martin, 2010) and (Rose, 2007)).

In the field of culture, resilience is defined as the ability of organizations, institutions and regional cultural systems to maintain their key functions, ensure employment and accessibility of services to the public in the face of external shocks, as well as restore quantitative parameters of activity after their violation.

The operationalization of this concept requires the identification of measurable indicators reflecting various aspects of the functioning of the cultural sphere. There are three main groups of indicators in the scientific literature: resource indicators characterizing the material, technical and personnel base of the cultural sphere (Muzychuk, 2023); indicators of accessibility and consumption reflecting the interaction of cultural institutions with the population: the number of visits to cultural events, the frequency of visits, the proportion

[1] HSE Analytical Bulletin on the economic and social consequences of the coronavirus in Russia and around the world "Economic and social consequences of COVID-19 in the field of culture in Russia". Available at: https://www.hse.ru/data/2020/07/06/1609165892/HSE_Covid_08_2020_5_3.pdf

of the population covered by cultural services (Antonova, 2014); performance indicators that characterize the effectiveness of cultural organizations: the volume of paid services to the public in the field of culture, indicators of collection and occupancy of halls, the ratio of budgetary and extra-budgetary financing (Evmenov, Blagova, 2017; Kosygina, Leonidova, 2025; Shabunova, Sokolova, 2025).

We should note that when measuring the resilience of socio-economic systems, both simple statistical and econometric methods are used. The most common is the analysis of dynamic series by comparing the values of key indicators during the active phase of the crisis or shock and the post-crisis period (Sensier et al., 2016; Danilova et al., 2024). Index methods are used that aggregate a set of indicators and allow for comparative analysis, for example, between regions. The authors have developed a methodology for assessing regional economic complexity (RECI) and the region's resilience to shocks (RSI) based on data from 85 regions of the Russian Federation for 2014–2023. The study includes clustering of regions according to the level of sustainability and economic complexity (Polyakova, Kolmakov, 2025). An example of foreign research is the regional resilience/stability index, developed by the European Commission to assess the resilience of regions to economic shocks, which includes indicators of employment, GRP, household income and structural characteristics of the economy[2]. Regression models are used to identify the factors of resistance, in which the dependent variable is the rate of recovery of indicators, and the independent variable is the characteristics of the regional economy, the institutional environment, the demographic structure or the resource supply of the industry. For example, S.P. Zemtsov and A.A. Voloshinskaya developed an author's methodology and assessed the resilience of the economies of Russian regions to shocks in eight basic industries. The factors that influenced the probability of a reduction in economic activity in 2022 and its recovery in the first half of 2023 have been econometrically identified. Of the 85 regional economies examined, 55 turned out to be relatively stress-resistant (Zemtsov, Voloshinskaya, 2024).

For a correct analysis of the dynamics of resilience, it is important to choose a base period relative to which changes are recorded. M. Sensier rightly points out the difficulty of identifying the time limits of a crisis phenomenon when assessing economic sustainability (Sensier et al., 2016). Traditionally, a crisis is perceived as a short-term episode, but it is preceded by a long period of accumulation of imbalances. The pandemic, with its sudden and spontaneous nature, which led to the absence of a clear preparatory period, was an exception, breaking out of the general pattern. For this reason, when studying recovery processes after crisis events, researchers often rely on data for 2018–2019, preceding the pandemic, as a starting point. Such a methodical choice makes it possible to more reliably verify the degree of recovery of the economy as a whole or a particular sector to pre-crisis levels.

Therefore, based on the analysis of the scientific literature, it is possible to formulate the foundations of this study. The resilience of the cultural sphere is understood as its adaptive ability to maintain its functionality under stress and restore previous volumes of activity after the crisis. The practical implementation of this concept is based on three groups of measurable indicators. Existing methodological tools, in particular, time series analysis (comparing data before and after the crisis) and the use of index

[2] European Commission. A regional resilience dashboard for the EU: Mapping EU regions' strengths and vulnerabilities. DG Regional Policy Newsroom. 2026. Available at: https://ec.europa.eu/regional_policy/whats-new/newsroom/07-01-2026-a-regional-resilience-dashboard-for-the-eu-mapping-eu-regions-strengths-and-vulnerabilities_en

methods to compare different regions, confirm the validity of the chosen research strategy. The synthesis of the considered approaches forms the basis of the author's methodology for quantifying cultural resilience at the regional level.

Materials and methods

A set of quantitative indicators reflecting key aspects of the functioning of the cultural sphere is used. Among them are: attendance at cultural institutions is an indicator of the level of consumption of cultural services by the population; the volume of paid services to the population is an indicator of the economic activity of cultural organizations; consolidated expenditures of regional budgets on culture is an indicator of state policy in this area; the number of employees of cultural institutions is an indicator of the personnel stability of the industry. The choice of these indicators is based on their relevance for assessing resistance, as well as the availability of complete and comparable statistical data for the period under review for the regions of the Northwestern Federal District.

The information base of the study consisted of data from the Federal Treasury of the Russian Federation on the execution of consolidated budgets of the subjects of the Russian Federation, official statistical data from the Federal State Statistics Service (Rosstat), information from the Automated Information System (AIS) of statistics of the Ministry of Culture of the Russian Federation, as well as materials from the Unified Interdepartmental Information and Statistical System (EMISS). To ensure comparability of data over time, all financial indicators (consolidated cultural expenditures and the volume of paid services to the population) were recalculated into comparable prices in 2023 using a deflator index based on the consumer price index.

The assessment of resilience is carried out by comparing the values of the selected indicators in the post-crisis period with the pre-pandemic level. The year 2019 was adopted as the base year, which corresponds to the established research practice, according to which the period immediately preceding the crisis is used as a reference point in analyzing the effects of natural shocks (Sensier et al., 2016). The chronological scope of the study covers 2019-2021, which allows recording both the depth of the recession in the active phase of the pandemic (2020) and the first results of recovery (2021). It is worth noting that statistical data for 2022 and 2023 are currently available, which indicate the further dynamics of the development of the cultural sphere in the regions of the Northwestern Federal District. However, their inclusion in the main analysis requires careful interpretation, since the post-crisis period after 2021 is characterized not only by recovery processes, but also by the impact of new external factors (sanctions restrictions, structural restructuring of the economy), which may distort the assessment of the actual pandemic shock. In this regard, the data for 2022–2023. They are used in the work as a reference for contextualizing long-term trends, but are not included in the calculation of the integral resilience index.

It is proposed a method for quantifying cultural resilience, which includes several successive stages. At the first stage, two basic indexes were calculated for each region and each indicator:

– the "fall index" is the ratio of the indicator value in 2020 to the value in 2019, characterizing the depth of the recession during the active phase of the crisis (1);

$$I_{fall}^{i,r} = \frac{P_{2020}^{i,r}}{P_{2019}^{i,r}}, \quad (1)$$

where $I_{fall}^{i,r}$ – fall index;

P –value of the indicator; i – type of indicator; r – region;

– the "recovery index" is the ratio of the indicator value in 2021 to the value in 2019, reflecting the degree of return to the pre-crisis level (2).

$$I_{recov}^{i,r} = \frac{P_{2021}^{i,r}}{P_{2019}^{i,r}} \quad (2)$$

where $I_{\text{recov}}^{i,r}$ – recovery index;

P – value of the indicator;

i – type of indicator; r – region.

An index value of 1 indicates that there are no changes relative to the base year; a value of less than 1 indicates a decrease in the indicator, and more than 1 indicates an increase.

At the second stage, an integral resilience index was calculated for each region as the arithmetic mean of the recovery and decline indices for four indicators (3).

$$R_r = \frac{\sum I_{fall}^{i,r} + \sum I_{\text{recov}}^{i,r}}{8}, \quad (3)$$

where R_r – resilience index;

$\sum I_{fall}^{i,r}$ – sum of fall indices;

$\sum I_{\text{recov}}^{i,r}$ – sum of the recovery indices.

At the final stage, all regions of the Northwestern Federal District were divided into three groups (high, medium, and low resistance) based on the obtained values of the integral index of cultural resilience. The boundaries of the groups are determined by the method of equal intervals between the minimum and maximum values of the index (4).

$$h = (R_{max} - R_{min})/k, \quad (4)$$

where h – size of the interval;

R_{max} and R_{min} – maximum and minimum values of the integral resilience index among the regions of the Northwestern Federal District,

$k = 3$ – number of allocated groups.

The obtained results are visualized in the form of a cartographic scheme, which makes it possible to visualize the spatial differentiation of the sustainability of the cultural sphere within the Northwestern Federal District.

The proposed methodology combines the analytical advantages of the index approach (the possibility of aggregation and interregional comparisons), taking into account the industry specifics of the cultural sphere, which ensures the correctness of the conclusions and their applicability for the purposes of regional cultural policy.

Research results

One of the indicators reflecting the volume of consumption of cultural services is the number of visits to institutions. Over the period 2018–2023, there has been a steady increase in the total number of visits to cultural institutions throughout the country and in the regions of the Northwestern Federal District, which is consistent with the targets of the national project "Culture"[3], implemented since 2019 and designed to increase the accessibility of cultural services to the population (Kondakova, 2023b).

However, it was the COVID-19 pandemic that had the most significant impact on this indicator. A.Yu. Smirnov's research confirms that as a result of the negative impact of the coronavirus epidemic in 2020–2022, the number of theater and museum visitors has significantly decreased (Smirnov, 2026). In most regions, attendance dropped by almost half in 2020. The largest decrease was recorded in Saint Petersburg, where the fall index was 0.42. At the same time, the indicator subsequently did not reach the level of 2019. The Murmansk Region is also showing a negative trend in 2021, having failed to restore the 2019 indicator.

The Pskov Region differs from all the regions of the Northwestern Federal District. While all regions (and Russia as a whole), without exception, recorded a sharp decrease in attendance in

[3] The deadlines for the implementation of the national project "Culture" are from 2019 to 2024. In 2025, it was included in the national project "Family".

2020 (drop indices from 0.42 to 0.81), the Pskov Region saw an increase from 8.75 visits in 2019 to 9.92 in 2020. During the pandemic restrictions, attendance at cultural institutions in the region increased by 13%. It can be assumed that this is due to the increase in attendance at cultural and leisure facilities (CLF) events. For instance, the figure in 2019 was 2,166,702 people, compared to 3,526,677 people in 2020. During the pandemic period, it increased by more than 1.6 times[4]. This may be due to the general development of the cultural sphere in the Pskov Region or the rapid adaptation to the digital format[5]. It is also worth considering the methodological features of calculating the indicator, especially during the pandemic period, as the system for recording visits changed in 2020. Due to the digital transition, the number of visits included visits to online resources of organizations[6].

The highest recovery index (2021 to 2019) was recorded in the Komi Republic (1.38), the Leningrad Region (1.36) and the Vologda Region (1.20). At the same time, there was a significant jump in the Komi Republic in 2021 (11.89 visits), which exceeded not only the pre-crisis level (8.60), but also the figures for subsequent years (9.08 in 2022, 10.64 in 2023). It is important to note the significant regional differentiation within the NWFD in terms of both the rate of decline and the rate of recovery *(Tab. 1)*.

Table 1. Number of visits to cultural institutions per capita in Russia and subjects of the Northwestern Federal District in 2018-2023

Constituent entity of the Russian Federation	Year						Fall index (2020 to 2019)	Recovery Index* (2021 to 2019)
	2018	2019	2020	2021	For reference			
					2022	2023		
Total for the Russian Federation	**7.87**	**8.21**	**4.36**	**8.36**	**9.26**	**10.41**	**0.53**	**1.02**
Northwestern Federal District	**7.97**	**8.47**	**4.73**	**8.61**	**8.36**	**9.43**	**0.56**	**1.02**
Komi Republic	8.13	8.60	4.18	11.89	9.08	10.64	0.49	1.38
Leningrad Region	5.76	5.95	4.82	8.07	6.13	7.06	0.81	1.36
Vologda Region	10.07	10.82	6.40	12.98	10.61	12.03	0.59	1.20
Pskov Region	7.70	8.75	9.92	10.47	13.76	14.68	1.13	1.20
Republic of Karelia	5.56	5.92	3.80	7.11	6.80	7.61	0.64	1.20
Kaliningrad Region	6.59	6.69	4.08	7.85	6.47	7.35	0.61	1.17
Arkhangelsk Region	7.80	8.30	4.22	9.61	8.52	9.80	0.51	1.16
Novgorod Region	12.92	13.95	9.41	15.85	15.49	17.57	0.67	1.14
Murmansk Region	9.60	9.97	5.18	9.76	10.54	11.90	0.52	0.98
Saint Petersburg	8.01	8.57	3.56	6.39	7.44	8.36	0.42	0.75

Note: the total number of visits to circuses, zoos, theaters, libraries, CLFs, recreation and entertainment parks, and museums (with the exception of art schools, concert organizations, and independent groups).
* Ranked by recovery index.
According to: AIS "Statistics" data of the Ministry of Culture of the Russian Federation. Available at: https://stat.mkrf.ru/indicators/?ysclid=mifpk0iiyh818882109

[4] AIS "Statistics" data from the Ministry of Culture of the Russian Federation. Available at: https://stat.mkrf.ru/indicators/?ysclid=mifpk0iiyh818882109. Indicator: the number of visits to cultural events in total, people. By type of cultural and leisure organizations (CLO).

[5] The Pskov Region has become a leader in the Northwestern Federal District in terms of the growth of attendance at cultural institutions within the framework of the national project. PAI-novosti. Available at: https://informpskov.ru/news/313678.html

[6] On the methodology for calculating the indicator "Number of visits to cultural events": Order R-1358 of the Ministry of Culture of the Russian Federation, dated October 16, 2020. Electronic fund of legal and regulatory documents. Available at: https://docs.cntd.ru/document/566240243

To assess the cultural resilience of the subjects of the Northwestern Federal District during the COVID-19 pandemic, indicators of the volume of paid services provided by cultural institutions per capita were analyzed. In Russia as a whole, the volume of paid cultural services decreased in 2020 to 0.49 from the level of 2019, and recovered to 0.69 by 2021. On average, the decline in the Northwestern Federal District turned out to be stronger (index 0.42), and the recovery was noticeably weaker (index 0.49) compared to the national level. There is significant differentiation within the Northwestern Federal District. The Republic of Karelia and the Kaliningrad Region demonstrated the highest resilience in terms of paid cultural services. The recovery index in Karelia was 0.93 (with a drop of 0.65), and in the Kaliningrad Region – 0.89 (with a drop of 0.56). The average level is typical for the Vologda and Leningrad regions (recovery indices 0.77 and 0.73, respectively) with a moderate drop (0.67 and 0.69). The Leningrad Region demonstrated the lowest depth of the crisis recession among all the regions of the Northwestern Federal District, however, recovery to the level of 2019 remains incomplete. Saint Petersburg has extremely low indicators: the fall index was 0.37 (an outsider in the Northwestern Federal District), the recovery index was 0.41. Despite the high absolute growth rates of paid services of cultural institutions in 2022-2023 (from 3719 to 6473 thousand rubles), the values of 2023 remain significantly lower than the pre-crisis maximum (9,003 thousand rubles). The Arkhangelsk region is characterized by the maximum drop in the district (along with Saint Petersburg) to 0.42.

The recovery of paid services in 2021 also occurred unevenly, with a difference in the recovery index of up to 0.52. It is noteworthy that the differences in absolute values were also significant. In all regions of the Northwestern Federal District, the index of recovery in the volume of paid services remains below 1, and the average value in Russia is 0.69. In most regions, the volume of paid services reaches and exceeds the docked levels only in 2022–2023 *(Tab. 2)*.

Unlike the volume of paid services, budget expenditures on culture in Russia and the Northwestern Federal District as a whole did not significantly decrease during the pandemic. The 2020 fall index by 2019 was 0.96 for both the Russian Federation as a whole and the Northwestern Federal District. The 2021 recovery index by 2019 is also fixed at 0.96, which indicates almost complete preservation of budget financing. Moreover, by 2023, consolidated budget expenditures on culture exceeded the pre-crisis level in the Russian Federation as a whole (714.5 billion rubles versus 671 billion rubles). in 2019), and for the Northwestern Federal District (84.98 billion rubles versus 76.7). It is noteworthy that the values are relatively stable both by country and by region separately.

According to this indicator, the regional differentiation in the index values is much smaller. The largest increase in spending in 2021 was recorded in the Murmansk (recovery index 1.12), Kaliningrad (1.07), and Novgorod regions (1.08). Regions with stable or slightly increased financing are the Leningrad (index 1.02) and Arkhangelsk (index 1.00) regions. They have maintained pre-crisis spending levels. At the same time, in the Leningrad Region in 2022–2023 there was a slight decrease in budget financing of culture (from 9.98 to 9.40 billion rubles). There are a number of regions with reduced budget funding during the pandemic and subsequent stagnation. In the Republic of Karelia, the recovery index was 0.95, and by 2023, expenses decreased to 2.55 billion rubles against 2.92 billion rubles in 2019, despite a short-term surge in 2020

Table 2. Volume of paid services of cultural institutions per capita in Russia and subjects of the Northwestern Federal District in 2018–2023, rubles at comparable prices in 2023

Constituent entity of the Russian Federation	Year						Fall index (2020 to 2019)	Recovery index* (2021 to 2019)
	2018	2019	2020	2021	For reference			
					2022	2023		
Total for the Russian Federation	**1896.64**	**1971.16**	**975.29**	**1363.71**	**1479.07**	**н\д**	**0.49**	**0.69**
Northwestern Federal District	**3690.61**	**4479.68**	**1868.22**	**2174.41**	**2481.51**	**3501.90**	**0.42**	**0.49**
Republic of Karelia	1189.50	1318.25	857.34	1220.26	1396.67	2351.50	0.65	0.93
Kaliningrad Region	1662.57	1807.08	1008.53	1608.29	1761.15	2229.40	0.56	0.89
Vologda Region	1067.68	1673.35	1124.14	1280.26	1377.23	1612.00	0.67	0.77
Leningrad Region	659.82	1711.09	1178.88	1255.85	1207.83	1490.20	0.69	0.73
Murmansk Region	1892.98	1908.40	818.37	1399.54	1661.57	1748.90	0.43	0.73
Pskov Region	978.39	985.85	494.23	721.11	758.81	843.7	0.50	0.73
Novgorod Region	1058.24	1176.46	680.09	811.06	817.9	1023.70	0.58	0.69
Arkhangelsk Region	1210.20	1277.23	536.2	874.19	920.7	1158.30	0.42	0.68
Komi Republic	888.11	872.5	478.33	592.21	520.13	696.8	0.55	0.68
Saint Petersburg	7618.24	9002.84	3362.24	3719.09	4386.07	6472.80	0.37	0.41

* Ranked by the recovery index.
The volume of paid services to the public is the monetary equivalent of the volume of services provided by residents of the Russian economy (legal entities, individual entrepreneurs, the self-employed, notaries and lawyers who have established law offices) to citizens of the Russian Federation, as well as to citizens of other states (non-residents) who consume certain services on the territory of the Russian Federation. The indicator is formed in accordance with the official statistical methodology approved by Rosstat Order 668, dated December 20, 2023.
According to: EMISS data 1.10.1. Volume of paid services to the public. Available at: https://www.fedstat.ru/organizations/?expandId=1293165#fpsr1293165

(3.46 billion rubles). The Komi Republic (index 0.94), the Vologda Region (0.93), and the Pskov Region (0.93) also showed a reduction in budget expenditures on culture in 2021 compared to 2019. At the same time, volumes in the Vologda and Pskov regions were partially restored by 2023, but they are still below pre-crisis levels. Saint Petersburg deserves special attention (the recovery index of 0.90 is the lowest in the district). Expenses decreased from 32.44 billion rubles in 2019 to 29.34 billion rubles in 2021 and only by 2023 exceeded the pre-crisis level (37.18 billion rubles). During the most acute period of the pandemic, budget support for culture in the metropolis was the least stable among all regions of the Northwestern Federal District. The most interesting conclusions can be drawn when comparing the dynamics of budget expenditures and market revenues. For example, in Karelia, low budget support is combined with the successful adaptation of paid services to the public. The most alarming case is Saint Petersburg, where both financing channels (budget and market) have shown low stability *(Tab. 3)*.

The dynamics of the number of employees of cultural institutions demonstrates sustainability, and in a number of regions, an increase in this indicator has been recorded during the pandemic. In Russia as a whole, the recovery index was 1.04. It is noteworthy that in most regions both indexes are greater than 1. The only exceptions are the Vologda Region (both indexes = 0.95) and the Komi Republic with a recovery index of 0.98. The index values do show insignificant regional

Table 3. Expenditures of the consolidated budgets of Russia and subjects of the Northwestern Federal District on culture in 2018-2023 at comparable prices in 2023, billion rubles

Constituent entity of the Russian Federation	Year						Fall index (2020 to 2019)	Recovery index* (2021 to 2019)
	2018	2019	2020	2021	For reference			
					2022	2023		
Russian Federation	**634.33**	**671**	**644.76**	**645.8**	**668.5**	**714.5**	**0.96**	**0.96**
Northwestern Federal District	**71.91**	**76.7**	**73.93**	**73.78**	**77.07**	**84.98**	**0.96**	**0.96**
Murmansk Region	5.62	5.95	6.27	6.65	7.26	6.58	1.05	1.12
Kaliningrad Region	2.84	3.42	3.41	3.71	3.6	3.88	1.00	1.08
Novgorod Region	2.24	2.34	2.22	2.51	3.04	4.56	0.95	1.07
Leningrad Region	9.3	9.76	10.27	9.98	9.44	9.4	1.05	1.02
Arkhangelsk Region	5.58	5.73	5.8	5.72	5.78	7.03	1.01	1.00
Republic Of Karelia	2.49	2.92	3.46	2.78	2.79	2.55	1.18	0.95
Komi Republic	5.69	6.02	6.1	5.64	5.49	5.68	1.01	0.94
Vologda Region	3.83	4.86	4.79	4.51	4.99	4.92	0.99	0.93
Pskov Region	1.75	2.02	1.89	1.87	1.96	2.12	0.94	0.93
Saint Petersburg	31.34	32.44	28.68	29.34	31.55	37.18	0.88	0.90

* Ranked by the recovery index.
According to: data from the Federal Treasury of the Russian Federation.

differentiation. However, we can single out a group of leaders in the recovery index: the Pskov (index 1.07), Kaliningrad (1.07) and Arkhangelsk (1.06) regions. On the contrary, subjects with stagnation or staff reduction – the Komi Republic and the Vologda Region – became the only regions of the Northwestern Federal District where the number of cultural workers in 2021 was lower than the pre-crisis level. The case of the Vologda Region is particularly significant: the decline began as early as 2020 (index 0.95) and was not compensated in subsequent years (6,760 people in 2023 versus 7,026 people in 2019; *Tab. 4*). The likely reason for this is the structural optimization of the economy and budget expenditures.

Based on four particular indicators of resilience, which include indices of recovery in the volume of paid services, budget expenditures on culture, attendance and number of employees of cultural institutions, an integral index of resilience was calculated as the arithmetic average of four recovery indices (2021 to 2019) for each region. The obtained values of the integral index range from 0.72 to 0.96 with a total range of 0.24. Based on this range, three levels of resilience were identified: low (from 0.72 to 0.80); medium (from 0.81 to 0.88); high (from 0.89 to 0.96).

The group with high resilience includes five regions of the Northwestern Federal District: the Kaliningrad, Pskov, Novgorod, Leningrad regions, and the Republic of Karelia. These territories are characterized by balanced or advanced recovery in most indicators (market, budget, personnel). It is worth noting that this group includes regions with both high incomes (Leningrad Region) and more modest economic indicators. This confirms that the sustainability of the cultural sphere is determined not only by budgetary possibilities, but also by the effectiveness of management decisions.

Table 4. Number of employees of cultural institutions of Russia and subjects of the Northwestern Federal District in 2018–2023, people

Constituent entity of the Russian Federation	Year						Fall index (2020 to 2019)	Recovery index* (2021 to 2019)
	2018	2019	2020	2021	For reference			
					2022	2023		
Total for the Russian Federation	**792494**	**744528**	**768841**	**772021**	**771502**	**769082**	**1.03**	**1.04**
Northwestern Federal District	**88163**	**84591**	**85565**	**86498**	**87255**	**87354**	**1.01**	**1.02**
Pskov Region	3889	3843	3933	4112	4139	4117	1.02	1.07
Kaliningrad Region	5167	4730	4920	5050	5084	5107	1.04	1.07
Arkhangelsk Region	7576	6717	7162	7152	7193	7170	1.07	1.06
Republic Of Karelia	3821	3581	3689	3709	3675	3711	1.03	1.04
Novgorod Region	3929	3732	3875	3833	3810	3749	1.04	1.03
Saint Petersburg	36906	35221	35346	36080	36311	36529	1.00	1.02
Murmansk Region	4327	4002	4073	4081	4094	4089	1.02	1.02
Leningrad Region	10247	10356	10545	10509	10818	10806	1.02	1.01
Komi Republic	5104	4873	4862	4786	4881	4808	1.00	0.98
Vologda Region	6724	7026	6646	6695	6754	6760	0.95	0.95

* Ranked by the recovery index.
According to: AIS "Statistics" data of the Ministry of Culture of the Russian Federation. Available at: https://stat.mkrf.ru/indicators/?ysclid=mifpk0iiyh818882109

The Vologda, Murmansk, Arkhangelsk regions, and the Komi Republic showed average resilience. These regions are characterized by multidirectional trends: for example, in the Murmansk Region, high budget expenditures are combined with incomplete restoration of paid services, while in the Komi Republic there was a decrease in all three indicators, but the integral value remained within the average range.

It is noteworthy that the group with low sustainability includes the largest cultural center in the country, Saint Petersburg (integral index 0.72). It is the only region in the group with low cultural resilience. A significant decrease in the volume of paid services in 2020 (fall index of 0.37), a low recovery index for paid services (0.41) and budget expenditures (0.90) led to the fact that even staff retention (an index of 1.02) could not compensate for the failure.

Geographical differentiation is noteworthy: regions with high resilience are located mainly in the western part of the Northwestern Federal District (Kaliningrad, Pskov, Novgorod, Leningrad regions, Republic of Karelia), while subjects with medium resilience are located in the eastern and northern parts of the district (Vologda, Arkhangelsk, Murmansk regions, Komi Republic).

It is also important to note that the average index value for the country is 0.84, while for the Northwestern Federal District it is 0.80. At the same time, if we exclude Saint Petersburg, all regions of the Northwestern Federal District demonstrate a higher sustainability index than the national average *(Figure)*.

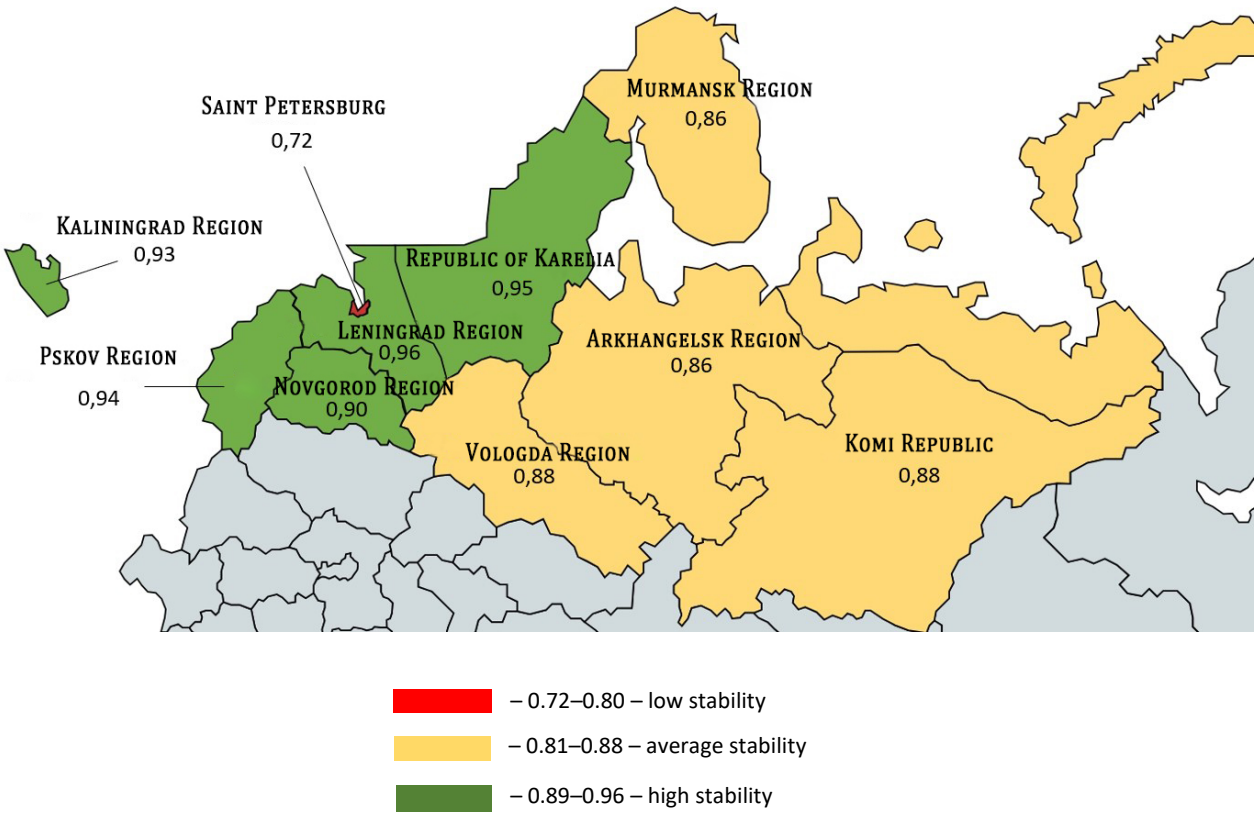

Figure. Integral index of cultural resilience in the regions of Northwestern Federal District in the post-crisis period*

* It is calculated as the arithmetic average of the 2021 to 2019 recovery indices in terms of paid services, budget expenditures and the number of employees.
Source: own compilation.

Conclusion

As a result of the analysis, we found that the COVID-19 pandemic had a significant destabilizing effect on the cultural sector of the regions of the Northwestern Federal District. At the same time, the degree of negative consequences and the pace of recovery showed noticeable heterogeneity in individual regions of the district. The absence of dependence between the scale of the cultural potential of the region and its ability to withstand crises has been revealed. This is illustrated by the fact that Saint Petersburg, which is a developed cultural center, has demonstrated the greatest exposure to negative influences, while some territories with less developed cultural infrastructure have been able to show a high degree of resilience. Most likely, the viability of the cultural sector is determined not so much by the amount of financial injections from the budget or the existing infrastructure, as by the effectiveness of adaptive mechanisms, the ability to find alternative sources of financing and a flexible approach to managing human resources in the sector itself at the regional level. Therefore, the hypothesis of the study was confirmed.

The limitations of the study are related to the use of data only for 2019–2021 to calculate the integral cultural resilience index, which made it possible to isolate the pandemic shock, but does not take into account the

post-crisis dynamics of 2022–2023, which was influenced by new external factors such as tougher international sanctions, the withdrawal of foreign cultural institutions and digital platforms from the Russian market, the restructuring of the logistics of touring activities, the rising cost of material and technical resources, and changing the structure of public financing and priorities of cultural policy in the context of economic instability. In addition, the proposed set of four indicators does not cover the qualitative characteristics of cultural services, the level of digital maturity of institutions and public satisfaction with the quality of service

The practical significance of the work lies in the possibility of using the results obtained and the developed integral index of resilience to improve the mechanisms of regional cultural policy, especially in terms of targeted support for the most vulnerable territories and the development of crisis management scenarios in the field of culture. The proposed index makes it possible to identify regions with low resilience (using the example of the Northwestern Federal District). Saint Petersburg), for which it is recommended to develop special post-crisis recovery programs, including, for example, subsidizing paid services to the public and temporarily increasing the budget financing rate until pre-crisis indicators are reached. Based on our methodology, it is also possible to form regional cultural reserve funds with predefined activation criteria. For regions with an average level of resilience, but a pronounced personnel decline (based on the Northwestern Federal District – the Vologda Region and the Komi Republic), it is necessary to implement targeted regional staff retention programs, including grants for advanced training, housing programs for young professionals, incentive allowances for work in crisis conditions, and other measures.

Future research areas include expanding the indicator base through indicators of the digital transformation of the cultural sector in the regions, conducting comparative analysis with other federal districts, as well as econometric modeling of factors determining differences in the regional resilience of the sector.

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РЕЗИЛЬЕНТНОСТЬ СФЕРЫ КУЛЬТУРЫ В РЕГИОНАХ: ОТ ШОКА ПАНДЕМИИ К ВОССТАНОВЛЕНИЮ

Цель исследования состоит в оценке резильентности сферы культуры регионов (субъектов Северо-Западного федерального округа) к кризисам на примере пандемии COVID-19. Научная новизна заключается в обосновании и эмпирическом подтверждении того, что бюджетные учреждения культуры могут характеризоваться резильентностью подобно коммерческим организациям, регионам и национальным экономикам, что расширяет границы применимости соответствующей концепции на непредпринимательский сектор. Разработана методика количественной оценки резильентности сферы культуры регионов, основанная на агрегировании четырех индикаторов: объем платных услуг, бюджетные расходы, численность сотрудников, посещаемость учреждений культуры. Информационную базу составили данные Росстата, Федерального казначейства, АИС Минкультуры РФ и ЕМИСС за 2018–2023 гг. Выделены три уровня резильентности сферы культуры в регионах (низкий, средний, высокий). Установлено, что высокий ее уровень имеют пять регионов Северо-Западного федерального округа: Калининградская, Псковская, Новгородская, Ленинградская области и Республика Карелия; средний уровень – Вологодская, Мурманская, Архангельская области и Республика Коми; г. Санкт-Петербург – единственный субъект СЗФО с низкой резильентностью. Выявлена географическая закономерность: западные регионы СЗФО демонстрируют более высокую устойчивость в развитии сферы культуры по сравнению с восточными и северными. Установлено, что высокая адаптивность сферы культуры достигается за счет не только бюджетного финансирования, но и адаптации платных услуг, при этом кадровая составляющая продемонстрировала наибольшую устойчивость во всех регионах, за исключением Вологодской области и Республики Коми. Направления будущих исследований включают расширение набора индикаторов, учет цифровой трансформации культурных услуг и сравнительный анализ с другими федеральными округами. Практическая значимость работы состоит в возможности использования полученных результатов для совершенствования механизмов управления культурной сферой, разработки адресных мер поддержки учреждений культуры, а также формирования политики в сфере культуры на региональном и федеральном уровнях.

Культура, регионы, культурная политика, резильентность, устойчивость, пандемия, COVID-19.

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LIFE QUALITY AND HUMAN POTENTIAL OF TERRITORIES

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ASSESSMENT OF THE RELATIVE EFFECTIVENESS OF INCREASING LIFE EXPECTANCY IN RUSSIAN REGIONS: NONPARAMETRIC APPROACH

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Life expectancy is a key indicator of the quality of public administration and at the same time one of the goals of the national development. In conditions of limited budgetary resources and significant territorial differentiation of the socio-economic development of Russian regions, it becomes critically important to assess the effectiveness of the transformation of available regional resources into an increase in life expectancy. The pandemic crisis of 2020–2021 has actualized the need to identify sustainable models for increasing life expectancy in regions that demonstrate best management practices in the face of external shocks. Thus, the aim of the study is to assess the relative effectiveness of 79 regions of the Russian Federation in achieving high life expectancy over the period 2005–2023, to typologize them according to productivity dynamics and identify key trajectories of change. Using the DEA (Data Envelope Analysis) method, the relative efficiency coefficients of the regions were calculated; then, using the Malmquist index, the temporal dynamics was analyzed with a decomposition into a component of changes in efficiency and technological progress. It was revealed that 83.5% of regions are characterized by a simultaneous improvement in efficiency and technology, however, 16.5% of regions showed a decrease in efficiency with technological progress. We established that the long-term growth in life expectancy is due not only to the volume of resources, but also to the quality of management, a balance between the efficiency of using determinants and technological development,

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which determines the need for a differentiated demographic policy to ensure a sustainable increase in life expectancy throughout the country.

Life expectancy, DEA analysis, efficiency, region, Malmquist index, regional policy, typology of regions.

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Introduction

Demographic dynamics constitute one of the most sensitive indicators of a nation's socio-economic development, reflecting both the quality of life and the effectiveness of social policy. In present-day Russia, achieving higher life expectancy has been designated a strategic priority for national development. Under Presidential Decree 309 of May 7, 2024, "On the National Development Goals of the Russian Federation for the Period up to 2030 and the Long-Term Outlook up to 2036"[1], the attainment of specific life-expectancy targets serves as a key criterion for assessing the performance of government bodies at all levels.

Meeting this goal, however, encounters a number of systemic challenges. The Russian Federation is characterized by pronounced population aging, which places an increasing burden on the health and social security systems. High regional differentiation remains a major concern: the gap in life expectancy between the leading and lagging regions reaches ten years[2], pointing to unequal opportunities for citizens' health depending on their place of residence. The situation was further aggravated by the COVID-19 pandemic, which caused a substantial drop in life expectancy in 2020–2021, followed by a period of demographic recovery.

Given fiscal constraints and the need to optimize public spending, a simple, extensive path of increasing healthcare and social program funding is no longer the sole solution. There is a compelling need to shift the focus from the volume of resources spent to an assessment of how efficiently those resources are used. The critical question becomes not how much funding a region receives, but how effectively that funding is transformed into the preservation of human life and health.

Despite a vast body of research on mortality factors and life expectancy, existing studies are often limited to correlation analyses of the influence of socio-economic determinants on life expectancy, without addressing the key question of how efficiently regions transform their available resources – financial, human, and infrastructural – into population longevity. High spending does not always guarantee high life-expectancy indicators, which points to efficiency reserves within the system.

[1] On the National Development Goals of the Russian Federation for the Period up to 2030 and the Long-Term Outlook up to 2036: Presidential Decree 309 of May 7, 2024. Available at: http://www.kremlin.ru/acts/bank/50542 (accessed: 27.03.2026).

[2] Calculated from the data of the Unified Interdepartmental Statistical Information System (EMISS). Available at: https://www.fedstat.ru/indicator/31293 (accessed: 12.03.2026).

In addition, a methodological limitation of many studies is the inertia inherent in demographic processes. Ignoring the time lags between resource allocation and the resulting demographic effect can distort efficiency assessments. Moreover, Russia's spatial landscape is highly heterogeneous in terms of economic scale, population density, geography, and climate. The use of methods that assume constant returns to scale is, in this case, inappropriate. There is a need for approaches that allow for variable returns to scale, which would make it possible to compare the efficiency of regions of a similar type and to avoid systematic errors in the assessment of both small and large federal subjects.

Accordingly, the aim of this study is to assess the relative efficiency of the regions of the Russian Federation in achieving high life expectancy over the period 2005–2023, using the non-parametric method of Data Envelopment Analysis (DEA), with a subsequent typology based on productivity dynamics and the identification of key trajectories of change.

The novelty of the study lies in its comprehensive approach to efficiency assessment. This approach includes accounting for regional heterogeneity through a model with variable returns to scale – which improves the quality of estimates for subjects with different population sizes – identifying the benchmark regions that form the "best-practice frontier" and assessing the degree of lag among inefficient subjects, and conducting a dynamic analysis of efficiency change based on the decomposition of the Malmquist index. This decomposition separates the contribution of technological progress (which reflects nationwide trends and federal initiatives) from that of local management efficiency (the "catch-up" effect). Such an approach subsequently allows for the development of differentiated regional policy recommendations that take into account both the reserves for internal improvement and the need to introduce advanced health-preservation technologies.

Theoretical review

Research into the factors that determine life expectancy rests on a number of established theoretical concepts that help explain both the historical dynamics of mortality and present-day interregional differences.

A key concept is the epidemiological transition theory, developed by A. Omran and later elaborated in the work of R. Rogers. According to this theory, the structure of morbidity and mortality shifts systematically in the course of socio-economic development: from a predominance of exogenous causes (infectious and parasitic diseases) to endogenous ones (cardiovascular and oncological diseases), and, at the current stage, to factors associated with lifestyle and the quality of medical care. This theory provides a rationale for the view that, in developed and transition economies, the key determinants of life expectancy are no longer so much sanitary and epidemiological safety as the level of development of the healthcare system, behavioral risks, and socio-economic conditions (Omran, 1971; Rogers, Hackenberg, 1987).

An important theoretical foundation is the concept of human potential and social capital, developed in the work of A. Sen and empirically embodied in the Human Development Index (HDI) of the United Nations Development Programme. This approach treats life expectancy not merely as a result of economic growth, but as an integral indicator of the quality of institutions, the accessibility of education and healthcare, and the level of social inequality. Research conducted within this paradigm demonstrates that achievements in life expectancy are determined by the set of

opportunities available to the population, not only by the volume of resources at their disposal (Sen, 1999; Chatterjee, 2005).

In order to justify the application of efficiency analysis methods, an important role is played by the theory of resource efficiency in the social sphere, which adapts the microeconomic theory of production to the analysis of social systems. Within this theory, regions, countries, or social programs are treated as production units (decision-making units, DMUs) that transform multiple resources ("inputs") into demographic and social outcomes ("outputs"). This approach makes it possible to quantitatively assess how efficiently the resources used – healthcare financing, human resources, the population's income level – are converted into increased life expectancy and quality of life (Hashimoto, Ishikawa, 1993; Mariano, Rebelatto, 2014).

From this perspective, it is useful to draw on the concept of "health production" developed by M. Grossman (Grossman, 1972). According to this concept, health is viewed not as an exogenous biological given but as a form of capital that is accumulated and maintained over the life course through the investment of time, financial resources, medical services, education, and behavioral practices. Grossman formalized this process through a health production function in which "healthy time" is the output and various resources serve as input factors. In a macro- and regional context, life expectancy can be interpreted as the cumulative result of demographic development – that is, as a measurable output of a production process carried out by the healthcare system, the socio-economic and institutional environment, and the behavior of the population as a whole (Volkova, Volkova, 2024).

The contemporary scholarly literature identifies several groups of factors that exert a significant influence on life expectancy, while recognizing that their contribution varies considerably depending on a country's level of development and its regional specificities. The influence of healthcare factors on life expectancy has been widely covered in the literature. Numerous studies confirm the importance of the availability of medical personnel and hospital beds. In a study by L. Asandului and co-authors, based on an analysis of 30 European countries, it was shown that the number of physicians and hospital beds per capita, together with public health expenditure, are significant input variables that determine the efficiency of healthcare systems in achieving high life expectancy and low infant mortality (Asandului et al., 2014). At the same time, the literature points to the non-linearity of this relationship: once a certain saturation threshold is reached, an increase in the number of beds and physicians ceases to yield a commensurate gain in life expectancy, indicating an effect of "excess capacity" (Cetin, Bahce, 2016).

Socio-economic conditions are likewise key determinants of demographic well-being, as confirmed by studies demonstrating a stable link between income inequality, poverty levels, and mortality. Thus, an empirical analysis of 28 developed countries conducted by E. Neumayer and T. Plümper showed that market-income inequality is positively correlated with inequality in life expectancy, whereas income redistribution through the fiscal system helps reduce disparities in longevity (Neumayer, Plümper, 2016). Similar results were obtained in a study by R. Rogers and co-authors, which established that differences in education, income, and employment mediate a substantial part of the educational gradients in adult mortality (Rogers et al., 2013).

Behavioral patterns and environmental conditions have a substantial impact on mortality. Alcohol-related mortality is of particular significance for Russia. Studies by

A.V. Nemtsov and A.T. Terekhina confirm that a high level of alcohol consumption, especially in the form of strong spirits, makes a decisive contribution to excess mortality among working-age men (Nemtsov, Terekhina, 2007). For this reason, indicators such as mortality from accidental alcohol poisoning are often used in models for assessing the efficiency of regional demographic policy, serving as a proxy variable for the prevalence of risky behavior (Timonin et al., 2016).

The influence of urbanization on life expectancy is ambiguous. On the one hand, urbanization provides better access to specialized medical care and social services. On the other hand, the urban environment is associated with elevated stress levels, air pollution, and the prevalence of behavioral risks. Empirical research for China, conducted using geographically weighted regression, has confirmed that the contribution of urbanization to life expectancy varies across space and over time, which makes it necessary to take regional specificities into account when formulating public demographic policy measures (Jiang et al., 2018).

The specificities of Russian regions call for a separate examination in the context of the present study. Russia is characterized by significant disparities between central and peripheral territories – a particularly distinctive situation has taken shape in the North Caucasus, where high life expectancy is traditionally recorded alongside relatively low economic indicators – as well as by specific challenges facing the regions of the Far East and the Arctic, associated with extreme climatic conditions and low population density (Shchur, Timonin, 2020; Rodionova, Kopnova, 2020; Trofimova et al., 2023).

The need to assess the efficiency of regional socio-economic systems in achieving high life expectancy is thus driven by several key factors. First, the resources channeled into healthcare, social policy, and human capital development are invariably limited, which demands that they be used as productively as possible. Second, the existence of substantial interregional differentiation in life-expectancy indicators across Russia points to heterogeneity in conditions and management practices, making it imperative to identify leading regions and to disseminate their experience. Third, efficiency assessment not only makes it possible to rank territories but also to establish quantitative target benchmarks for inefficient regions, showing what outcomes can be achieved with the existing level of resource provision (Mariano et al., 2015; Storto, 2020). The application of efficiency measurement methods thus serves as a tool for informing managerial decisions aimed at improving the quality of life and reducing spatial inequality.

A broad range of methodological approaches is employed in international practice to assess the efficiency of social progress and development:

1. Multidimensional indices, such as the Human Development Index (HDI), which combines indicators of health, education, and income (Herrero et al., 2010). Despite their visual appeal, these indices do not make it possible to assess the resource efficiency of the outcomes achieved.

2. Index-based methods and principal component analysis, used to construct aggregated indicators of social well-being (England, 1998). These methods allow information to be condensed but do not provide insights into the "inputs" and "outputs" of the process.

3. Dynamic productivity indices, above all the Malmquist index, which decomposes performance change into technical efficiency change and technological change (Pastor, Lovell, 2005; Färe et al., 1994). This approach is valuable for analyzing changes over time, but does not yield a static assessment of efficiency at a particular point in time.

4. Parametric methods of Stochastic Frontier Analysis (SFA), which account for random error and require the specification of a functional form (Coelli et al., 2005).

5. Non-parametric methods of Data Envelopment Analysis (DEA), which make it possible to assess the relative efficiency of decision-making units without assumptions about the functional form (Charnes et al., 1978; Banker et al., 1984).

Each group of methods has its own advantages and limitations. Parametric methods (SFA), for instance, have the advantage of being able to account for stochastic error, which makes it possible to separate inefficiency from random shocks. Their application in the analysis of social systems, however, is constrained by the need for a rigid specification of the functional form of the production function, which can lead to specification errors when analyzing complex, multi-component processes (Coelli et al., 2005).

The present study gives preference to the non-parametric DEA method, which was originally proposed by A. Charnes, W. Cooper, and E. Rhodes (Charnes et al., 1978) and later modified by R. Banker, A. Charnes, and W. Cooper to account for variable returns to scale (the BCC model) (Banker et al., 1984). The DEA method makes it possible to assess how efficiently given input resources are transformed into socially meaningful outputs without the need to set price or a priori weighting parameters, which is particularly important for intangible and multi-criteria social indicators. Although the method was initially designed for the market sector, its adaptation to healthcare, education, and demographic research is methodologically well founded and has been confirmed by an extensive body of empirical literature (Kohl et al., 2019; Emrouznejad, Yang, 2018). When the model is correctly specified, DEA demonstrates high relevance for the analysis of social production processes, thereby making it possible to move from a descriptive assessment of demographic indicators to the measurement of how effectively resources are used in achieving socio-demographic goals.

The choice of DEA is thus dictated by the following characteristics of the method: first, its ability to handle multiple input and output variables without reducing them to a common unit of measurement; second, the absence of any need to assign weights a priori; and third, the capacity to identify benchmark regions for inefficient units.

The application of DEA in Russian research on social efficiency is represented by a number of studies. In the work of M.V. Bikeeva and co-authors, the DEA method was used to analyze the effectiveness of the implementation of the "Demography" national project (Bikeeva, Sysoeva, 2023). At the same time, M.V. Frants emphasizes the need to take spatial effects into account when assessing the efficiency of regional healthcare systems, since the results of neighboring regions can influence the achievements of a particular subject (Frants, 2025).

A specific methodological problem when modeling the determinants of life expectancy is the presence of time lags. Demographic processes are highly inertial: investments in healthcare, education, and social infrastructure do not lead to an immediate change in mortality indicators. The effect of investment in healthcare fixed assets or in prevention programs materializes with a time lag that can range from several years to a decade (Poças et al., 2020).

Existing studies employ various approaches to accounting for lags: the inclusion of lagged values of input variables in the model, the use of distributed lags, and panel data aggregation. However, including lagged variables in a standard DEA model increases the dimensionality of the input space, which, given a limited number of observation units (regions),

reduces the discriminatory power of the method and can lead to an unreasonably high number of efficient regions (Marshall, Shortle, 2005; Despotis, 2005). A critical review of alternative methods – dynamic DEA, window analysis, the use of lags as part of inputs – shows that they either do not solve the problem of accounting for the inertia of demographic processes in a static model or lead to a loss of degrees of freedom and a decline in the reliability of the results.

The application of DEA analysis to demographic research, therefore, runs into the problem of accounting for time lags while preserving the discriminatory power of the model, which rules out the mechanical inclusion of multiple lagged variables. For this reason, the Malmquist index (MI) is used within the present approach to analyze the dynamics of efficiency over time. The MI makes it possible to decompose efficiency change into two components: technical efficiency change (catch-up effect, EC) and technological change (frontier shift, TC) (Färe et al., 1994). In the context of demographic analysis, the EC component is interpreted as the ability of regions to catch up with the leaders by improving the use of existing resources, while the TC component is seen as the result of the introduction of new medical technologies, the digitalization of healthcare, and improvements in prevention and treatment methods. Such a decomposition analysis provides a deeper understanding of the sources of life expectancy growth than a static efficiency assessment (Briec et al., 2013).

Data and methods

The empirical basis of the study consists of official data from the Federal State Statistics Service (Rosstat) for the period 2005–2023, organized as a panel database. The initial set of variables included 50 socio-economic indicators reflecting the key determinants of public health and living conditions. To ensure the methodological validity of the analysis, which depends critically on the homogeneity of the sample and the completeness of the time series, regions with incomplete or incomparable data were excluded from the set of objects. In particular, the following were removed from the analysis: the Chechen Republic, the Republic of Crimea, the City of Sevastopol, as well as subjects with a complex administrative structure that includes autonomous areas (the Arkhangelsk Region excluding the AA; the Nenets Autonomous Area; the Khanty-Mansi Autonomous Area – Yugra; the Yamal-Nenets Autonomous Area; and the Tyumen Region excluding the AA). This filtering was prompted by the need to minimize statistical noise and gaps in reporting, thereby ensuring the correctness of the comparative efficiency assessment.

The methodology of Data Envelopment Analysis (DEA) is a non-parametric approach to assessing the relative efficiency of homogeneous decision-making units (DMUs) that use multiple inputs to produce multiple outputs. Unlike stochastic frontier models, DEA does not require the a priori specification of the functional form of the production frontier, constructing it empirically on the basis of best practices in the sample (Charnes et al., 1978). The basic CCR model, proposed by A. Charnes, W. Cooper, and E. Rhodes, assumes constant returns to scale (CRS). For the analysis of socio-economic systems such as regions, however, it is more appropriate to use the BCC model with variable returns to scale (VRS), developed by R. Banker and co-authors, which makes it possible to separate technical efficiency from scale efficiency (Banker et al., 1984). To assess productivity dynamics over time, the Malmquist index is used, which allows the decomposition of total productivity change into its components:

efficiency change and technical change (Färe et al., 1994).

In the present study, a panel DEA model was constructed to assess the efficiency of the regions of the Russian Federation in raising the life expectancy of the population. The specification of the model is determined by the goal of maximizing the target indicator for a given set of socio-economic conditions, as well as by the heterogeneity of the regions and the need to assess efficiency relative to the local production possibility frontier.

From a mathematical point of view, the DEA model is a linear programming problem. Suppose there are *N* regions (decision-making units, DMUs), each of which uses *M* types of resources (inputs *xij*) to produce *K* outputs (outputs *yrj*) (1):

$$\min_{\theta,\lambda} \theta$$

subject to:

$$\sum_{j=1}^{N} \lambda_j y_{rj} \geq y_{ro}, r = 1, \dots, K \text{(output constraints);}$$

$$\sum_{j=1}^{N} \lambda_j x_{ij} \leq \theta \cdot x_{io}, i = 1, \dots, M \text{(input constraints);}$$

$$\sum_{i=1}^{N} \lambda_j = 1 \text{(convexity condition / VRS);}$$

where

θ is the scalar efficiency score ($0 < \theta \leq 1$); a value of $\theta = 1$ indicates that the region lies on the efficiency frontier;

λ_j is a vector of weights that identifies the benchmark region for an inefficient unit;

the constraint $\sum \lambda_j = 1$ ensures variable returns to scale, making it possible to separate pure technical efficiency from scale efficiency.

Life expectancy at birth was chosen as the sole output parameter. The selection of input variables was carried out through a multi-stage procedure designed to strike a balance between the explanatory power of the model and the preservation of its discriminatory capacity. To ensure content validity, the strength of the linear association between each indicator and the target variable was first assessed using Pearson's correlation coefficient; only statistically significant predictors were included in further analysis. A key constraint was the requirement that there be no multicollinearity among the input factors, since high inter-factor correlation distorts the weights in the DEA model. To address this, a greedy selection algorithm was applied: the variables were ranked in descending order of their correlation with the target variable and then sequentially added to the model on the condition that their correlation with the already selected factors did not exceed a threshold value of 0.7.

At the final stage, three alternative sets of input variables were formed (with 7, 8, and 10 factors). To verify the absence of multicollinearity in each specification, the variance inflation factor (VIF) was calculated. The diagnostic analysis confirmed the statistical admissibility of all three variants: the maximum VIF values were 2.73, 3.79, and 4.10, none of which exceeded the critical threshold of five. The specification with eight factors (max VIF = 3.79, mean VIF = 2.21) was chosen for the main analysis. This choice stems from the search for an optimal compromise between statistical reliability and the substantive completeness of the model: the eight-factor specification preserves a sufficient margin of robustness while, at the same time, providing a more comprehensive description of socio-economic conditions than the minimalist model.

The final input group comprises eight selected indicators:

X1 – number of mid-level medical personnel per 10,000 population;

X2 – mortality from diseases of the circulatory system, per 100,000 population;

X3 – spending from the budgets of territorial compulsory health insurance funds, million rubles;

X4 – share of the working-age population, %;

X5 – poverty rate, %;

X6 – retail trade turnover per capita, rubles;

X7 – mortality from road traffic accidents, per 100,000 population;

X8 – mortality from external causes, per 100,000 population.

Thus, the resources of regional systems for increasing life expectancy can be identified as: (a) the supply and accessibility of healthcare services (X1, X2, X3); (b) the standard of living (X5, X6); and (c) lifestyle and self-preservation behavior (X4, X7, X8).

The use of cause-specific mortality indicators is justified by the fact that they serve not as "explanations by the thing itself" but as integral indicators of the effectiveness of regional socio-economic systems in the context of raising life expectancy (Ivanova et al., 2024). This represents an important diagnostic finding, confirming that regional differences in life expectancy depend not only on socio-economic and institutional conditions but are also channeled through a limited number of causes of excess mortality that exert the greatest influence on overall population mortality.

Given the heterogeneous nature of the variables – where indicators X3 and X6 exert a positive influence on the target variable (resource provision), while the remaining ones exert a negative influence (morbidity, pollution) – an inversion procedure was applied to the positive factors in order to comply with the monotonicity axiom of DEA. The choice of an output-oriented model is justified by the fact that, for regions, the priority task is to maximize life expectancy for the existing level of socio-economic development. The model was estimated under the assumption of variable returns to scale (VRS) in order to take regional heterogeneity into account.

As a result of the calculations, the following metrics were obtained for each region and year: efficiency scores, which make it possible to identify the leaders on the efficiency frontier; target values and slacks, which show the deviation of the current level of life expectancy from the efficient level; and lambda weights, which define the reference group (benchmark regions) for inefficient regions.

Within the DEA methodology, the *Malmquist Productivity Index* (MPI) was calculated to assess productivity dynamics over time, with decomposition into the *efficiency change* (EC) component and the *technical change* (TC) component (Färe et al., 1994).

The Malmquist index for a particular region between periods t and t+1 is calculated using the formula:

$$M_o^{t,t+1} = \underbrace{\frac{D_o^{t+1}(x^{t+1},y^{t+1})}{D_o^t(x^t,y^t)}}_{\text{Efficiency Change (EC)}} \times \underbrace{\left[\frac{D_o^t(x^{t+1},y^{t+1})}{D_o^{t+1}(x^{t+1},y^{t+1})} \times \frac{D_o^t(x^t,y^t)}{D_o^{t+1}(x^t,y^t)}\right]^{1/2}}_{\text{Technological Change (TC)}}, \quad (2)$$

where

$D_o^t(x^t, y^t)$ is the distance function (the reciprocal of the efficiency score θ), calculated relative to the technology of period t for observations from period t;

$D_o^t(x^{t+1}, y^{t+1})$ is the distance function for observations from period t + 1, calculated relative to the technology of period t (a mixed-period measure).

An index value above one indicates productivity growth, while a value below one signals a decline. In the context of this study, MPI productivity is understood as the ability of a regional system to deliver an increase in life expectancy. It consists of the efficiency of using the available resources (EC), described by variables X1–X8, and technological progress (TC), which reflects the expansion of

the system's capabilities – for instance, through the introduction of technological or managerial innovations.

With the aim of producing an integral assessment of each region's dynamics, the accumulated (geometric mean) values of the MPI and its components were calculated over the entire study period. Using the combination of the EC and TC component values, a typology of regions by source of life expectancy growth is proposed. To analyze the temporal stability of development trajectories, the number of years each region fell into a given type during the observed period was also assessed. This level of detail made it possible to move from merely registering changes in efficiency to assessing the stability of regional policies: identifying stable leaders provides a basis for replicating best practices, while identifying volatile regions grounds the need for a systematic analysis of the causes of instability.

All computational procedures, including the calculation of efficiency scores and the Malmquist index, were implemented in the statistical programming environment R, version 4.3.2. The packages *Benchmarking* (for DEA models) and *prodlim* (for the Malmquist index) were used. The application of these specialized packages provided the necessary flexibility when working with panel data and ensured the reproducibility of the study's findings.

At the same time, the present study has a number of limitations that should be taken into account when interpreting the results. First, an assumption of a zero time lag was employed. In the model, the current year's resources were matched with life expectancy for the same period, which is justified by the nature of life expectancy as an indicator that is sensitive to current conditions. The use of single-year variables is also consistent with the annual cycle of budget planning and monitoring of the effectiveness of regional programs and is widely applied in empirical DEA research on the social sphere and healthcare, where the focus is shifted to assessing the current technical efficiency of resource use (Emrouznejad, Yang, 2018; Kohl et al., 2019). Undoubtedly, some of the input indicators (for instance, healthcare indicators) may have a prolonged effect; however, introducing arbitrary lags without a theoretically grounded delay length for each resource, and under the conditions of the structural changes of recent years, could introduce additional specification error and reduce the sample size.

Second, the assessment of regional efficiency was performed without taking spatial dependence into account. The classic DEA model identifies benchmarks based on the structural similarity of parameters, not geographic proximity, which makes it possible to assess the internal efficiency of resource use. Accounting for interregional influence requires the calibration of a spatial weights matrix and the application of specialized methods (Spatial DEA), which lies beyond the scope of this study.

Third, the study relies on deterministic efficiency estimates within the framework of the classic DEA model, which assumes the absence of a stochastic component in the formation of the production possibility frontier. Thus, the obtained efficiency scores are not accompanied by confidence intervals. Bootstrapping, which provides statistical inference in DEA, was not applied owing to the study's focus on comparative typologization rather than on the testing of statistical hypotheses. A systematic analysis of the determinants of efficiency and the profiling of clusters using external socio-economic determinants (GRP, institutional indicators, human capital) with the application of econometric methods (spatial models, Tobit regression) constitutes a self-contained task, the solution of which is planned as a continuation of the research.

Results and discussion

The dynamics of life expectancy in Russian regions over the period 2005–2023 were characterized by a lengthy stage of growth, a subsequent structural shock, and an accelerated post-crisis recovery *(Fig. 1)*. Over fourteen years, average life expectancy rose from 64.4 years in 2005 to 72.4 in 2019, reflecting a systemic improvement in socio-economic conditions and the quality of life of the population, including the enhanced effectiveness of the healthcare system. In the pandemic period of 2020–2021, however, the average life expectancy fell dramatically to 69.3 years (a decline of 3.1 years) owing to excess mortality, both directly from COVID-19 and as a result of the overload on the healthcare system during that period and the substantial reduction in the accessibility of medical services for the population. The following two years, nonetheless, demonstrated the regions' high resilience to this type of challenge: thanks to compensatory mechanisms and the normalization of the epidemiological situation, the indicators returned to pre-crisis levels, and in 2023 the average life expectancy stood at 72.3 years.

Despite the nationwide trend toward rising life expectancy, a significant differentiation among Russian regions persists with respect to this indicator, and it shows no signs of substantial convergence throughout the entire period under review. The interquartile range, which reflects the variability of values within the core set of regions, has remained stable within 5–7 years, while the gap between the maximum and minimum values reaches 10–13 years – something that is obviously linked both to the socio-economic inequality of the regions and to inequalities in the quality of managing socio-demographic processes.

The DEA analysis showed that, on average over the observed period, 29% of the regions lay on the efficiency frontier; in the inefficient regions, life expectancy was, on average, four years lower – that is, with better resource utilization, the inefficient regions could have raised the population's life expectancy by an average of 6% *(Fig. 2)*.

These indicators are unstable over time, however. A gradual improvement was observed

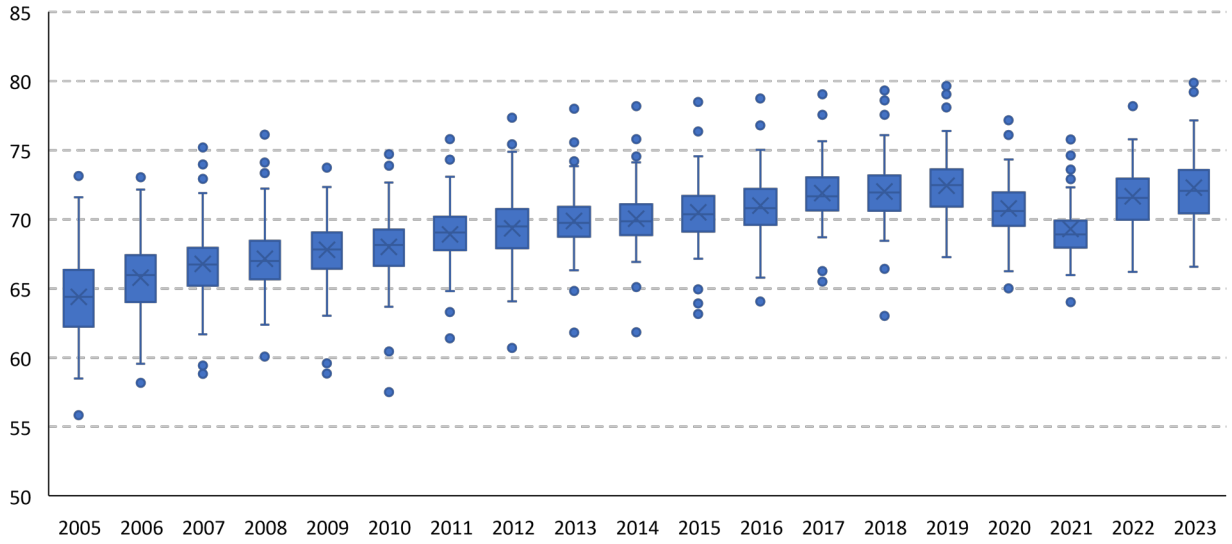

Figure 1. Dynamics of life expectancy in Russian regions, 2005–2023
Calculated from: Regions of Russia. Socio-Economic Indicators. 2025.
Available at: https://rosstat.gov.ru/folder/210/document/13204 (accessed: January 29, 2026).

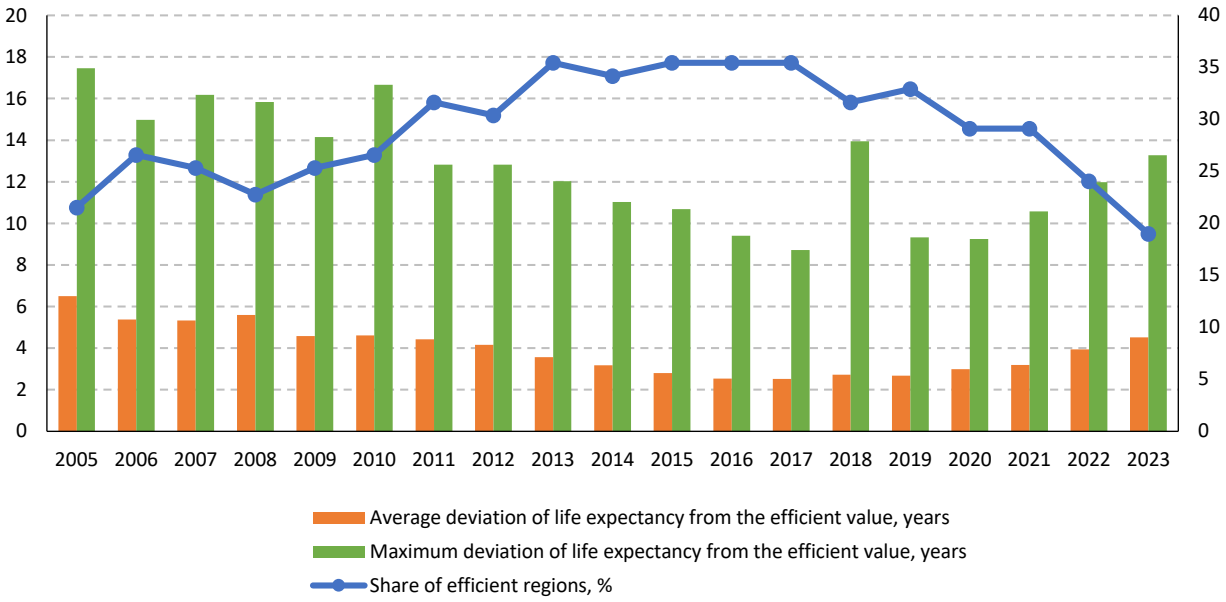

Figure 2. Average efficiency scores of Russian regions in raising population life expectancy, 2005–2023, based on DEA analysis

Calculated from: Regions of Russia. Socio-Economic Indicators. 2025.
Available at: https://rosstat.gov.ru/folder/210/document/13204 (accessed: January 29, 2026).

up to 2017, after which the trend reversed: the share of efficient regions declined substantially, and both the average and the maximum deviation of life expectancy values from the efficient level began to increase, indicating a growing disparity in demographic processes among Russian regions that began during the pandemic and has continued in subsequent years.

Throughout the entire period 2005–2023, only six regions lay on the efficiency frontier every year: the City of Moscow, the Moscow Region, the Krasnodar Territory, the Republic of Tatarstan, the Republic of Dagestan, and the Republic of Ingushetia. Clearly, these are four regions with the most favorable socio-economic situation and a developed healthcare system, as well as two regions where high life expectancy stems from entrenched genetic and socio-cultural specificities, which determines their leading positions.

The least efficient regions over the period under review were the Far Eastern regions (the Jewish Autonomous Region, the Amur and Magadan regions, the Khabarovsk and Primorye territories), where more efficient resource use could have raised life expectancy by 8–10 years, as well as a number of Siberian regions (the Irkutsk Region, the Komi Republic, the Republic of Buryatia, the Republic of Sakha (Yakutia), the Krasnoyarsk Territory), where the effect could have amounted to 7–8 years *(Fig. 3)*.

The application of the DEA methodology made it possible to identify ten benchmark regions – the Vologda, Volgograd, Kaliningrad, Vladimir, Kaluga, Leningrad, Voronezh, and Kostroma regions, the Karachayevo-Circassian Republic, and the Kamchatka Territory – that form the efficiency frontier in the space of socio-economic determinants of life expectancy and can serve as benchmarks for other regions in the task of effectively raising the population's life expectancy. A comparative analysis showed that, when self-preservation practices are comparable, belonging to the group of benchmarks is associated with statistically significantly lower values of healthcare accessibility *(Table)*. In this case, however, it is

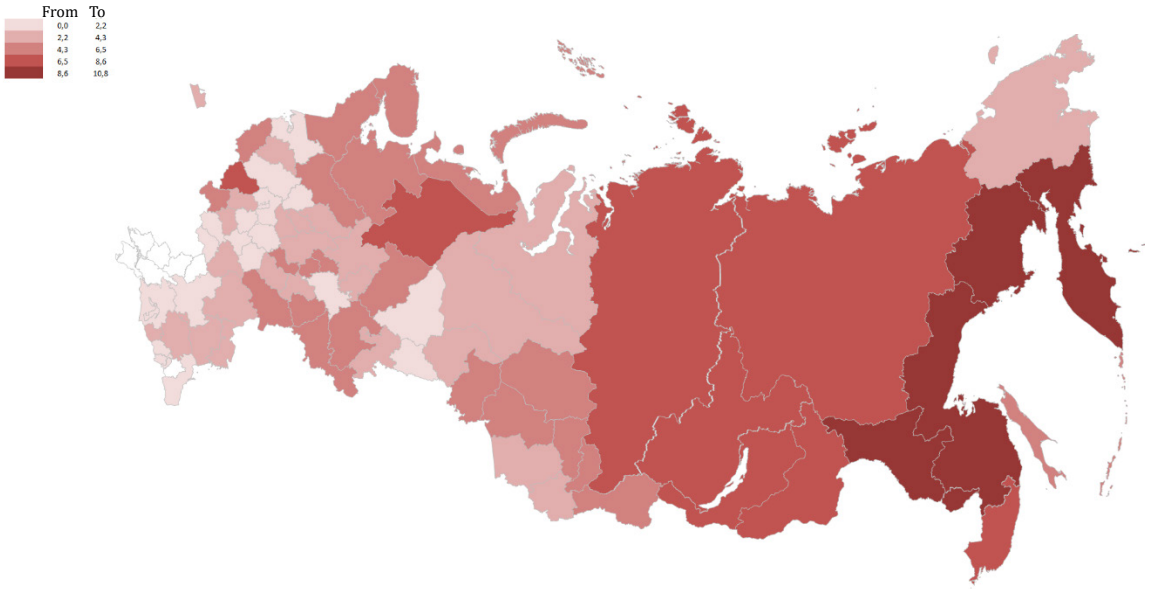

Figure 3. Deviation of life expectancy from the efficient level in Russian regions, average for 2005–2023**

Calculated from: Regions of Russia. Socio-Economic Indicators. 2025.
Available at: https://rosstat.gov.ru/folder/210/document/13204 (accessed: January 29, 2026).

Table. Ratio of the mean values of life expectancy determinants in the benchmark regions and the other regions (differences are statistically significant at p < 0.05)

"Resource" indicator*		Benchmark regions	Other regions	Deviation
Number of mid-level medical personnel, per 10,000 people	X1	102.83	112.69	-9.86
Mortality from diseases of the circulatory system, per 100,000 people	X2	776.16	700.43	75.73
Spending from the budgets of territorial compulsory health insurance funds, million rubles	X3	10951.45	19106.82	-8155.37
Poverty rate, %	X5	14.54	15.29	-0.75
Retail trade turnover per capita, rubles	X6	135315.98	148588.56	-13272.58
Mortality from road traffic accidents, per 100,000 people	X7	21.12	19.51	1.61
Mortality from external causes, per 100,000 people	X8	138.61	152.94	-14.33

* For the indicator "Share of the working-age population," the differences between the benchmark regions and the other regions are not statistically significant.
*Calculated from: Regions of Russia. Socio-Economic Indicators. 2025. Available at: https://rosstat.gov.ru/folder/210/document/13204 (accessed: January 29, 2026).

more appropriate to conclude that higher and more efficient indicators of life expectancy and health require a smaller volume of medical care, which is what the statistical data reflect.

At the same time, the heterogeneity identified among the benchmarks (the coefficient of variation across factors ranged from 15 to 45%) points to a multiplicity of optimal configurations of socio-economic factors for achieving high efficiency in the healthcare system. For instance, the Karachayevo-Circassian Republic is characterized by the optimal use of minimal resources; the Leningrad Region achieves high life-expectancy indicators thanks to a higher standard of living, which compensates for the relatively higher values of avoidable mortality (from road traffic accidents and external causes); the Kaliningrad and Kaluga regions show average life expectancy with an average level of resources; and the Kamchatka Territory demonstrates that, even with low life expectancy, a region can be efficient relative to its own capacity to shape it.

It should be noted separately that the leading regions in terms of DEA efficiency do not belong to the group of benchmark regions. From the standpoint of the DEA methodology, this result indicates that efficiency is not identical to being a benchmark. A region can be efficient without, however, serving as a useful reference point for others, because of incomparable scale (the City of Moscow), specific contextual features (the republics of the North Caucasus), or a unique combination of factors (the Republic of Tatarstan, the Krasnodar Territory). The ten benchmark regions listed above thus represent an "attainable ideal" – that is, they use effective practices that can be adapted and introduced in other regions – whereas the formal leaders with an efficiency score of 1 may represent an "unattainable ideal", useful for understanding the limits of what is possible but not for practical emulation. The lack of overlap between these two groups indicates that the most efficient regions achieve their results through unique, non-replicable mechanisms, while the regions that serve as practical benchmarks demonstrate efficiency through the optimization of available resources under conditions that are relevant for the majority of the subjects of the Russian Federation.

In addition to the static analysis, the dynamics of the efficiency of raising life expectancy in the regions of the Russian Federation over the period 2005–2023 were analyzed using the Malmquist index (MPI) and its decomposition into the efficiency change (EC) and technical change (TC) components. This analysis revealed a stable positive trajectory in life expectancy improvement, while substantial regional differentiation persists.

The cumulated Malmquist index across the entire set of regions stood at 1.0784, which attests to a cumulated productivity growth[3] of the regional systems in raising the population's life expectancy of 7.84% relative to 2005, with the "catch-up" effect serving as the main source of this growth: the efficiency change component (EC = 1.0417) made a larger contribution to the overall dynamics than did technical change (TC = 1.0352), indicating that processes of optimizing the use of available socio-economic resources have predominated over the expansion of the technological frontier of the possibilities for raising the population's life expectancy *(Fig. 4)*.

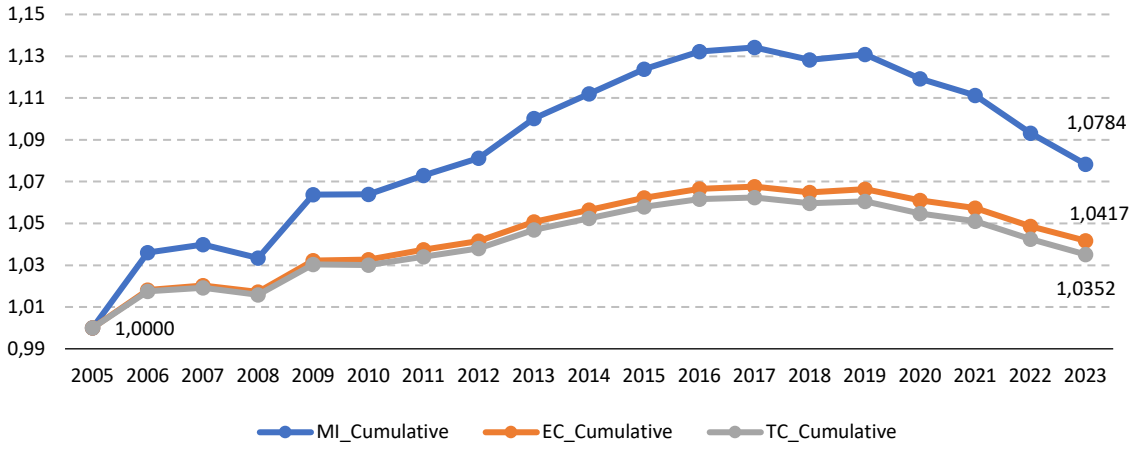

Figure 4. Dynamics of the cumulated Malmquist index and its components for Russian regions, 2005–2023 (2005 = 1)

Calculated from: Regions of Russia. Socio-Economic Indicators. 2025. Available at: https://rosstat.gov.ru/folder/210/document/13204 (accessed: January 29, 2026).

[3] It should be recalled that, in the present study, MPI productivity is understood as the ability of a regional system to deliver an increase in life expectancy.

It is evident that the Malmquist index showed a tendency to decline during the pandemic period, which corresponds to the fall in life expectancy at that time. It should be noted, however, that the recovery-driven rise in the population's life expectancy in 2022–2023 was not supported by an improvement in the performance of the regional systems – the annual values of the MPI, EC, and TC have all been below one since 2020, pointing to a deterioration both in the efficiency of the regional systems themselves and in the contraction of the technological and institutional opportunities for raising life expectancy. Yet the ability of the majority of regions to preserve the cumulated positive effect over the entire observation period testifies to the existence of adaptive capacity and institutional resilience.

A structural analysis of the distribution of Russian regions across the quadrants of the matrix formed by efficiency change (EC) and technical change (TC) shows that all regions are characterized by technological growth – that is, at the national level, an improvement is observed in the institutional and infrastructural conditions that support higher life expectancy (TC > 1). At the same time, four qualitatively distinct trajectories for raising the population's life expectancy can be identified, each characterized by a unique combination of managerial and infrastructural determinants *(Fig. 5)*.

The first group – "growth driven by efficiency" – encompasses 39 regions (49.4% of the sample) and represents a model of balanced development in which the improved utilization of existing resources serves as the dominant factor in raising life expectancy. These regions are characterized by the efficiency component exceeding the technical change component (EC > TC) while both indicators are positive, which attests to the priority given to organizational innovations in healthcare management, improvements in the quality of life, and the formation of stable patterns of self-preservation behavior. The mean value of the Malmquist index in this group is 1.122, indicating the highest rates of productivity growth among regional socio-economic systems in converting the resources they use into increases in the population's life expectancy. The regions in this category demonstrate that, even with a relatively lower standard of living and high avoidable mortality, it is possible to achieve meaningful demographic results through high-quality management and the introduction of effective organizational practices, making their experience a priority for replication.

The second group – "growth driven by technology" – includes 27 regions (34.2%) and reflects a development model in which the main contribution to the dynamics of life

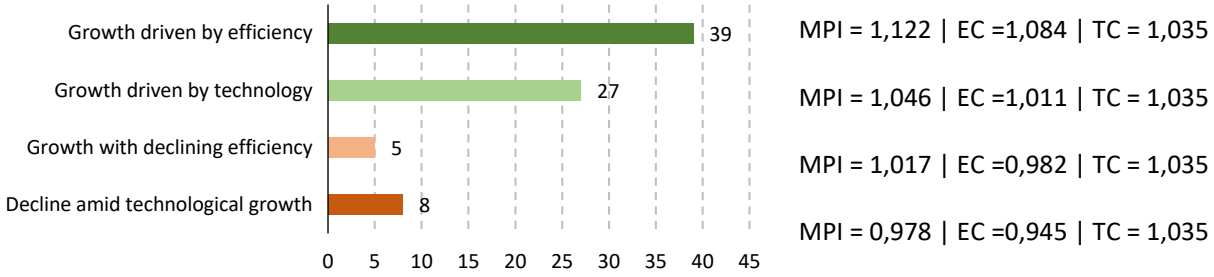

Figure 5. Distribution of regions by type of life-expectancy efficiency dynamics in Russian regions, 2005–2023

Calculated from: Regions of Russia. Socio-Economic Indicators. 2025.
Available at: https://rosstat.gov.ru/folder/210/document/13204 (accessed: January 29, 2026).

expectancy comes from the technical change component, which exceeds the catch-up effect (TC > EC). The efficiency of resource use remains at a stable level (EC ⩾ 1) but does not serve as a driver of growth. The mean value of the Malmquist index in this group is 1.046, which is somewhat below the indicators of the first category and points to the existence of reserves for improving the returns from the healthcare system and further raising the standard of living through the improvement of management processes.

The third group characterized by productivity growth with declining efficiency is represented by five regions (6.3%) and reflects a situation in which the development of infrastructural and institutional capacity does not compensate for the deterioration in the quality of resource use. Formally, the Malmquist index in this group remains above one (the mean value is 1.017), but this is achieved exclusively through the positive contribution of the technical change component, whereas efficiency exhibits negative dynamics (EC < 1). Such a trajectory signals imbalances in the management system: possible causes include a decline in the accessibility of medical services for certain population groups, the insufficient development of prevention programs, or staffing imbalances in the healthcare system. The key risk of this model lies in its unsustainability: when the potential for infrastructural growth is exhausted, life expectancy may begin to decline, since the organizational foundation of the regional system does not ensure the conversion of resources into demographic outcomes.

The fourth and most problematic group – "decline amid technological growth" – encompasses eight regions (10.1%) and reflects a critical situation in which the negative dynamics of resource-use efficiency completely offset the positive effect of infrastructural development. The mean Malmquist index in this category is 0.978, which points to a cumulative decline in the productivity of the regional socio-economic systems in this group in the sphere of raising life expectancy relative to the base period. These territories are characterized by systemic management problems: the inefficient use of healthcare-system resources against a background of an average standard of living and a high prevalence of self-preservation behavior. Despite the formal presence of technological progress (TC > 1), its potential is not realized owing to organizational barriers, which leads to the stagnation or decline of life expectancy.

A supplementary analysis of the stability of regional trajectories, based on an assessment of the frequency with which regions fell into the favorable quadrants of the EC/TC matrix (the first and second groups) throughout the entire observation period, reveals substantial heterogeneity not only in the levels but also in the stability of the results achieved. Only 39.2% of the regions exhibit a stable positive dynamic, with an average frequency of falling into the full-growth quadrant exceeding 55%, whereas the overwhelming majority of subjects (60.8%) are characterized by volatile trajectories, in which periods of improved efficiency and technological progress alternate with phases of regression, which reduces the average stability to 40.1%. The instability of managerial decisions, or dependence on conjunctural factors, thus creates additional risks and reduces the predictability of demographic outcomes. At the same time, the regions that are leaders in terms of stability (the Kirov and Kostroma regions, the Krasnodar Territory, and the republics of Tatarstan and Dagestan) demonstrate that long-term growth in life expectancy is secured not by one-off

achievements but by the ability of a regional system to maintain a balanced dynamic of the efficiency and technological development components over a long period.

Conclusion

The study of the efficiency of raising life expectancy in the regions of the Russian Federation over the period 2005–2023, conducted on the basis of the DEA methodology and the Malmquist index, has yielded comprehensive findings of both theoretical and practical significance for regional policy in the sphere of increasing the population's life expectancy.

Summarizing the results of the study, it can be stated that the DEA methodology makes it possible to assess the efficiency of regional socio-economic systems in raising the population's life expectancy using non-parametric methods, treating the regions themselves as production units that transform resources into demographic outcomes, and taking into account both the limited nature of the resources themselves and the high interregional differentiation of the socio-economic characteristics of Russia's regions. This method enables work with multiple inputs and outputs without a priori assumptions about the functional form of the production function, the construction of relative efficiency on the basis of an empirical production possibility frontier, the identification of leading regions and regions requiring improvement, and the decomposition of the sources of inefficiency.

A statistical analysis of various indicators of the socio-economic development of Russian regions for 2005–2023 made it possible to select eight of them as input variables for the DEA analysis. These reflect the accessibility of healthcare services, the standard of living, and the population's lifestyle and self-preservation behavior as the resources for raising life expectancy. The efficiency assessment carried out on this basis shows that the dynamics of life expectancy in Russian regions are highly sensitive to external shocks, while at the same time being compensated for by the substantial adaptive capacity of the regional systems.

The DEA analysis of regional efficiency in raising the population's life expectancy revealed considerable heterogeneity among the efficient regions. Moreover, the formal leader regions with an efficiency score of 1 do not appear on the list of the most sought-after benchmark regions, which testifies to the difference between efficiency as such and the ability to replicate best practices.

The analysis of temporal dynamics showed a stable positive trend toward improved performance of the regional socio-economic systems in raising life expectancy. The main source of this growth was the "catch-up" effect, which outweighed the contribution of technological progress, indicating that processes of optimizing the use of available resources have predominated over the expansion of the technological frontier. The proposed typology of regions by type of life-expectancy dynamics shows that long-term growth in life expectancy is determined not so much by the absolute volume of resource provision as by the quality of governance and the balance between the efficiency of the use of available resources and technological development (both infrastructural and institutional). The most sustainable results are demonstrated by regions that combine both components, whereas imbalances in their dynamics create risks for achieving the target indicators of demographic development, a fact that confirms the

persistent asymmetry in the distribution of demographic outcomes and the disparities in the resources available across Russian regions.

Thus, the scientific novelty of the study lies in the adaptation of a non-parametric approach (DEA and the Malmquist index) to the assessment of the relative efficiency of Russian regions in attaining life expectancy as a key indicator of demographic development. The work quantitatively separates the resource and management components of the productivity dynamics over the period 2005–2023, offering a reproducible benchmarking methodology and an empirical basis for the transition from unified federal programs to targeted strategies for socio-economic development and a differentiated demographic policy. This will make it possible to ensure sustainable progress in raising the population's life expectancy across the entire territory of the country.

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ОЦЕНКА ОТНОСИТЕЛЬНОЙ ЭФФЕКТИВНОСТИ ПОВЫШЕНИЯ ПРОДОЛЖИТЕЛЬНОСТИ ЖИЗНИ НАСЕЛЕНИЯ В РОССИЙСКИХ РЕГИОНАХ: НЕПАРАМЕТРИЧЕСКИЙ ПОДХОД

Ожидаемая продолжительность жизни выступает ключевым индикатором качества государственного управления и одновременно одной из целей национального развития. В условиях ограниченных бюджетных ресурсов и существенной территориальной дифференциации социально-экономического развития российских регионов критически важной становится оценка эффективности трансформации доступных региональных ресурсов в повышение продолжительности жизни. Пандемийный кризис 2020–2021 гг. актуализировал необходимость выявления устойчивых моделей повышения ожидаемой продолжительности жизни населения в регионах, демонстрирующих наилучшие практики управления в условиях внешних шоков. Таким образом, цель исследования – провести оценку относительной эффективности 79 регионов Российской Федерации в достижении высокой ожидаемой продолжительности жизни за период 2005–2023 гг., типологизировать их по динамике производительности и выявить ключевые траектории изменений. Методом DEA (Data Envelopment Analysis) рассчитаны коэффициенты относительной эффективности регионов; затем с помощью индекса Малмквиста проанализирована временная динамика с декомпозицией на компонент изменения эффективности и технологического прогресса. Выявлено, что для 83,5% регионов характерно одновременное улучшение эффективности и технологий, однако 16,5% регионов показали снижение эффективности при технологическом прогрессе. Установлено, что долгосрочный рост ожидаемой продолжительности жизни обусловлен не только объемом ресурсов, но и качеством управления, сбалансированностью между эффективностью использования детерминант и технологическим развитием, что определяет необходимость дифференцированной демографической политики для обеспечения устойчивого повышения продолжительности жизни населения на всей территории страны.

Продолжительность жизни, dea-анализ, эффективность, регион, индекс Малмквиста, региональная политика, типология регионов.

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MONITORING OF CHANGES: MAIN TRENDS

THE ECONOMY OF NORTHWEST RUSSIA IN MARCH 2026: MAINTAINING STABILITY AMID INCREASING PRESSURE

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The Vologda Research Center of the Russian Academy of Sciences continues to acquaint its readers with materials on the state of and trends in the development of the economy of the Northwestern Federal District (NWFD) against the backdrop of nationwide dynamics.

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The global context is characterized by a steady slowdown in the largest economies in the first quarter of 2026 *(Tab. 1)*. Negative factors affecting the global economy included the U.S. and Israeli military operation against Iran, which caused logistical disruptions in the

Table 1. Global economic trends, % change from previous year

Indicator	2023	2024	2025	Q1 2026	2026	2027
World	2.8	2.8	2.7	n/a	3.1	3.2
Advanced economies	1.6	1.7	1.7	n/a	1.8	1.7
• United States	2.9	2.8	2.1	2.0	2.3	2.1
• Euro area	0.5	0.9	1.4	0.1	1.1	1.2
• Japan	0.7	-0.2	1.3	0.5	0.7	0.6
Emerging market and developing economies	4.4	4.3	4.2	n/a	3.9	4.2
East Asia and Pacific	5.2	5	4.8	n/a	4.9	4.8
• China	5.4	5	4.9	1.3	4.4	4.0
Europe and Central Asia	3.6	3.6	2.4	n/a	2.0	2.1
• **Russia**	**4.1***	**4.9***	**1.0***	**-0.2***	**1.1**	**1.1**
Latin America and the Caribbean	2.4	2.4	2.2	n/a	2.3	2.7
Middle East and North Africa	2.1	2.6	3.1	n/a	1.9	4.6
South Asia	8	6.3	7.1	n/a	6.2	6.5
• India	9.2	6.5	7.2	1.8	6.5	6.5
Sub-Saharan Africa	3	3.7	4	n/a	4.3	4.4

*Rosstat data.
Source: Global Economic Prospects, April 2026. Washington: World Bank. 180 p. DOI: 10.1596/978-1-4648-2267-4.

For citation: Sidorov M.A., Lukin E.V. (2026). The economy of Northwest Russia in March 2026: Maintaining stability amid increasing pressure. *Problems of Territory's Development,* 30(3), 154–168. DOI: 10.15838/ptd.2026.3.143.9

Strait of Hormuz, volatility on the global energy market, and high demand on the precious metals market. The risks of "stagflation" persist for the developed economies against the backdrop of pressure stemming from their dependence on energy resources. The developing economies are also slowing down.

Forecasts for global economic development are mixed. The World Bank's April report revised the growth rates of the largest economies in 2026–2027 upward. According to UNCTAD estimates, however, GDP growth will, on the contrary, slow down in many developed and developing countries in 2026 amid weak domestic demand, high uncertainty, and geopolitical risks[1].

According to the Russian Ministry of Economic Development, the Russian economy posted a decline in GDP of 0.3% in the first quarter of 2026[2], following a 1.4% increase in the first quarter of 2025 *(Fig. 1)*.

Changes in the Business Confidence Index reflect the worsening expectations of the country's enterprises. In April 2026, the index for mining and manufacturing fell to –4.4 and –3.2, respectively (compared with 0.1 and 1.8 a year earlier; *Fig. 2*). In the services sector, the indicator stood at –5 in the first quarter of 2026, against –2 a year earlier, while in construction it dropped by 3 percentage points, hitting the lowest level among the sectors listed (–11).

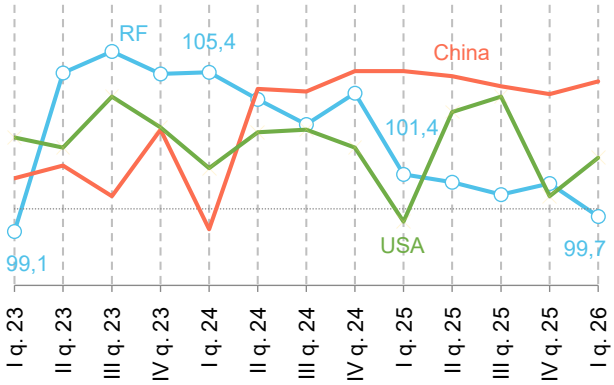


Figure 1. Gross domestic product growth, % change from corresponding quarter of previous year

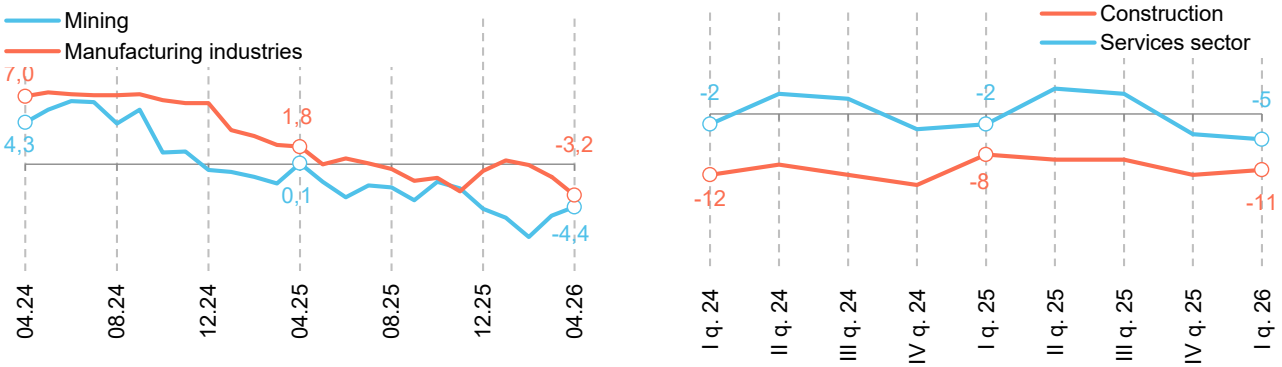


Figure 2. Business Confidence Index, %

[1] Trade to slow down along with GDP. Available at: https://www.kommersant.ru/doc/8688975

[2] Here and throughout the text (unless otherwise stated), January–March 2026 is compared with January–March 2025.

1. Gross output

Output of goods and services in basic economic activities across the NWFD as a whole increased by 0.8% (it is noteworthy that a tendency toward the preservation of the direction of this indicator's dynamics has emerged across the country's federal districts; *Fig. 3*). A number of the district's regions substantially increased their output; the leaders were the Kaliningrad Region and the Pskov Region (up 11.0 and 7.2%, respectively). At the same time, half of the regions in the NWFD posted a decline in the output of goods and services (ranging from 1.3 to 7.2%).

Industrial output in the NWFD and in the country as a whole accelerated somewhat in its positive production dynamics, posting increases in output of 0.9 and 0.3%, respectively (compared with 0.5 and 0.1%, respectively, a year earlier; *Tab. 2*). Several regions of the district recorded a substantial increase in the output of this sector, most notably the Kaliningrad Region and the Pskov Region (up 19.2 and 17.2%, respectively). At the same time, industrial output declined in half of the NWFD regions, with the Republic of Karelia, the Arkhangelsk Region, and the Komi Republic posting declines of 6.5, 5.6, and 4.3%, respectively.

Manufacturing output in the NWFD increased by 0.9%, even as the sector's output declined by 0.7% across the Russian Federation as a whole. This growth was driven by positive dynamics in a number of the district's regions, the largest contributions coming from the Pskov Region, the Kaliningrad Region, and the City of Saint Petersburg, where manufacturing output rose by 18.3, 17.4, and 4.7%, respectively. In several of the district's subjects, however, the sector's output declined, most notably in the Republic of Karelia, the Arkhangelsk Region, and the Leningrad Region (by 11.7, 7.7, and 5.6%, respectively).

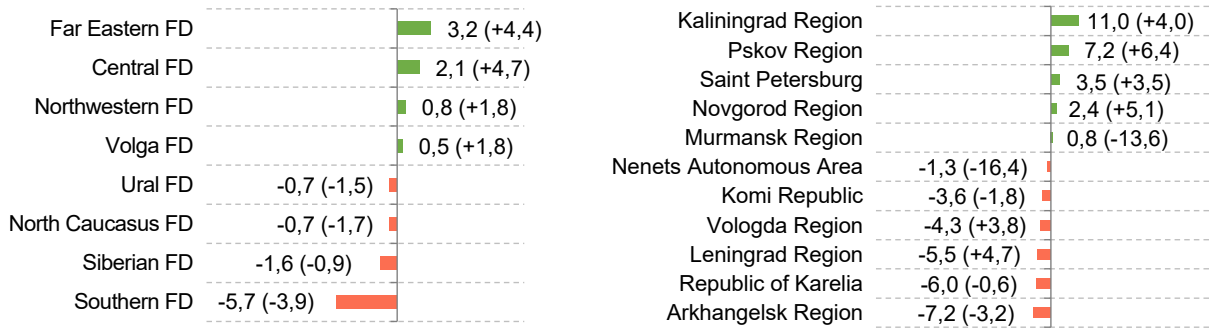


Figure 3. Growth in output of goods and services in basic economic activities*, January–March 2026 vs. January–March 2025, by federal district and NWFD Regions, %

* Basic economic activities include: crop production, animal husbandry, hunting, and related service activities; mining and quarrying; manufacturing; electricity, gas, steam, and air conditioning supply; water supply; sewerage, waste management, and remediation activities; construction; wholesale trade (except of motor vehicles and motorcycles); retail trade (except of motor vehicles and motorcycles); transportation.

Note: figures in parentheses indicate the change in the indicator for January–March 2025 relative to January–March 2024, in %.

Table 2. Industrial production trends, % change from corresponding period of previous year

Territory	3 months 2024	3 months 2025	3 months 2026	R*
Industry overall				
Russian Federation	106.2	100.1	100.3	-
Northwestern Federal District	109.0	100.5	100.9	4
Kaliningrad Region	106.3	100.4	119.2	2
Pskov Region	117.7	104.2	117.2	3
Novgorod Region	109.1	106.1	104.1	25
City of Saint Petersburg	116.2	107.2	103.6	28
Nenets Autonomous Area	97.9	89.3	102.5	32
Murmansk Region	103.5	90.9	98.3	53
Vologda Region	108.5	101.8	97.3	56
Leningrad Region	109.2	99.9	96.3	58
Komi Republic	103.4	96.1	95.7	61
Arkhangelsk Region	110.3	94.5	94.4	67
Republic of Karelia	100.2	95.9	93.5	72
Manufacturing				
Russian Federation	110.2	103.9	99.3	-
Northwestern Federal District	111.2	103.7	100.9	4
Pskov Region	113.9	107.7	118.3	5
Kaliningrad Region	107.3	100.4	117.4	7
City of Saint Petersburg	117.4	110.2	104.7	24
Novgorod Region	109.3	106.6	104.6	26
Murmansk Region	102.1	85.7	97.6	49
Vologda Region	109.7	101.8	97.2	51
Komi Republic	106.3	100.4	95.0	57
Leningrad Region	106.5	100.4	94.4	58
Arkhangelsk Region	110.2	96.3	92.3	68
Republic of Karelia	102.0	90.1	88.3	76
Mining				
Russian Federation	100.9	95.8	100.8	-
Northwestern Federal District	101.4	92.9	99.8	4
Kaliningrad Region	100.5	87.9	251.9	1
Novgorod Region	87.9	80.5	108.9	18
Nenets Autonomous Area	97.8	88.8	103.0	27
Republic of Karelia	96.5	102.6	102.0	30
Arkhangelsk Region	118.2	82.4	100.0	34
City of Saint Petersburg	171.1	87.1	97.6	40
Leningrad Region	87.7	99.4	97.2	41
Murmansk Region	105.9	97.5	96.5	43
Komi Republic	102.9	95.0	95.7	49
Vologda Region	94.7	105.9	90.2	61
Pskov Region	91.7	106.0	87.9	65
Nenets Autonomous Area	89.5	168.6	59.4	84

* Here and throughout, R denotes the rank of the respective region among the federal subjects (and for the NWFD, among the federal districts) based on the indicator's performance in January–March 2026, unless otherwise specified. Rankings exclude statistical data for the Donetsk People's Republic (DPR), Lugansk People's Republic (LPR), Zaporozhye Region, and Kherson Region.

Mining in the NWFD continued to contract (by 0.2%, compared with a decline of 7.1% a year earlier). Nationwide, a resumption of positive dynamics was registered: the sector's output rose by 0.8%, after a decline of 4.2% a year earlier. A decrease in mining and quarrying output was recorded in the majority of the district's subjects, with the Nenets Autonomous Area and the Pskov Region posting declines of 40.6 and 12.1%, respectively. At the same time, the sector's output in the Kaliningrad Region grew by a factor of 2.5 (the best result in the country), and in the Novgorod Region it rose by 8.9%.

The lack of data on oil and gas extraction[3] complicates the understanding of the sector's situation; judging by the composite extraction index, however, it can be assumed that their output increased, since oil and gas account for roughly 60% of the NWFD's total extraction, while coal and metal ore extraction fell by 30.9 and 6.8%, respectively *(Fig. 4)*.

The sectoral dynamics of manufacturing output in the NWFD remain extremely uneven.

Manufacturing industries producing intermediate goods in the NWFD reduced their output. Production of coke and refined petroleum products fell by 8.5%, while chemical products and fabricated metal products declined by 5.0 and 4.0%, respectively. At the same time, output in the wood-processing industry rose by 78.2%.

The majority of ***manufacturing industries geared toward final consumer demand*** in the NWFD posted growth. Output of finished metal products rose substantially – by 37.0% – along with rubber and plastic products (up 28.7%), other finished goods (up 24.0%), and pharmaceuticals and medicinal materials (up 16.6%). At the same time, production contracted markedly in textiles and furniture

[3] Rosstat stops publishing data on oil extraction. Available at: https://www.rbc.ru/economics/26/04/2023/64492a769a794789b8b0feec (accessed: 20.05.2026).

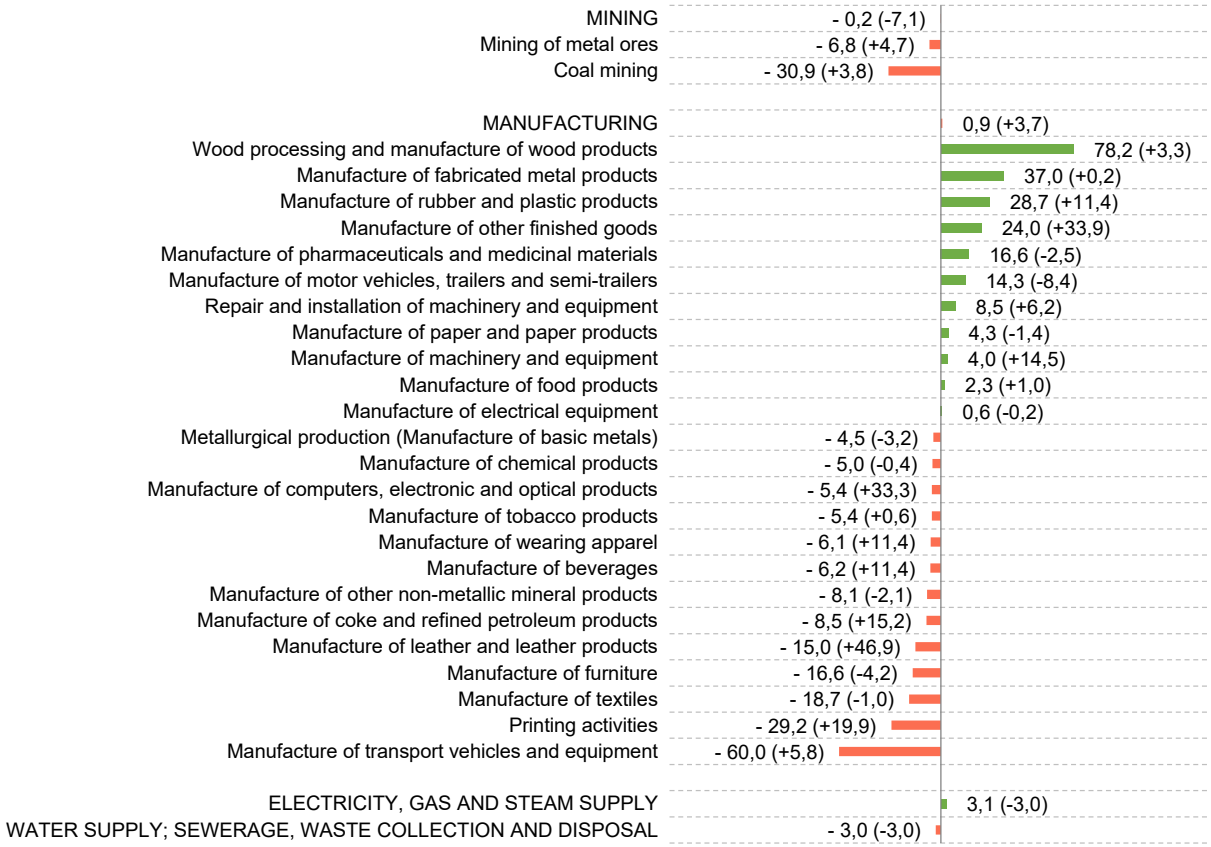


Figure 4. Growth in industrial output in the NWFD, January–March 2026, % change from January–March 2025

Note: figures in parentheses indicate the change in the indicator for January–March 2025 relative to January–March 2024, in %.

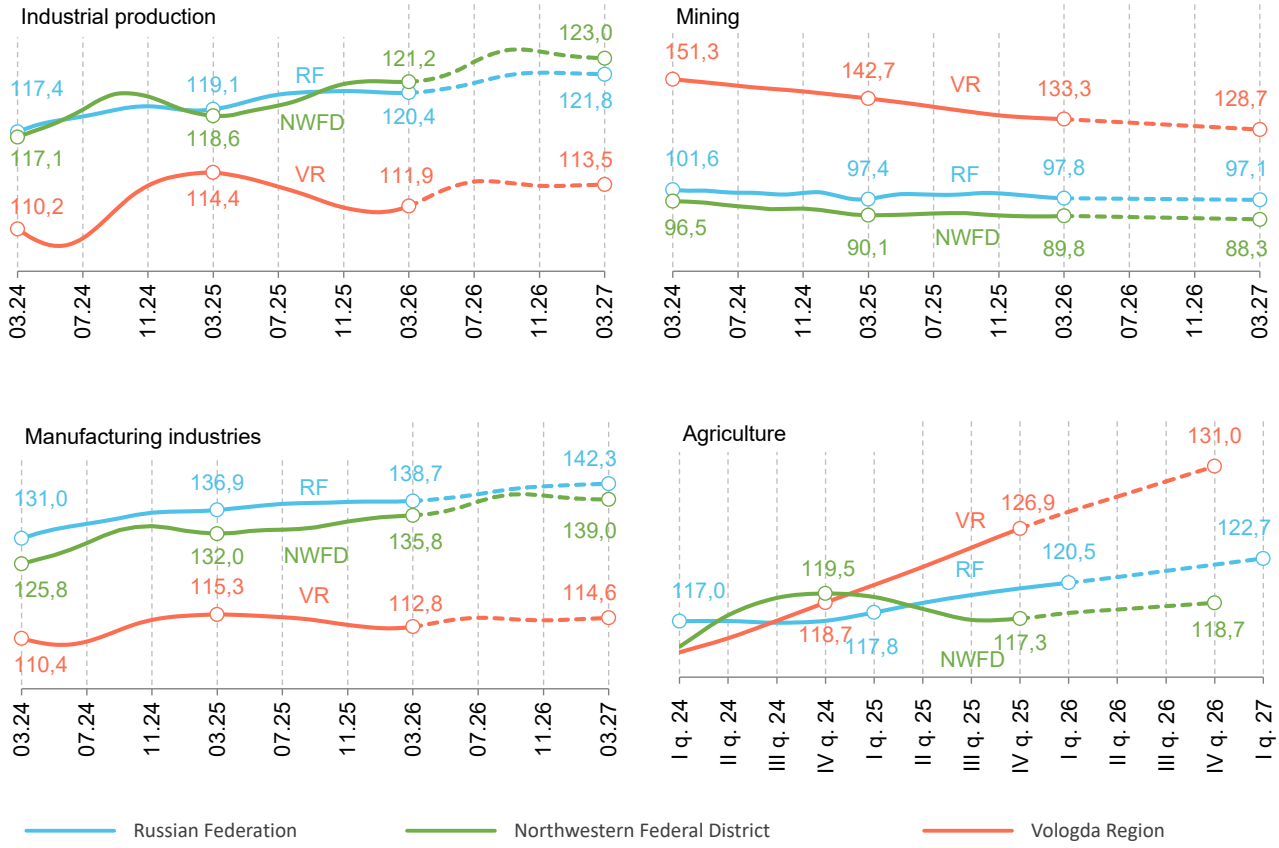
(by 18.7 and 16.6%, respectively), leather and leather products (by 15.0%, following a 46.9% increase the previous year), and beverages and wearing apparel (by 6.2 and 6.1%, respectively).

In a number of ***manufacturing industries serving investment demand*** in the NWFD, the positive dynamics gave way to declining output: production of transport vehicles and equipment fell by 60.0%, and that of computers, electronic, and optical products by 5.4% (a year earlier, increases of 5.8 and 33.3%, respectively, had been posted). The output of non-metallic mineral products contracted by 8.1%. At the same time, the production of motor vehicles, trailers, and semi-trailers, as well as of machinery and equipment, increased (by 14.3 and 4.0%, respectively).

> *The Weld Expert plant has opened in the Khrabrovo Industrial Park near Kaliningrad. The enterprise produces robotic welding systems for machine building, metallurgy, the oil and gas sector, and research organizations. Of the 250 million rubles invested in the enterprise, about 90 million rubles represents state support channeled through various instruments – the Industrial Development Fund of the Kaliningrad Region and the regional "My Business" center*[4].

[4] Alexey Besprozvannykh opens production of robotic welding systems. Available at: https://gov39.ru/press/402895/ (accessed: 18.05.2026).

Trends in industrial and agricultural production, 2024–2027, % of 2018 level



The EFER firefighting robot and barrel technology plant in Petrozavodsk has completed the construction of a new building. The entire process from idea to implementation is now concentrated on a single site, and the total floor area will increase by more than 2,000 square meters[5].

Agriculture in a number of the NWFD's subjects increased its output against the backdrop of a 0.2% nationwide increase *(Tab. 3)*. In the Pskov Region, agricultural output rose by 14.1%, while in the Vologda and Leningrad regions it grew by 5.6 and 5.4%, respectively. At the same time, the Novgorod and Murmansk regions recorded declines in the sector's output of 3.7 and 3.3%, respectively.

Table 3. Agricultural production trends, % change from corresponding period of previous year

Territory	3 months 2024	3 months 2025	3 months 2026	R
Russian Federation	101.9	101.7	100.2	-
Northwestern Federal District	104.1	105.2	-	-
Pskov Region	121.9	114.1	114.1	-
Vologda Region	97.9	105.4	105.6	-
Leningrad Region	100.7	101.5	105.4	-
Republic of Karelia	96.9	94.3	100.7	-
Novgorod Region	87.4	113.9	96.7	-
Murmansk Region	112.4	79.3	96.3	-
Komi Republic	97.4	107.7	-	-
Nenets Autonomous Area	107.4	96.5	-	-
Arkhangelsk Region	105.0	103.7	-	-
Kaliningrad Region	106.0	97.1	-	-

[5] A new building of the EFER Firefighting Robotics Engineering Center opens in Petrozavodsk. Available at: https://tv-karelia.ru/v-petrozavodske-otkrylsya-novyj-korpus-inzhenernogo-czentra-pozharnoj-robototehniki-efer/ (accessed: 18.05.2026).

The ***labor market*** situation was characterized by a deceleration of changes.

The unemployment rate in the NWFD remained at the January–March 2025 level (2.0%; nationwide, a decline of 0.1 percentage points was registered, to 2.2%; *Tab. 4*). The value of the indicator fell in half of the district's subjects, reaching 0.7% in the Novgorod Region – the best result in the country. At the same time, unemployment remained unchanged in the City of Saint Petersburg, the Leningrad Region, and the Arkhangelsk Region, while in the Vologda Region and the Murmansk Region it began to rise again.

Table 4. Labor market trends, % change from corresponding period of previous year

Territory	3 months 2024	3 months 2025	3 months 2026	R
Unemployment rate, % of labor force				
Russian Federation	2.8	2.3	2.2	-
Northwestern Federal District	2.4	2.0	2.0	4
Novgorod Region	1.7	1.2	0.7	1
City of Saint Petersburg	1.5	1.5	1.5	20
Pskov Region	2.4	2.2	1.5	21
Kaliningrad Region	2.8	2.2	1.8	38
Vologda Region	3.0	1.6	2.1	53
Arkhangelsk Region	4.2	2.4	2.4	62
Murmansk Region	2.6	2.3	2.5	63
Leningrad Region	2.8	2.8	2.8	68
Republic of Karelia	4.7	3.2	3.0	72
Komi Republic	4.9	4.2	3.1	73
Nenets Autonomous Area	6.0	3.8	3.5	76
Employer demand for workers				
Russian Federation	118.4	107.5	96.9	-
Northwestern Federal District	115.8	108.7	-	-
Leningrad Region	126.1	120.5	181.7	-
Murmansk Region	105.5	90.0	162.1	-
Novgorod Region	129.0	111.4	127.7	-
Vologda Region	130.0	113.6	87.3	-
Kaliningrad Region	115.8	107.1	84.7	-
Komi Republic	115.5	100.2	78.4	-
Arkhangelsk Region	122.1	97.1	77.4	-
Nenets Autonomous Area	103.9	114.4	70.3	-
City of Saint Petersburg	112.7	110.1	69.0	-
Republic of Karelia	115.6	95.9	-	-
Pskov Region	115.6	119.0	-	-

The Russian labor market is going through an atypical period: it is no longer a "candidate's market" or an "employer's market". It has entered a new phase – a wait-and-see market, in which both sides have adopted a holding pattern. Companies are postponing decisions to expand their teams, while job seekers are deferring active search. As a result, the market is effectively "frozen". Vacancies exist, candidates exist, but the pace of hiring is slowing[6].

The volume of job vacancies reported by employers to public employment services declined in the majority of the NWFD's subjects, as it did across the Russian Federation as a whole. In particular, the City of Saint Petersburg and the country posted a comparable deterioration in the dynamic (a decline of 15.5 and 15.6%, respectively). The reduction in the number of registered vacancies was also substantial in the Novgorod Region and the Arkhangelsk Region (by 40.6 and 30.5%, respectively). In three of the district's regions, the reported employer demand for workers increased; the leader among them was the Leningrad Region, where the 81.7% increase was driven partly by employers adjusting their vacancies as part of the quota campaign and partly by the implementation of large-scale investment projects in the real sector of the economy[7].

2. Income generation

The slowdown in household income growth occurred against a backdrop of a substantial decline in entrepreneurial and budget revenues. ***Real disposable personal income*** in the Russian Federation rose by 2.6% *(Tab. 5)*. A year earlier, an increase in this indicator had also been registered (by 7.1%).

[6] A new phase of the labor market has begun in Russia. Available at: https://www.gazeta.ru/social/news/2026/03/24/28118071.shtml (accessed: 18.05.2026).

[7] A record 112,000 job vacancies open in Leningrad Region. Available at: https://spbdnevnik.ru/news/2026-01-21/v-lenoblasti-otkryto-rekordnye-112-tysyach-vakansiy (accessed: 13.05.2026).

Table 5. Trends in household, entrepreneurial, and government income generation, % change from corresponding period of previous year

Territory	3 months 2024	3 months 2025	3 months 2026	R
Real disposable personal income				
Russian Federation	106.3	107.1	102.6	-
Northwestern Federal District	111.7	105.7	-	-
Republic of Karelia	109.1	103.2	-	-
Komi Republic	103.2	103.4	-	-
Nenets Autonomous Area	112.0	108.0	-	-
Arkhangelsk Region	107.4	101.5	-	-
Vologda Region	106.7	101.4	-	-
Kaliningrad Region	110.4	102.7	-	-
Leningrad Region	119.0	110.2	-	-
Murmansk Region	102.7	101.5	-	-
Novgorod Region	112.0	104.7	-	-
Pskov Region	115.6	105.8	-	-
City of Saint Petersburg	113.4	106.9	-	-
Territory	2 months 2024	2 months 2025	2 months 2026	R*
Balanced financial result of organizations				
Russian Federation	75.4	107.1	60.1	-
Northwestern Federal District	73.1	107.0	53.4	5
Kaliningrad Region	-	37.2	295.6	2
Novgorod Region	37.3	71.8	111.7	16
Leningrad Region	79.7	85.5	90.8	23
Pskov Region	248.3	99.0	70.3	32
City of Saint Petersburg	104.7	132.4	41.6	52
Arkhangelsk Region	205.4	86.2	32.4	62
Komi Republic	20.0	162.3	12.5	74
Vologda Region	71.1	74.1	6.3	75
Nenets Autonomous Area	0.5	146.5	-	77
Republic of Karelia	5.5	64.5	-	78
Murmansk Region	63.4	-	-	82
Consolidated budget revenues (including territorial state extra-budgetary funds)				
Russian Federation	183.1	89.6	80.9	-
Northwestern Federal District	224.8	84.5	76.2	-
Pskov Region	133.2	85.1	96.3	-
Kaliningrad Region	163.8	95.2	87.8	-
Republic of Karelia	97.4	99.0	87.3	-
Novgorod Region	164.7	95.4	84.4	-
City of Saint Petersburg	263.0	84.0	76.3	-
Leningrad Region	290.5	82.3	75.7	-
Vologda Region	279.5	71.6	74.9	-
Murmansk Region	218.4	85.0	72.2	-
Komi Republic	297.5	83.9	68.2	-
Arkhangelsk Region	162.5	84.9	67.0	-
Nenets Autonomous Area	161.6	87.5	48.3	-

* For the indicator "Balanced financial result of organizations", the rank is based on the indicator's performance in January–February 2026, excluding statistical data for the Donetsk People's Republic (DPR), Lugansk People's Republic (LPR), Zaporozhye Region, and Kherson Region.

The ***balanced financial result of organizations*** in the NWFD and the Russian Federation in January–February 2026 demonstrated a real-terms decline of 46.4 and 39.9%, respectively, after having risen by 7.0 and 7.1% a year earlier. The deterioration in the financial situation was observed at enterprises in almost all of the district's subjects, with the Murmansk Region, the Republic of Karelia, and the Nenets Autonomous Area posting negative values for the indicator. The exceptions were the Kaliningrad Region and the Novgorod Region, which posted increases in their balanced financial results of 195.6 and 11.7%, respectively.

Real consolidated budget revenues (including territorial state extra-budgetary funds) in the NWFD contracted by 23.8% in January–February 2026. A decline in budget revenues was registered in all subjects of the district, with the Nenets Autonomous Area exceeding 50%, and the Arkhangelsk Region and the Komi Republic reaching 33.0 and 31.8%, respectively. Receipts from taxes on entrepreneurial income in the NWFD fell almost threefold (by 64.7%). Personal income tax (PIT) receipts in the macro-region rose by 0.8%; this was noted in half of the district's subjects, with the Novgorod Region, in particular, posting an 11% increase in this indicator. In several of the NWFD's regions, however, PIT revenues declined, most sharply in the Arkhangelsk Region (by 10.3%). The dynamics of excise tax receipts across the NWFD worsened by 11%. Nationwide, real consolidated budget revenues fell by 19.1%, with a 59.1% decline in taxes on entrepreneurial income and an 11.9% drop in excise tax receipts. PIT revenues in the country as a whole increased by 0.1%.

Labor market development trends, 2024–2027, % of 2018 level

3. Final use

Consumer demand grew considerably faster than household incomes.

Retail trade turnover in the NWFD rose by 7.3%, and by 6.2% nationwide (Tab. 6). Food retail turnover in the Russian Federation increased by 1.9%, and non-food retail by 5.2%. In the NWFD, non-food retail turnover grew by 6%. The leaders in the macro-region in terms of non-food retail turnover growth were the Vologda Region and the Murmansk Region (both up 8.3%), while in the City of Saint Petersburg the increase was 8%. Food retail turnover in the NWFD rose by 3.8%, with the sharpest rise registered in the Kaliningrad Region (7.6%). A negative impact on this indicator came from its decline in the Murmansk Region and the Republic of Karelia (down 0.9 and 0.3%, respectively).

Table 6. Consumer market trends, % change from corresponding period of previous year

Territory	3 months 2024	3 months 2025	3 months 2026	R
Retail trade turnover				
Russian Federation	112.1	102.8	106.2	-
Northwestern Federal District	111.5	102.8	107.3	3
Novgorod Region	106.2	109.5	107.5	17
City of Saint Petersburg	114.8	103.2	110.1	19
Vologda Region	108.6	108.7	108.9	38
Kaliningrad Region	113.0	106.5	105.4	48
Murmansk Region	100.9	99.4	101.8	60
Arkhangelsk Region	100.3	95.9	104.3	63
Leningrad Region	111.3	99.7	103.7	65
Komi Republic	107.3	104.4	101.8	66
Pskov Region	113.9	102.3	102.1	68
Republic of Karelia	110.1	101.1	100.3	73
Nenets Autonomous Area	101.9	103.1	98.7	80
Volume of paid services provided to the population				
Russian Federation	105.0	102.3	103.3	-
Northwestern Federal District	103.2	102.5	104.3	1
Leningrad Region	111.9	103.5	108.9	4
Kaliningrad Region	111.0	102.7	106.1	13
Pskov Region	104.3	101.0	104.8	21
Vologda Region	103.9	97.4	104.4	28
City of Saint Petersburg	100.8	104.2	104.3	31
Arkhangelsk Region	104.8	98.9	103.6	46
Nenets Autonomous Area	101.2	100.8	102.5	57
Novgorod Region	100.9	100.7	101.9	66
Republic of Karelia	105.0	100.6	101.4	72
Murmansk Region	101.7	99.4	101.0	75
Komi Republic	104.7	97.1	99.6	80
Consumer price index (December to December)				
Russian Federation	102.0	102.7	103.0	-
Northwestern Federal District	102.1	103.2	103.2	7
Kaliningrad Region	101.4	103.3	102.5	17
Republic of Karelia	102.5	103.4	102.6	26
Arkhangelsk Region	101.8	103.0	102.6	26
Pskov Region	101.9	103.1	102.7	36
Murmansk Region	102.3	104.4	102.8	40
Nenets Autonomous Area	100.8	104.1	103.0	54
Vologda Region	101.5	103.5	103.0	54
Novgorod Region	101.8	102.8	103.1	64
Leningrad Region	102.6	103.5	103.3	71
City of Saint Petersburg	102.2	102.9	103.6	79
Komi Republic	102.2	103.6	104.0	85
Producer price index for industrial goods (December to December)				
Russian Federation	101.9	99.9	101.0	-
Northwestern Federal District	103.0	102.2	101.0	5
Nenets Autonomous Area	99.8	99.8	96.0	8
Leningrad Region	101.9	101.6	96.1	9
Komi Republic	103.2	98.2	98.7	14
Republic of Karelia	106.2	101.1	100.6	35
Arkhangelsk Region	106.4	103.7	100.7	39
Vologda Region	102.2	97.3	100.7	39
Pskov Region	104.4	101.3	101.2	49
Novgorod Region	100.1	103.6	101.6	52
Kaliningrad Region	99.3	101.6	101.7	54
City of Saint Petersburg	104.0	111.3	104.0	75
Murmansk Region	103.4	103.0	105.6	78

The volume of ***paid services*** provided to the population in the NWFD increased by 4.3%, the best result among all federal districts (nationwide, growth stood at 3.3%). An increase in this indicator was registered in almost all of the district's subjects; the leaders were the Leningrad Region and the Kaliningrad Region (up 8.9 and 6.1%, respectively). The exception was the Komi Republic, where the volume of paid services provided to households declined by 0.4%.

Consumer inflation in the NWFD was close to the national average (3.2 vs. 3.0%, respectively). Food prices in the federal district rose by 2.8%, and nationwide by 3.2%. Non-food price increases were more moderate, at 1.6 and 1.4%, respectively. Consumer prices for services in the macro-region and across the country rose by 5.6 and 4.6%, respectively. Housing and utilities tariffs in the NWFD and the Russian Federation increased by 2.4 and 2.6%, respectively.

Producer prices for industrial goods in the NWFD and the Russian Federation rose by 1.0%. A sharp increase in the price of industrial output was recorded in the Murmansk Region and the City of Saint Petersburg (by 5.6% and 4.0%, respectively). In three subjects of the district – the Nenets Autonomous Area, the Leningrad Region, and the Komi Republic – industrial output prices declined (by 4.0, 3.9, and 1.3%, respectively).

Table 7. Construction sector trends, % change from corresponding period of previous year

Territory	3 months 2024	3 months 2025	3 months 2026	R
Volume of work in TEA "Construction"				
Russian Federation	103.2	105.8	90.0	-
Northwestern Federal District	98.4	117.4	81.6	8
Komi Republic	90.6	101.0	108.5	19
Murmansk Region	153.1	38.7	96.9	35
Novgorod Region	179.3	86.4	95.1	36
City of Saint Petersburg	78.0	123.4	90.9	41
Kaliningrad Region	101.5	111.6	75.1	62
Leningrad Region	115.2	166.0	75.0	63
Vologda Region	105.5	148.1	69.9	71
Arkhangelsk Region	115.9	94.5	66.1	73
Republic of Karelia	75.9	122.9	62.0	76
Pskov Region	123.2	145.1	60.1	77
Nenets Autonomous Area	106.0	49.9	53.5	82
Housing completions				
Russian Federation	101.5	108.9	71.8	-
Northwestern Federal District	108.3	98.8	64.6	6
Pskov Region	116.5	56.0	124.3	8
Arkhangelsk Region	115.8	95.7	98.3	21
Republic of Karelia	99.1	108.1	96.3	22
Leningrad Region	114.6	117.3	86.7	32
Komi Republic	70.7	153.9	83.6	34
Nenets Autonomous Area	124.0	118.8	71.0	45
Murmansk Region	179.4	175.3	63.5	58
Kaliningrad Region	117.5	83.9	58.4	63
Novgorod Region	82.3	150.8	55.4	70
Vologda Region	108.8	150.9	42.3	79
City of Saint Petersburg	102.6	65.7	16.2	84
Volume of mortgage loans issued				
Russian Federation	81.0	56.6	166.1	-
Northwestern Federal District	85.7	56.6	167.0	6
Republic of Karelia	68.2	48.7	212.7	5
Murmansk Region	81.3	47.4	191.0	18
Nenets Autonomous Area	71.7	43.7	219.4	24
Komi Republic	63.4	53.0	183.7	25
Arkhangelsk Region	96.7	51.7	183.2	26
Leningrad Region	78.8	59.7	177.9	32
Novgorod Region	76.3	60.0	176.4	38
Vologda Region	77.7	51.3	165.4	53
Pskov Region	73.1	65.6	164.1	58
Kaliningrad Region	99.4	63.9	158.7	66
City of Saint Petersburg	90.6	57.4	157.7	68

In the ***construction sector*** of the NWFD, the volume of work completed fell by 18.4% – the worst result among all federal districts – while in the Russian Federation the indicator dropped by 10% *(Tab. 7)*. Among the district's subjects, only the Komi Republic posted an increase (8.5%). The remaining regions registered a decline in construction activity, with seven of them seeing a contraction ranging from 46.5 to 24.9%. It should be noted that the observed dynamics in the volume of completed construction work may be linked to the accelerated completion of projects at the end of 2025.

Housing completions in the NWFD showed a deeper decline than in the Russian Federation as a whole (down 35.4 vs. 28.2%), driven by negative dynamics in housing completions in the majority of the district's regions. In the City of Saint Petersburg, in particular, the drop reached 83.8% – one of the worst changes in the indicator nationwide. The only region where housing completions accelerated was the Pskov Region (up 24.3%).

The ***volume of mortgage loans issued*** demonstrated a sharp increase both in the NWFD and across the country as a whole – by 67.0 and 66.1%, respectively. This affected all subjects of the district, manifesting itself in a revival of mortgage lending ranging from 57.7 to 112.7%. An important factor behind this was the presidential instruction to revise the rate on family mortgages, which are to be linked to the number of children[8]. The exact values have yet to be determined, but the anticipated increase for families with one child may have caused the observed growth in the volume of mortgage loans issued.

[8] The rate on family mortgages expected to be reduced for each child. Experts comment on the mechanism and its consequences. Available at: https://rg.ru/2026/02/12/semejnuiu-ipoteku-priviazhut-k-kolichestvu-detej.html (accessed: 13.05.2026).

In January–February 2026, ***real consolidated budget expenditures (including territorial state extra-budgetary funds)*** in the NWFD increased by 1.2%, even as they declined by 3.6% across the Russian Federation as a whole *(Tab. 8)*. The positive dynamic of the aggregate indicator for the macro-region was driven by growth in a number of its subjects, with the largest increases posted by the Pskov Region, the City of Saint Petersburg, and the Leningrad Region (up 8.6, 7.3, and 6.3%, respectively). At the same time, more than half of the NWFD's regions showed a decline in budget spending, with the Murmansk Region, the Vologda Region, and the Arkhangelsk Region seeing contractions of 12.5, 12.0, and 10.7%, respectively. In both the NWFD and the Russian Federation as a whole, budget expenditures on social policy and healthcare fell – by 3.3 and 4.2%, and by 2.8 and 6.9%, respectively.

Table 8. Consolidated budget expenditure trends (including territorial state extra-budgetary funds), % change from corresponding period of previous year

Territory	2 months 2024	2 months 2025	2 months 2026
Russian Federation	101.3	107.5	96.4
Northwestern Federal District	104.5	104.0	101.2
Pskov Region	104.4	99.7	108.6
City of Saint Petersburg	105.7	108.9	107.3
Leningrad Region	100.2	119.9	106.3
Kaliningrad Region	108.1	94.0	101.8
Republic of Karelia	82.3	103.4	97.6
Novgorod Region	115.9	83.9	95.5
Nenets Autonomous Area	72.1	98.3	94.0
Komi Republic	105.7	98.3	90.6
Arkhangelsk Region	105.2	93.2	89.3
Vologda Region	106.8	106.2	88.0
Murmansk Region	116.3	86.1	87.5

According to the Federal Customs Service, in January–March 2026, the total value of Russia's ***exports*** remained virtually unchanged, while ***imports*** rose by 6.3%. Exports to Asia grew by 3.7%, whereas exports to Europe and Africa contracted by 9.1 and 6.5%, respectively. Imports from Europe and Asia increased by 7.0 and 6.2%, respectively. Exports of food products rose by 18.6%, and imports by 7.0%. The value of mineral product exports fell by 12.4% (their share accounted for 52.1%), while imports of mineral products declined by 5.7%. An increase was registered in the export of metals and metal products (up 34.7%). Exports of machinery and equipment contracted by 11.1%, while imports of this category grew by 6.8%, with their share accounting for 46% of total imports.

Global market prices for natural gas fell by 5.4% *(Tab. 9)*.

At the same time, phosphate fertilizers rose in price by 20.2%, rolled metal products by 5.7%, and crude oil by 2.3%.

Table 9. Global commodity price trends, % change from corresponding period of previous year

Commodity	3 months 2024	3 months 2025	3 months 2026
Crude oil	101.3	91.8	102.3
Natural gas	36.1	164.7	94.6
Rolled metal products	96,2	100,2	105,7
Phosphate fertilizers	116,4	83,0	120,2

Global prices for steel products show an upward trend: increases were recorded both for flat products (up 16.3–26.9%) and for long products (up 6.3–10.3%), with the exception of merchant bars, which became cheaper by 1.6% *(Tab. 10)*. On the domestic market, prices fell: flat rolled products by 13.9–7.3%, and long products by 14.4–8.3% *(Tab. 11)*.

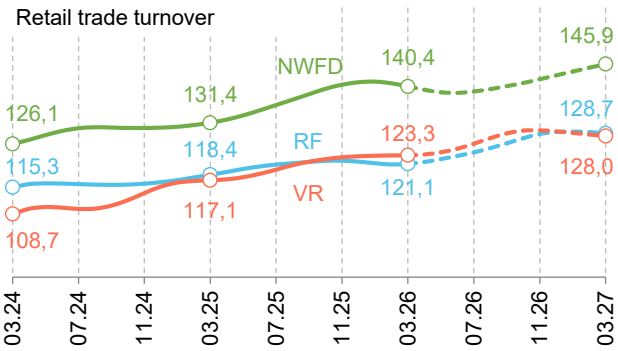
Table 10. World market prices for steel products (EU countries) per metric ton (as of early April of the respective year)

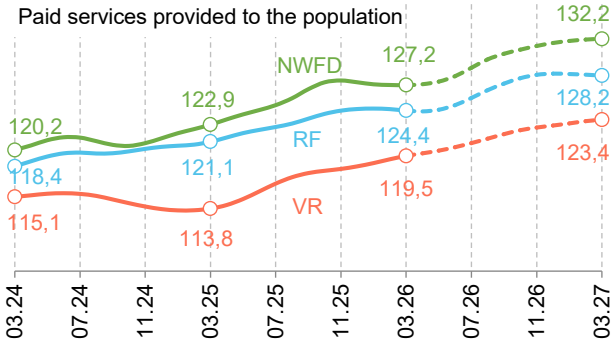
Type of steel product	Unit of measurement	2024	2025	2026	2026, % to	
					2025	2024
Flat products						
Cold-rolled sheet	USD	800	753	875	116.3	109.4
Galvanized sheet	USD	840	795	935	117.6	111.3
Hot-rolled sheet	USD	698	660	838	126.9	120.1
Long products						
Reinforcing steel (rebar)	USD	763	653	720	110.3	94.4
Structural sections	USD	915	713	758	106.3	82.8
Merchant bars	USD	865	713	701	98.4	81.0

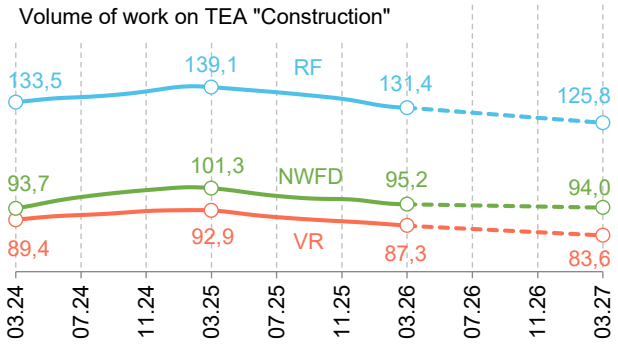
Table 11. Russian domestic market prices for steel products per metric ton (as of early May of the respective year)

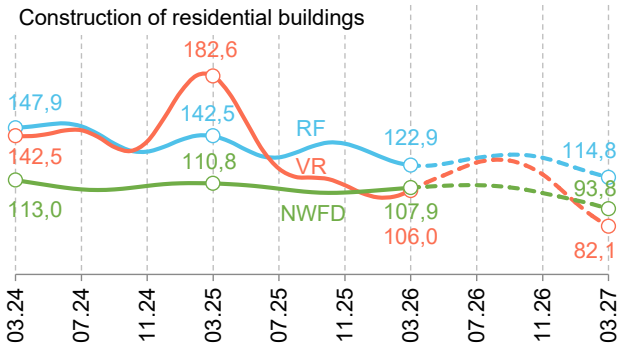
Type of steel product	Unit of measurement	2024	2025	2026	2026, % to	
					2025	2024
Flat products						
Cold-rolled sheet	RUB	89350	83375	71775	86.1	80.3
Galvanized sheet	RUB	117875	105350	91400	86.8	77.5
Hot-rolled sheet	RUB	68675	62700	58100	92.7	84.6
Long products						
Rebar	RUB	67592	58995	52050	88.2	77.0
Beams and channels	RUB	88094	80963	69456	85.8	78.8
Round bars	RUB	65933	58333	53500	91.7	81.1
Angles	RUB	68500	59800	51200	85.6	74.7

Consumer market and construction development trends, 2024–2027, % of 2018 level

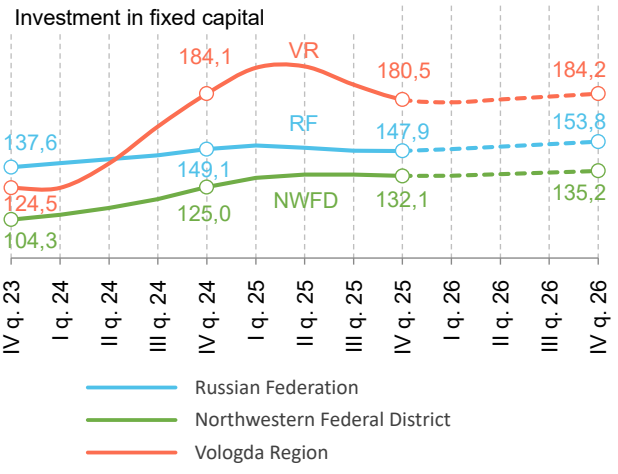


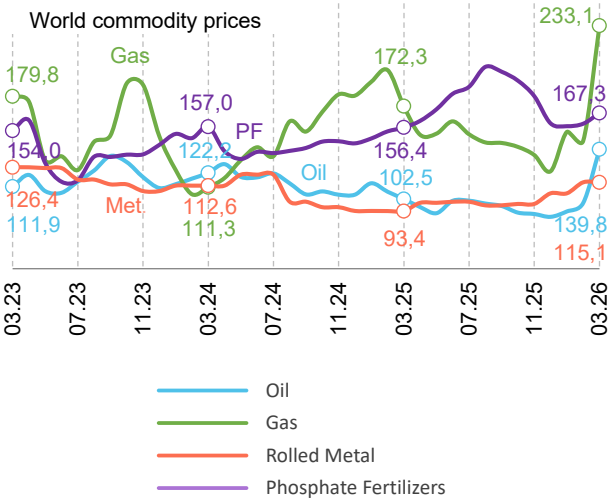






Investment activity and foreign trade trends, 2023–2026, % of 2018 level





Summing up, it is worth noting that in the first quarter of 2026 the economy of the NWFD remained resilient; however, a combination of diverse challenges continued to worsen the operating environment and required constant adaptation, which was partially manifested in a number of positive developments.

1. Against the backdrop of declining budget and business revenues, consumer demand continued to grow, even though its values were understated because of the shift of part of the turnover to late 2025 ahead of the tax reform coming into force.

2. The increase in budget expenditures and mortgage lending had a positive impact on the economic dynamics.

3. In a number of the macro-region's industrial sectors, output grew substantially, including in the final-demand manufacturing industries and in several investment-demand manufacturing industries.

At the same time, the economy of the NWFD came under mounting pressure, since the strengthening of the ruble helped to curb inflation but reduced budget and exporters' revenues, while simultaneously heightening competition from imported goods. Thus, both the NWFD and the country as a whole face a mounting imperative to resume the investment cycle as quickly as possible. This will be facilitated by a systemic boost in the demand for the output of key industries, targeted support for investment in the real sector of the economy in tandem with improving the efficiency of jobs, and an easing of tax and monetary policy. Examples of measures already implemented include expanded support for industrial projects[9], support for construction[10], and backing for infrastructure projects[11].

Sources: Rosstat, Ministry of Economic Development of Russia, Bank of Russia, Federal Customs Service, Government of Russia, metalinfo.ru, metaltorg.ru, divercitytimes.com, tradingeconomics.com, data.stats.gov.cn, bea.gov, and others.

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[9] Decree of the Government of the Russian Federation 943-r of April 23, 2026, on the Allocation of More Than 49.6 Billion Rubles to Subsidize a Loan for the Implementation of a Large-Scale Investment Project in the Petrochemical Industry; Resolution of the Government of the Russian Federation 520-r of March 18, 2026, on the Allocation of More Than 45.6 Billion Rubles for the Development of Industrial Parks and Technology Parks in a Number of Regions.

[10] Decree of the Government of the Russian Federation 906-r of April 21, 2026, on the Allocation of More Than 700 Million Rubles for the Implementation of Measures under the Federal Project "A New Rhythm of Construction" in 2026–2027.

[11] Resolution of the Government of the Russian Federation 386 of April 10, 2026, and Decree of the Government of the Russian Federation 797-r of April 10, 2026, on the Allocation of 10 Billion Rubles to the Regions for Measures to Computerize Healthcare Systems.

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