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A peer-reviewed scientific journal that covers issues of analysis and forecast of changes in the economy and social spheres in various countries, regions, and local territories.

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In 2017 the socio-economic research was supplemented by agricultural issues. ISED T RAS was joined by the Northwestern Dairy and Grassland Farming Research Institute, and was reorganized into the Vologda Research Center of the Russian Academy of Sciences.

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- socio-economic problems regarding scientific and innovative transformation activities of territories;
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- development of scientifically based systems of dairy cattle breeding in the conditions of the North-Western region of Russia;
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- development of technologies and technical means for agricultural production in the North-Western region of Russia;
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Economic Reforms in the Context of Dominant Ideologies



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Abstract. Russia's post-Soviet development has been marked by recurring economic reforms of varying scale and nature. Economic policy is often grounded in ideological justifications conveyed through theoretical narratives that explain its direction. Drawing on transcripts of 35 in-depth interviews and three focus groups with Russian academic economists, we use thematic and narrative analysis to identify five key themes and the theoretical narratives they contain: the crisis of Russian economics and economists' self-identification; "scientific neoliberalism" or the supposed "ideological neutrality" of economic policy; economic sovereignty and identity; state intervention in the name of justice; and institutions and economic policy. We then systematize these narratives against previously identified ideal types of economic ideology, showing that each appears in the scholarly literature and that a single narrative may align with several ideal types. Finally, we classify the narratives on a trichotomous scale – destructiveness, neutrality, constructiveness – with respect to economic policy and reforms in Russia. We argue that a constructive ideology of economic reform should emerge evolutionarily through the pragmatic adaptation of contemporary science to current challenges, taking into account historical development, culture, and existing institutions. The findings will be of interest to researchers studying ideology in economics and to those involved in designing reforms and implementing economic policy.

Key words: economic ideologies, thematic analysis, theoretical narrative, economic policy, reforms.

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Introduction

Russia has faced the need for economic reforms quite often. It would be difficult to find a historical period in which economic reforms of one kind or another – from radical to structural – were not carried out. Economic science, of course, provides the theoretical foundations for such reforms. And even when politicians speak exclusively of technocratic and pragmatic reforms, they are, in John Maynard Keynes's apt phrase, "usually the slaves of some defunct economist" (Keynes, 2007, p. 340).

Economic ideologies, which, according to Joseph Schumpeter, are bound up with a "pre-scientific cognitive act" that cannot be eliminated from the process of cognition (Schumpeter, 2012, p. 264), exert considerable influence on reforms, on reformers, and on how reforms are perceived in public discourse. Moreover, ideologically charged

theoretical narratives – transmitted through economics education and various social networks – significantly shape how citizens understand the economic processes taking place in their country, and they justify particular economic policy measures by molding public opinion. Neoliberal ideology offers a good example of such a significant influence on the explanation and justification of radical market reforms (Slobodian, 2025).

V.M. Polterovich proposed a logical scheme in which ideology is one of the most important components shaping the links between economic theory, economic mechanisms, and human qualities: "economic theory → dominant ideology → economic mechanism → ... → civic culture and human qualities" (Polterovich, 2022, p. 202). This scheme allows not only for forward links but also for feedback loops, the existence of which its author

also acknowledges. In this paper, we are interested primarily in the links between economic science, economic ideologies, and the implementation of economic reforms.

Dominant economic ideologies are often discussed in a destructive context, since they “negatively affect scientific research” (Polterovich, 2017, p. 63). Yet there are ideologies worth striving toward in order to harmonize economic relations. One example is the “ideology of cooperation”, which V.M. Polterovich associates with the possibility of “building a coordinated market economy with a high level of corporate social responsibility combined with consensual democracy” (Polterovich, 2023, p. 14).

Work is now emerging that shows how much the ideological preferences of governments matter in economic policymaking, even when such policy departs from classical narratives – for example, less income redistribution under right-wing governments (Resmini, Rojas, 2025). It follows that, under certain conditions, the short-term material interests of elites may matter less than an understanding of the direction of reforms carried out within particular ideological frameworks.

The aim of this study is to systematize the theoretical narratives associated with economic policymaking and the implementation of reforms. The identified theoretical narratives will be correlated with the economic ideologies that exist in Russian economic science. The narratives will also be assessed for their alignment with constructive economic reforms.

Economic reforms and constructive ideology

Relying on theoretical narratives, ideological constructs, and clichés about reform can obscure how specific mechanisms and institutions actually work in a given country. China, with its developing socialist market economy, offers a good example. The very phrase “socialist market” contains an ideological contradiction. Yet the practice of reform and economic policy in China shows that

this model has made it possible, over a long period, to preserve both competitive market mechanisms and institutions that ensure high levels of economic stability and governability (Popov, 2025, pp. 161–162). This is achieved, among other things, because “private capital exerts less influence on state policy than in the West” (Zhang, 2023, p. 822).

The negative attitude toward reforms is also linked to the fact that ideologically charged reform programs often rest on ideologemes that are far removed from the frontier of scientific knowledge (Polterovich, 2017, p. 60). Consequently, strategies of socio-economic development shaped by one or another dominant ideology “as a rule, fail” (Polterovich, 2017, p. 55). This critical view can be considered fair if one assumes that an approach to reform grounded in a dominant ideology will inevitably be one-sided, inflexible, and dogmatic (Volchik, Kot, 2025). But this raises a problem connected with the Schumpeterian interpretation of ideologies, in which they cannot be eliminated from the process of scientific inquiry. Thus, whether we like it or not, any reform based on scientific concepts of socio-economic development is ideological to one degree or another. The main question then shifts to the dogmatism inherent in ideological positions. Indeed, if the ideology underlying economic policy and the design of socio-economic development strategies is dogmatic and inflexible, it is highly likely to adversely affect the outcomes of reforms and even the formation of human qualities (Polterovich, 2022).

Dogmatism should be countered with pragmatism. China’s market transformation of the economy serves as an example of a pragmatic approach to designing a reform strategy. In a socialist country, one might assume that ideology always plays a very important role, yet in the case of the Chinese reforms carried out since 1978, a pragmatic strategy was implemented in practice. On the one hand, it made it possible to gradually build the institutions and mechanisms of a competitive

market economy; on the other, it avoided the “shock therapy” (Weber, 2021) that underlay Russia’s radical market reforms of the 1990s. And if ideology is in fact irremovable from the scientific process, then the task is not to “purify” reform design of ideological influence but to find the necessary balance and combinations of ideal types for building a constructive ideological agenda.

Designing a constructive ideology is thus linked to pragmatism, to an appreciation of historical specificities, existing institutions, and culture, and to adapting contemporary scientific advances to practical problem-solving. It is therefore important that the combination of ideological types and the theories employed “be rooted in social reality” (Wu, 2025, p. 304).

Approaches that treat economic policy as de-ideologized and technocratic usually rest on the assumption that democratic institutions of open-access orders create the conditions for comprehensive economic development and growth (North et al., 2011; Acemoglu, Robinson, 2015). In current conditions, democratic political institutions are also regarded as an important precondition for technological innovation and modern development driven by breakthrough technologies (Aghion et al., 2007). However, open-access orders with developed market economies exist in only a small number of countries. Most countries in the modern world do not fall within the narrow corridor that makes it possible to reap economic advantages from combining inclusive democratic institutions with a competitive market economy (Acemoglu, Robinson, 2021).

The choice of reform trajectory depends to a considerable extent on the “ideological landscape” within which reforms are designed and implemented. The well-known sociobiologist P. Turchin treats “ideological consensus” as an important condition for the stable and progressive economic development of the United States: “... the ideology of the postwar consensus is sometimes

called the American creed. The main elements of this ideology were democracy (the principles of which are enshrined in the constitution), laissez-faire policy, and American patriotism” (Turchin, 2024, p. 139). By contrast, he associates the breakdown of consensus with institutional and economic instability and elite conflict: “...one never ceases to be amazed at how much our ideological landscape has changed. Cultural stability began to erode under the impact of the antiwar and civil rights movements of the 1960s. The economic pillars collapsed under the onslaught of neoliberal economics in the 1970s. But as of 2020, the postwar consensus had not been replaced by any equally coherent narrative accepted by the overwhelming majority of the elite and the population” (Turchin, 2024, p. 140).

The case of the People’s Republic of China testifies to the importance of ideological context for the success of reforms, and it is especially instructive when compared directly with the Soviet experience. The “institutional flexibility” of the Chinese authorities in carrying out market reforms ensured their success, whereas the “ideological conservatism” of the Soviet authorities, along with the curtailment of the Kosygin reforms, contributed to the country’s “economic exhaustion,” which ultimately led to its collapse (Balatsky, 2025a, p. 173).

In carrying out reforms, ideology is capable of answering the question “what kind of state are we building?” (Ilyin, Morev, 2025). Yet state-building and the formation of a corresponding economic order depend on the adaptive efficiency of the institutional environment, or the “rules that shape the direction of the economic system over time” (North, 1997, p. 106). The influence of ideology (which can be regarded as a combination of ideal types) on the direction and trajectory of development is inertial and bound up with path dependence. It is therefore important to understand which “dogmas, theories, and myths” are associated

with a given ideology: “Ideologies underlie the subjective frameworks that people possess to explain the world around them. Ideologies contain a substantial normative element; that is, they explain both how the world is and how it should be. Although subjective models can be, and usually are, a mixture of beliefs, dogmas, sound theories, and myths, there are usually elements of an organized structure that make them an economical means of receiving and interpreting information” (North, 1991, p. 484).

Reform design must rest on cutting-edge scientific advances. Otherwise there is a risk that development strategies will contain ideological elements that lead to inefficient decisions (Polterovich, 2017). It should be kept in mind, however, that many theoretical frameworks and advances in economics are themselves subject to ideological influence. “The difficulty lies in the fact that the useful and the ideological elements of Western economics are not clearly separated and are often simply mixed together. Therefore, unless we are scientifically perceptive and carefully evaluate these theories, it is quite possible that harmful aspects will be treated as though they were valuable elements of economic science, while its sound and rational aspects will be ignored” (Zhang, 2017, pp. 22–23). This ideological influence of “Western economics” is often implicit. Our conception of ideal types assumes that, in reality, both scientific research and policy design draw – openly or implicitly – on ideologies as a “pre-scientific cognitive act” (Schumpeter, 2012). In practice, moreover, we observe combinations of ideal ideological types, one of which is dominant; the design of reforms and the conduct of economic policy therefore unfold under the influence of various ideal ideological types. In this context, it is important to understand how the dominant ideal types of ideology relate to the use of particular policy measures. The ideological justification of reforms is equally important. Russia’s radical market reforms

of the 1990s offer an example of such justification: ideas and ideologemes of market transformation that promised tangible economic results soon became popular both in broad public discourse and in the scholarly community. Our earlier analysis of economic ideologies showed that neoliberal ideology dominated scholarly publications between 1992 and 2002 (Volchik, 2025).

Another example of the implicit use of dirigisme as an ideal type of economic ideology is V.M. Polterovich’s concept of positive cooperation: “... the most preferable strategy is that of positive (not directed against third parties) cooperation, which provides for institutional reform and reform of economic policy and includes two main stages: (1) the formation of catch-up development institutions...; (2) the building of a coordinated market economy with a high level of corporate social responsibility...” (Polterovich, 2023, p. 9).

Theoretical narratives are linked to widely shared economic concepts and models that can be assigned to one or another fundamental paradigm. According to W. Samuels: “It is now widely recognized that the primary mode of ideological penetration of economic theory is the fundamental paradigm, or cognitive system, that provides a general framework for thought and meaning and that, although laden with metaphysical content and psychological conditioning, is a key ideological asset” (Samuels, 1992, pp. 239–240).

It is indeed possible to trace a certain influence of “fundamental paradigms” on economic ideologies (Polterovich, 2022). This influence was most clearly visible during Russia’s radical market reforms, when the ideas of the “Washington Consensus” and neoliberal economic ideology were strong. Our study of ideologies also shows that, in in-depth interviews and focus groups, Russian scholars often associate ideal types of ideology with one or another “fundamental paradigm”.

The position that denies ideology in “normal” or “genuine” economic science is in fact an

illustration of the implicit ideological character of that very position. The universalism inherent in particular theories and models is not an argument for de-ideologization: “There is a widespread view that some part of economic theory is free of ideology and useful for explaining any economic system without subjecting it to implicit criticism or rationalization. However, economists have not reached agreement on which part is so free of ideology or what conditions govern its freedom” (Samuels, 1992, p. 239).

The influence of ideology on economic research often operates implicitly, through the framing of the problem and the selection of relevant data and variables. This is consistent with Schumpeter’s approach: “Once we recognize the possibility of ideological bias, it becomes easy to detect it. All that is needed is to examine the scientific procedure carefully. It begins with the perception of interrelated phenomena that we intend to analyze and ends (to date) with the construction of a scientific model in which these phenomena are conceptualized and the relations between them are precisely formulated either as assumptions or as propositions (theorems)” (Schumpeter, 2012, p. 253).

The ideal types of ideology that economists employ – often implicitly – are bound up with the “social conditioning” of the choice of problems that are most in demand or relevant to current economic processes: “Even in mathematics and logic, and to an even greater extent in physics, the researcher’s choice of problems and approaches to them – and hence the character of scientific thought in a given era – becomes socially conditioned. This is precisely what we have in mind when we speak of scientific ideology, rather than of an ever more perfect perception of objective scientific truths. Yet few would deny that in the case of logic, mathematics, and physics, the influence of ideological bias goes no further than the choice of problems and approaches – that is, the sociological interpretation

does not call into question the ‘objective truth’ of scientific results” (Schumpeter, 2012, p. 251).

One could say that the ideological “biases” of economists blind them to problems – and to ways of framing questions – that do not align with their notions of “genuine” economic science. In social science research, it is therefore difficult to separate “pure science” from the “moral judgments” of scholars: “The question of a [narrative’s] plot is not reducible to its elegance. There is also a moral dimension. Hayden White wrote: ‘the demand for the closure of a historical narrative is a demand for... moral judgment’ (White, 1981, p. 20). A monetarist will not experience moral satisfaction until he has laid the blame on the Federal Reserve” (McCloskey, 2015, p. 21).

The concept of the theoretical narrative used in this article is close in meaning to the concept of metaphor employed by D. McCloskey: “...metaphor here is an occasion and instrument for thought, not its replacement. Metaphors generate attitudes that are better kept in view and under the control of logical reasoning” (McCloskey, 2015, p. 65). This is why the role of ideas and ideologies (which often appear in scholarly and public discourse in the form of theoretical narratives) is so significant in historical perspective, when we consider the evolution of economic orders – for example, how the ideology of capitalism shaped the modern world (McCloskey, 2006).

Research methods

The choice of the in-depth interview method (Legard et al., 2003) is explained by the fact that it yields the richest and most varied material for identifying relevant narratives. The use of focus groups is justified when the issues or concepts under study can be interpreted differently by different people (Cyr, 2024, p. 222). Focus groups not only foster a deeper understanding of the processes under consideration (Kamberelis, Dimitriadis, 2013, p. 41), which is especially important, but can also generate solidary, unifying solutions to complex

problems (Kamberelis, Dimitriadis, 2013, p. 57) – much like a constructive economic ideology.

Large text corpora call for a variety of approaches to textual analysis using qualitative methods (Stueber, 2019). In recent years, so-called “thematic analysis” has gained ground; it presupposes the researcher’s active involvement in interpreting the qualitative data under consideration (Braun, Clarke, 2022, p. 8). A distinctive feature of this approach is its flexibility, which allows it to be applied within various theoretical frameworks, across a wide range of research questions and sample sizes (Kiger, Varpio, 2020, p. 848). Thematic analysis, for instance, is widely used in economic research (Mahmood et al., 2021; Chaiechi, Eijdenberg, 2022; Srtang et al., 2022), in research within the methodology of other social sciences (Riggs et al., 2016; Drápal et al., 2023), and in medical qualitative research (Joffe, 2011; Ahmed et al., 2025).

Thematic analysis makes it possible to generalize and consolidate respondents’ views into “recognizable ‘patterns’” (Lochmiller, 2021, p. 2031), identifying regularities in the available data for subsequent analysis (Kutsyuruba, 2023, p. 143).

Theorizing proceeds as researchers consider ways to support, refute, refine, or extend a theme (Fife, Gossner, 2024). Within the analysis of individual themes organized around a limited number of fundamental concepts concerning objects, relations, and processes, a distinctive “conceptual space” takes shape (Agazzi, 2017, pp. 211–212, 227). In the context of our study, this means that identifying themes makes it possible to reveal theoretical narratives and the economic ideologies corresponding to them.

The data source for the analysis was a series of in-depth interviews and focus groups with representatives of Russian economic science. From April to July 2025, 35 interviews were conducted. The focus groups were held from April to June 2026, three focus groups in total with eight participants each: the first focus group was conducted in person, the second online. The average duration of a focus group was 1 hour 40 minutes.

For the interviews, respondents were selected primarily from those holding an academic degree in economics ($N = 31$). However, given the diversity of economics as a field, four economists with

Table 1. Characteristics of interview and focus group respondents

Characteristic	Interviews	Focus groups
Geographic characteristics	Central Federal District – 9; Northwestern Federal District – 5; Southern Federal District – 6; North Caucasus Federal District – 1; Volga Federal District – 6; Ural Federal District – 2; Siberian Federal District – 4; Far Eastern Federal District – 2	Central Federal District – 6; Northwestern Federal District – 2; Southern Federal District – 8; North Caucasus Federal District – 2; Ural Federal District – 1; Siberian Federal District – 5
Age characteristics	Under 35 – 8; 36–59 – 17; over 60 – 10	Under 35 – 1; 36–59 – 16; over 60 – 7
Gender characteristics	Men – 16; women – 19	Men – 11; women – 13
Academic degrees	Candidates of Sciences – 21; Doctors of Sciences – 14	Candidates of Sciences – 16; Doctors of Sciences – 8
Affiliation	University staff – 31; RAS staff – 4	University staff – 22; RAS staff – 2
Total	35	24
Source: own compilation.		

academic degrees in other disciplines were also interviewed: two in the physical and mathematical sciences, one in history, and one in sociology. The focus groups involved 23 respondents with an academic degree in economics and one economist with a degree in history.

Informants were selected until saturation was reached using expert network sampling (peer-referrals constituting network sampling), a type of non-random targeted sampling (Watters, Biernacki, 1989; Heckathorn, Cameron, 2017), since qualitative research is best served by targeted selection, in which “the units of analysis selected for study are those that possess the greatest amount of rich information capable of answering the research questions” (Vanke et al., 2020, p. 36). Interviews and focus groups were conducted until saturation was reached, when the amount of new information obtained made further data collection inadvisable (Kvale, 2003, p. 106).

For thematic analysis of the interview and focus group materials, we used the Python programming language, along with the natural language processing libraries NLTK and Scikit-learn. The corpus of text documents under study was preprocessed as follows:

- 1) from the interview and focus group transcripts, respondents’ answers relating to the discussion of the relationship between economic policy and economic ideology were selected;

- 2) statements by the moderators (the interviewer and, in the case of focus groups, the facilitator) were removed from the texts, leaving only the participants’ direct speech;

- 3) respondents’ utterances were divided into complete semantic blocks consisting of several sentences that convey the meaning and context of each opinion;

- 4) stop words and symbols were removed using the NLTK library;

- 5) for the entire text corpus, tokenization (division into individual words) was performed, along with lemmatization, i.e., reducing all words to their base form.

The final dataset for analysis thus consisted of 1,307 informant utterances. Next, bigram and trigram frequencies were obtained for all preprocessed materials. On this basis, the most common phrases characterizing the key topics discussed by respondents and focus group participants were identified.

The results of the bigram and trigram frequency analysis suggest that respondents’ opinions cluster around the following topics: the crisis of Russian economic science and the self-identification of Russian economists; “scientific neoliberalism”, or the ostensible “ideological neutrality” of economic policy; economic sovereignty and identity; state intervention for the sake of justice; and institutions and economic policy.

Economic policy, reforms, and theoretical narratives

Thematic analysis of the in-depth interviews and focus groups allows us to move toward identifying and systematizing the theoretical narratives associated with economic policymaking and the implementation of reforms. In this context, theoretical narratives are linked to a particular economic ideology through “fundamental paradigms” (Samuels, 1992) and the theories and models relevant to them. One striking example is the ideology of neoliberalism, which, through theoretical narratives, “justified” and “promoted” the market reforms carried out in Russia.

Theoretical narratives serve as the basis for formulating economic policy. In turn, many theoretical narratives originate in economics education, which reflects the current state of economic science and of reality itself: *“For the past, I’d say, 40 years, we received our economics education under a planned economy, and that was one system of knowledge, one set of economic theories and approaches. Then the transition to a market economy began, and the entire system of economics education came to be based on research, theories, and concepts from foreign authors. There was very little Russian research, very few Russian theories that we could show*

our students. Now we've entered the 'next cycle'. A process of forming our own domestic economic and management science is under way, and within it our own theories are emerging, our own textbooks are appearing. That's very encouraging. And there's still a great deal of work ahead of us to create and further develop our own economic science" (Doctor of Sciences, Stavropol, 58 years old).

Topic 1 "The crisis of Russian economic science and the self-identification of Russian economists"

Thematic analysis showed that the topic of the "crisis of Russian economic science" is central to any discussion of economic policy: *"Right now we have a great many different concepts, where we're either trailing behind foreign science or going purely in opposition to it, but, so to speak, ideology is eclipsing practice"* (Candidate of Sciences, Yekaterinburg, 45 years old). At the same time, this challenge is not unique to Russian science.

"Contemporary economic science cannot fully cope with the challenges of the global economy and global markets, because it is unable to respond adequately to changing conditions. Since Russian economic science is part of global economic science, this is, of course, a property of economic science as a whole. But because of the specifics of the Russian market and Russian economic thought, it manifests itself most acutely in Russia" (Candidate of Sciences, Ryazan, 33 years old).

"It's not just us. Look at what's happening in the United States. Unthinkable things are going on — an attempt at... that kind of ideological influence and a revision of the entire economic policy! You're left dumbfounded. There they're trying to revise the foundations of fiscal policy. It's an attempt by ideology to influence the economy even more strongly than here" (Doctor of Sciences, Moscow, 70 years old).

The main theoretical narrative of this topic corresponds to its title: the crisis of contemporary economic science. Building on this topic, we can further systematize the theoretical narratives.

Almost all respondents acknowledge the existence of problems, yet their views on what reforms should look like differ dramatically, which made it possible to identify several lines of reasoning. On the one hand, there are arguments about the place of the mainstream: whether alternatives to it exist when making economic policy decisions, how de-ideologized neoliberalism really is, and so on. On the other hand, there are alternative approaches to economic policy tied to the idea of economic sovereignty. In both cases, there are both positive and negative statements: *"We don't have our own special path, no matter what anyone says. Again, our banks make money straight out of McConnell's 'Economics' textbook. You know? <...> If we didn't have the kind of regulation we have now, we'd have enormous inflation"* (Candidate of Sciences, Rostov-on-Don, 49 years old). Or: *"The focus in economics is shifting more toward current, hyped topics, if you can call them that — things like technological sovereignty and import substitution. Right now every other person is trying to write about it. The second trend is this story about growing isolation, specifically in the field of economics"* (Candidate of Sciences, Perm, 30 years old).

One of the important problems in implementing reforms — one that economic science should help overcome — is the bureaucracy's lack of a systematic understanding of the direction of economic policy, as a result of which it is forced to rely on often outdated theoretical narratives.

"State failures are also linked to the fact that officials themselves can't determine the best direction for economic policy. <...> They simply don't have the expertise for it" (Doctor of Sciences, Saint Petersburg, 47 years old).

Topic 2 "Scientific neoliberalism, or the ostensible ideological neutrality of economic policy"

This topic brought together the most contradictory statements. Respondents took two opposing positions. The first: only the neoliberal approach to economic policy can be considered

scientifically grounded. *“In the 1990s and early 2000s, economic policy had authority because it commanded Western methodology, which you could point to if anything came up – saying, this is why we’re acting the way we are. Now it’s more the opposite: among decision-makers, the only one who uses a scientific approach is the head of the Central Bank. I can’t name anyone else”* (Doctor of Sciences, Vladivostok, 55 years old). Any departure from this position automatically renders economic policy ideological: *“You can see it yourself: state policy, especially in the financial sphere, is handled by people who follow the principles of economic science. For example, the issue of fighting inflation goes beyond neoliberalism. The heads of economic agencies are people who don’t listen to loud ideologues. That’s the right approach: you need restraint and responsibility for the entire economic system. I don’t think ideology has much influence on policy right now”* (Doctor of Sciences, Moscow, 70 years old).

The opposing view holds that constructing a logical opposition of “scientific neoliberalism” versus “everything else as unscientific” is not quite correct, since this is merely an ostensible ideological neutrality: *“There are foundations that sponsor basic and applied research through grants, or state contracts, or university initiatives themselves. Accordingly, there are opportunities to support laboratories, research groups, and research projects so that they reach a certain level of research, purchase certain equipment, certain programs, software to carry out certain calculations, and submit to certain journals”* (Candidate of Sciences, Kazan, 41 years old).

At the same time, principles can always be set aside when the need arises: *“There’s a wise saying among researchers: they write one thing, say another, and do a third. What gets written? Economic freedom, free trade get written. Right? All of neoclassical*

economics is built on Ricardo’s principles of comparative advantage and, more generally, on the principles of free trade. What actually happens? In reality, we know that problems arise in one industry or another, and markets are immediately closed. And state assistance immediately appears – the very state that supposedly shouldn’t intervene in market processes. In my lifetime there have been many such examples. For instance, when there were problems with the airline <KLM (Royal Dutch Airlines)>¹ in the Netherlands, the state immediately stepped in and organized assistance for its national airline. So why did they set aside market principles? And why didn’t that company go bankrupt? You could give similar examples with ferrous metallurgy and so on. In practice, free trade gets written about in theory, but in real life it’s something else entirely” (Doctor of Sciences, Novosibirsk, 70 years old).

The main theoretical narratives: only the neoliberal approach is scientifically grounded; ostensible ideological neutrality.

Topic 3 “Economic sovereignty and identity”

The second response to the crisis in Russian economic science has been a line of reasoning about a special path, sovereignty, and the search for identity. Given the diversity of understandings of the special path (Tambovtsev, 2026), this topic includes several sub-topics.

First, “does a special path exist?”

“We won’t be able to replicate someone else’s economic trajectory. This aligns with Polterovich’s theory that all territories – whether it’s a country, a region, or some small piece of a region – all territories have their own initial macroeconomic conditions, institutional conditions, their own cultural constraints, religious constraints. And just take it and replicate it? How would we even replicate it?” (Doctor of Sciences, Novosibirsk, 70 years old).

¹ Petzinger J. (2020). German and Dutch governments put up billions to save airlines. Yahoo Finance UK. Available at: <https://uk.finance.yahoo.com/news/german-and-dutch-governments-put-up-billions-to-save-airlines-092234870.html>

According to the neoliberal narrative, the possibility of achieving economic sovereignty runs up against general economic laws: *“As for the principle of comparative costs, that principle has been working in the world for a thousand years. Why? Take a problem like import substitution. Import substitution isn’t about making a Berezka TV instead of a Philips TV. Or a Lada instead of a Mercedes. The principle of comparative costs applies here. A car has to be produced at the same level and quality as a Mercedes”* (Doctor of Sciences, Rostov-on-Don, 52 years old).

Second, “what special path is inherent to Russia?”

“If we’re talking about a special path, it can also be different: the libertarian island of Crimea and totalitarianism are also a special path” (Candidate of Sciences, Saint Petersburg, 70 years old).

“It’s as if the special path may, in a certain sense, be the most flexible in terms of applying and implementing economic policy, taking the specific economic situation into account” (Doctor of Sciences, Moscow, 72 years old).

“Here it turns out like Leo Tolstoy said – every family is happy or unhappy in its own way, we’re all happy in our own way, but all ‘special paths’ are the same” (Doctor of Sciences, Rostov-on-Don, 64 years old).

“So, as far as Russia specifically is concerned, things are not simple here, because Russian civilization is peripheral by its very nature” (Doctor of Sciences, Moscow, 59 years old).

“It’s an integrated model of the economy: courts, technological sovereignty, stable foreign economic ties, infrastructure development, logistics flows, trade turnover, and so on. That is, this is a model – specifically a model of sustainable development” (Doctor of Sciences, Stavropol, 58 years old).

“One person’s economic freedom is limited by another’s economic freedom. So the very concept of freedom is too philosophically complex. That’s why I don’t consider it a priority at all – at a primitive level

of understanding freedom, that’s just anarchy and revolution. <...> Well, I’d also say that, again, given the role of the state in Russia’s economy, economic freedoms are simply not something we’re used to” (Doctor of Sciences, Saint Petersburg, 47 years old).

Third, “economic sovereignty and its limits”.

“Certain strategies exist in any state. First, so that society can reconcile its interests, and second, so that there is some common reference point – what are we striving for, where are we going? And without setting strategic goals, there won’t be any meaningful result if everyone develops at their own pace and in different areas. That’s why goals are now tied more to strategic objectives in achieving sovereignty” (Candidate of Sciences, Kazan, 41 years old).

“Yes, we’ll be friends with other countries, but the interests of our business, which has now entered import substitution, come first! So if foreigners come back, their demands will be satisfied on a residual basis. That is, the assets they once sold for a pittance – they won’t get them back” (Doctor of Sciences, Tomsk, 49 years old).

“Raising the country’s economic status in the world, sensible mutually beneficial cooperation with other countries, while ensuring our own economic security and sustainable development, including through ESG policy” (Doctor of Sciences, Nizhny Novgorod, 58 years old).

“That industry exists only on paper – it’s not a real industry but a kind of postmodern thing, where behind the signboard there’s nothing at all” (Candidate of Sciences, Ryazan, 33 years old).

“So that the Russian economy finally pulls out of this crisis-management state and genuinely starts sustainable development, so that our budget finally goes from a deficit to a surplus, and not stay as deficit-ridden as it is now” (Doctor of Sciences, Moscow, 72 years old).

The main theoretical narratives: the special path as an adaptive strategy, economic sovereignty, import substitution, center–periphery.

Topic 4 “State intervention for the sake of justice

Topic 4 is connected to Topic 3 through the core value that respondents named – the aspiration to justice: *“This dream was articulated back in the 19th century – justice and a just society. What irritates us most is not the degree of inequality in wealth or income. Oddly enough, Russians actually tolerate that far more calmly than, say, our Ukrainian brothers or Germans. What comes first is inequality before the law. You see? Inequality and vulnerability to violence of various kinds, inequality of status”* (Doctor of Sciences, Moscow, 60 years old).

“You know, today in our state the main emphasis is on traditional values – that’s what the head of state emphasizes most. And that’s right, that’s good. And one of the main traditional values is precisely justice. We need it badly today in our state, where there is in fact inequality” (Candidate of Sciences, Makhachkala, 58 years old).

“Social justice should lie at the foundation of the state’s economic decisions, but not at the expense of economic efficiency. That is, it’s a combination of social justice and combating social dependency” (Doctor of Sciences, Vladivostok, 55 years old).

Respondents acknowledge the need for state intervention in the economy, provided that it helps overcome market failures and reduce inequality, but the scale of such intervention is a matter of debate.

“State intervention in the economy is inevitable. Everyone talked about it, including Smith, who is considered a liberal, but he stressed the need for the state in fighting monopolies, defending the country, and developing education. There’s the theory of public goods and market failures – a market economy doesn’t always cope on its own. The question is the limits and structure of intervention...” (Doctor of Sciences, Moscow, 70 years old).

“...One of the principles of state intervention in the economy is driven by <...> market failures, which result in inequality. But you shouldn’t go too far in that direction. Fighting inequality is good as long as it doesn’t start hindering economic growth,

entrepreneurial initiative, and so on...” (Candidate of Sciences, Saint Petersburg, 67 years old).

“State intervention in the economy can be useful and necessary under certain circumstances, but its scale and forms must be carefully regulated in order to avoid negative consequences” (Doctor of Sciences, Rostov-on-Don, 60 years old). After all, it seriously restricts entrepreneurs’ activity: *“But show me even one entrepreneur who wasn’t screaming about what this kind of state intervention is doing to the economy”* (Doctor of Sciences, Moscow, 72 years old).

“State intervention in the economy, on the one hand, is probably a bad thing. You look at the news, read it, and think: ‘Lord, what are they doing? Why is this happening?’ And on the other hand, you realize you’re just an ‘armchair expert’ or analyst. We don’t see the whole picture” (Candidate of Sciences, Krasnodar, 35 years old).

The main theoretical narrative: combating inequality, justice.

“We know today that our country has a very high level of differentiation, very uneven regional development, and social injustice in our society” (Doctor of Sciences, Makhachkala, 57 years old).

“Economic inequality is the main problem, and the most serious measures must be taken to solve it” (Candidate of Sciences, Rostov-on-Don, 48 years old).

Topic 5 “Institutions and economic policy”

Topic 5 is linked to Topic 3, “Economic sovereignty and identity,” through the main theoretical narrative that is very widespread in both Russian and international scholarly discourse – the “path dependence” effect, or dependence on the preceding path of development (North, 1993; David, 1994; Malkina, 2010; Nureev, 2010; Auzan, 2015; Zaostrovtssev, 2023; Acemoglu, 2025): *“There probably is some kind of rut, some set of attitudes, an institutional tradition that dictates a certain ideology to us, dictates certain research methods”* (Candidate of Sciences, Moscow, 34 years old); *“Our country has always moved along its own path, and that was*

the distinctive feature and the strength of our state. And going forward, I have a vision that moving along our own path, as it has always been, will open up opportunities for even greater development. Of course, we always look at best practices and the experience that exists in other countries, analyze and assess how it might be applied in our state. And of course, we must take our own specifics and conditions into account" (Candidate of Sciences, Moscow, 38 years old).

Respondents agree that institutions and their quality matter in the implementation of economic policy: *"The worse the institutions, the more restrictions – and the worse the result..."* (Candidate of Sciences, Vladivostok, 49 years old). However, any institutional changes have an effect only in the long term: *"For institutions dealing with demography to achieve their goals, we would need programs designed for the next 100 years"* (Candidate of Sciences, Kazan, 46 years old).

At the same time, respondents note the importance of using market principles for the implementation of a successful state economic policy: *"...The main principle left over from the Gaidar reforms is market principles. The transition of our economy to market rails was the right decision, although the manner of the transition is a matter of debate. It's our map for further movement. Right now the economy is in a difficult position, and foreign economic ties have suffered badly. But it keeps going*

under difficult conditions thanks to the activity of entrepreneurs, who find unconventional ways to bypass restrictions and develop new lines of activity..." (Doctor of Sciences, Moscow, 70 years old).

"...The main thing is not to undermine the market principles on which individual sectors still rest. In some spheres, market mechanisms still work, and preserving them is critically important..." (Doctor of Sciences, Tolyatti, 66 years old).

In turn, this can be achieved through the development of market infrastructure, which is a critical precondition for entrepreneurial initiative and, consequently, for the country's innovative development (Volchik, 2022; Volchik, 2023).

The main narratives: path dependence (the "rut" effect); market principles as the foundation of a successful economic policy.

Systematizing theoretical narratives on economic policy and reforms

According to our values-based approach to defining ideologies, we distinguish five ideal types of economic ideology: neoliberalism, socialism, dirigisme, the special path, and ecologism (Volchik, 2025). In practice, moreover, there exist combinations of economic ideologies "with one of them dominating" (Volchik, 2026, p. 22). This means that a given theoretical narrative may correspond to either one or several ideal types of economic ideology.

Table 2. Correspondence between theoretical narratives and ideal types of economic ideologies

Theoretical narrative		Ideal type of economic ideology
Crisis of economic science		Neoliberalism, socialism, dirigisme, the special path, and ecologism
	Only the neoliberal approach is scientifically grounded	Neoliberalism
	Ostensible ideological neutrality of neoliberalism	Socialism, dirigisme, the special path, and ecologism
	The special path as an adaptive strategy	The special path, dirigisme, socialism
	Economic sovereignty	The special path, dirigisme
	Import substitution	The special path, dirigisme
	Justice	Socialism
	Combating inequality	Socialism, dirigisme
	Center-periphery	Socialism, dirigisme
	Path dependence	Neoliberalism, socialism, dirigisme, the special path, and ecologism
	Market principles for economic policy	Neoliberalism

Source: own compilation.

Moreover, several different ideal types of economic ideology may appeal to the same theoretical narrative, yet the tone of that narrative can differ sharply across ideologies. Representatives of all ideologies spoke about the crisis of economic science in relation to economic policy, but whereas within neoliberal ideology this crisis is caused by a departure from the mainstream in economic decision-making, representatives of other currents see the problem in the neoclassical approach itself. From their point of view, appeals to the scientific grounding of neoliberalism look untenable, which gives rise to alternative approaches to economic policy. S.Yu. Glazyev, for instance, characterizes mainstream ideology as follows: “For many decades, the mainstream of economic thought has served as the ideological foundation for the propaganda toolkit used to protect capitalists’ interests against state restrictions on their profit-maximizing activity” (Glazyev, 2016, p. 12).

The main theoretical narratives associated with neoliberal ideology within this topic are well studied and reflected in the scholarly literature, often appealing to international experience (Shleifer, Treisman, 2005). In E. Yasin’s programmatic article, for example, we find such theoretical narratives as limiting the public sector, developing entrepreneurship, and combating inflation (Yasin, 2002). This narrative is bound up with convictions about scientifically grounded reforms based on the achievements of frontier economic science and the world experience of successful transformations. For a detailed treatment of existing approaches to criticizing this position and of the diversity of neoliberalisms, see (Kapelyushnikov, 2022; Volchik et al., 2024).

The alternative is the “grand” theoretical narrative of the special path, which encompasses the other economic ideologies depending on where that special path is meant to lead. The special-path narrative is treated as an adaptive strategy and insists on the need for constructive changes that

take domestic specificities into account; it is not something associated with isolationism or autarky. If we recognize the importance of the special path, we accordingly treat concepts such as national identity, national interests, culture, patriotism, and specific political institutions as significant for ensuring progressive economic development (Volchik, 2026, p. 30). The emphasis on the need for economic sovereignty and import substitution is characteristic of the dirigiste approach. Questions of justice and combating inequality belong to the ideology of socialism.

Within the socialist narrative, justice is the cornerstone of economic activity, which, within the corresponding system, should foster “innovation that ensures human development” (Buzgalin, 2013, p. 136). Moreover, “genuine social justice” is regarded within this current as the ultimate goal of societal transformation (Yeliseev, 2024, p. 32).

The narrative of economic sovereignty is the foundation for implementing a country’s special path of economic development and its further modernization. Taking the sovereignty factor into account is especially important in the long term, since “the effectiveness of managing internal processes in a country directly depends on the government’s freedom to make appropriate decisions. External interference from the hegemon country, as a rule, eliminates many effective domestic policy options” (Balatsky, 2025b, p. 61). A more applied narrative – import substitution – should be noted separately; it is built around measurable indicators that fit the logic of dirigiste ideology (see, for example, Popova, Sergeeva, 2022).

The narrative of combating inequality extends beyond the ideology of socialism and becomes part of dirigiste ideology. In this case, income differentiation appears as an obstacle that erodes incentives for efficient work and thereby reduces the efficiency of the entire economic system (see, for example, Vakhtina, 2015).

Respondents consider the “center–periphery” narrative in two contexts: either to emphasize the differentiation of regions within the Russian economic system (see, for example, Popov, 2023; Makushin et al., 2023) – in which case the narrative becomes an element of dirigiste ideology – or to highlight the peripheral character of Russian capitalism, in which case the narrative draws on a mixture of socialist ideology and world-systems analysis (see, for example, Gloveli, 2018).

The concept of “path dependence” can be used to explain the emergence of the special path. It turns out, however, that path dependence can be invoked by representatives of all ideologies. In the study by R. Nureev and A. Runov, for example, it is argued that Russia’s difficulties in transitioning to a market economy were “to a significant extent” conditioned by path dependence, which “goes back to the traditions of Eastern despotism” (Nureev, Runov, 2002, p. 27).

Systematizing theoretical narratives on a “destructiveness–neutrality–constructiveness” scale

The second line of systematization was to assess whether theoretical narratives facilitate the implementation of economic policy and reforms in Russia. To this end, the narratives were arranged along a trichotomous scale, from those that negatively affect reforms and economic policy, through neutral ones, to those that shape a

constructive agenda and promote change.

The most contentious narrative – that of the “crisis of economic science” – is itself one of the most destructive from the standpoint of economic policy, since it largely diverts attention away from economic policy and reform implementation, forcing a focus on issues of interest only to the academic economics community.

Its derivative narrative – “only the neoliberal approach is scientifically grounded” – is likewise destructive. Proponents of this approach tend to focus on criticizing or denying the policy being pursued, while opponents, through the narrative of “ostensible ideological neutrality”, expend considerable effort trying to debunk it.

Among the constructive narratives, two stand out: “the special path as an adaptive strategy” and “market principles for economic policy”. Despite being mutually opposed, these two narratives are entirely focused on carrying out economic reforms and defining the principles of economic policy. Moreover, they answer differently the questions of the limits of economic sovereignty and the justification of import substitution.

The narratives of “justice” and “combating inequality” deserve separate mention. They are rather neutral in character, since, for all their rhetorical persuasiveness, respondents were unable to describe how they are reflected in economic

Table 3. Systematization of theoretical narratives on a “destructiveness–neutrality–constructiveness” scale

Theoretical narrative		Type in relation to economic policy and reforms
Crisis of economic science		Destructive
	Only the neoliberal approach is scientifically grounded	Destructive
	Ostensible ideological neutrality of neoliberalism	Destructive
The special path as an adaptive strategy		Constructive
	Economic sovereignty	Constructive
	Import substitution	Constructive
	Justice	Neutral
	Combating inequality	Neutral
	Center–periphery	Neutral
	Path dependence	Neutral
	Market principles for economic policy	Constructive

Source: own compilation.

policy. They remain at the level of declared principles rather than finding practical application. The theoretical narratives of “center–periphery” and “path dependence” should also be classed as neutral; they serve as one explanation for the success or failure of reforms. However, when a reform program is designed on the basis of an analysis of the preceding path of development and takes failed experience into account, the theoretical narrative of “path dependence” becomes a constructive narrative.

Conclusion

Analyzing theoretical narratives about reforms and economic policy presents an important and complex scholarly problem. On the one hand, its relevance stems from the permanent economic reforms underway in contemporary Russia. On the other, theoretical narratives can serve to justify those reforms both within the academic community and in public discourse. In this study, a thematic analysis of data on reforms and economic policymaking, gathered through 35 in-depth interviews and three focus groups, made it possible to:

- first, identify five themes concerning how economists perceive economic policy and reforms in Russia (the crisis of Russian economic science and the self-identification of Russian economists; “scientific neoliberalism”, or the ostensible “ideological neutrality” of economic policy; economic sovereignty and identity; state intervention for the sake of justice; and institutions and economic policy);

- second, determine eleven theoretical narratives corresponding to each identified theme (the crisis of economic science; the ostensible ideological neutrality of neoliberalism; the special path as an adaptive strategy; economic sovereignty; import substitution; justice; combating inequality; center–periphery; path dependence; market principles for economic policy);

- third, systematize the theoretical narratives and link them to the corresponding five ideal types of economic ideologies.

The authors identified each theoretical narrative in the scholarly literature and showed that a given narrative may correspond to several ideal types of economic ideology, not just one. The narratives were then systematized in relation to the implementation of reforms and economic policy in Russia, ranging from destructive through neutral to constructive.

Building on this analysis, the authors propose that management decisions in economic policy be considered within a constructive agenda. Such an agenda rests on explicit recognition of the need for a pragmatic and adaptive approach to designing reform strategies – one that draws on the constructive theoretical narratives identified in this article and relevant to contemporary challenges. Accordingly, a constructive ideology of economic reforms can emerge evolutionarily, through the pragmatic adaptation of contemporary scientific advances to pressing problems, with due regard for historical patterns of development, culture, and existing institutions.

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Structural and Technological Changes in the Russian Economy since 2014



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Abstract. The challenges of modern economic development make it particularly urgent to improve the quality of economic growth and the efficiency of the economy. Reshaping Russia's external economic relations has set in motion far-reaching changes in core macroeconomic and intersectoral linkages. The study focuses on structural and technological shifts across industries, together with changes in sectoral labor productivity. Drawing on Rosstat data and updated input-output tables for 2011–2024 developed at the Institute of Economic Forecasting of the Russian Academy of Sciences, we apply methods and models of mathematical analysis and input-output modeling to show that the structural and technological characteristics of the Russian economy have changed substantially since 2014. Restricted access to external markets posed a major challenge, but the severe restrictions imposed by Western countries ultimately enabled the Russian economy to display flexibility and shift much of the real sector toward the domestic market, both in terms of output and investment. The improvement in the quality of growth during this

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period was accompanied by faster dynamics of primary resource productivity and labor productivity in certain economic activities. At the same time, significant changes in the technological level of production in several key economic sectors responsible for security and technological sovereignty (such as pharmaceuticals, machinery, and computer equipment) resulted from rising imports rather than import substitution. An important finding is that the Russian economy remains highly dependent on imports of goods and equipment. Modeling economic growth based on updated structural and technological interactions in Russian industries could be a subject of further research.

Key words: input-output table, primary resource productivity, labor productivity, structural and technological multiplier, structural shifts, economic growth quality, import substitution.

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Introduction

The new geopolitical environment is gradually reshaping the Russian economy. Despite external sanctions pressure, prerequisites are emerging in Russia for faster economic growth, new technological niches, and import-substituting industries. This means that, in practical terms, devising measures to achieve technological independence is becoming one of the most important tasks of economic development.

The challenges of modern economic development – including sanctions and geopolitical pressure and constraints on key production resources – are gradually bringing to the fore the problem of improving the quality and efficiency of economic growth. Just as the efficiency of labor use is reflected in labor productivity, the technological level of production is reflected in the efficiency of capital use. These indicators are interrelated, and it is no coincidence that many studies associate the level and dynamics of technological development with the level and dynamics of labor productivity (Marx, 1951). Under current conditions, with

primary and secondary sanctions, import substitution of technologies, even through direct borrowing, is a rather costly and lengthy process requiring not only significant investment but also skilled labor. Entrepreneurs often prefer to “wait out” the bad times in the hope of returning to purchases of imported equipment when possible. Most enterprises and sectors of the economy still lack long-term development programs and strategies, and their operations are often driven by short-term interests (Kapelyushnikov, Lukyanova, 2010), while economizing on technological development in the short term can become a significant obstacle to achieving the country’s strategic development goals and priorities in the long term.

The dynamics of economic growth depend substantially on the level and pace of scientific and technological development. At the same time, only sufficiently high rates of economic growth can guarantee a broad-based improvement in the technological level of production¹.

¹ Uzyakova E.S., Uzyakov R.M. (2018). Analyzing the impact of scientific and technological development on economic growth using input-output tools. *Problemy prognozirovaniya*, 6 (171), 82–92.

Various indicators of technological innovation are used to quantify the level and pace of technological change, including R&D expenditures, the share of new equipment, the number of patents (Kapelyushnikov, 2017), estimates of capital and materials productivity, labor intensity and resource intensity of the economy (Suvorov, Davidkova, 2005; Suvorov, 2008), and various combinations of output and fixed capital investment ratios (Almon, 2002; Eroshkin, Komkov, 2006). Technical progress is often associated with the rate of labor productivity growth or with declining labor intensity, which signals a growing influence of technical progress on the production process (Baldwin, 1995; Imagava, 2008).

Let us group some existing methods and models used to measure the technological level of production and its impact on economic dynamics.

1. Production function methods and models (Kapelyushnikov, 2017; Suvorov, 2008; Suvorov et al., 2015; Mamonov et al., 2015; Solow, 1956; Solow, 1957; Bergeaud et al., 2017).

In models based on production functions, technological progress is measured through total factor productivity (TFP) (Mamonov et al., 2015; Solow, 1956; Solow, 1957; Bergeaud et al., 2017). For the United States over 1909–1949, estimates of technological increments based on the Solow (1957) approach averaged 1.5%. Taking into account additional factors – the average educational level of the employed and the average age of equipment – average annual TFP growth rates rose to 2.5% (for the period since 1890) (Kapelyushnikov, 2017; Bergeaud et al., 2017). The highest rates (2.5%) were observed in 1913–1950, a period that includes the decade of the Great Depression, while the lowest (0.6%) were recorded for 2005–2015. Similarly derived average annual TFP growth rates for the United Kingdom did not exceed 1.8% over the period since 1890, and for Japan they reached no more than 4.4% over the same period, with the

lowest growth rates – about 0.4% – again recorded for 2005–2015 (Kapelyushnikov, 2017; Bergeaud et al., 2017).

2. Input-output modeling methods (Levitsky et al., 1975; Sayapova, 2016; Ono, 2008).

In this case, the technical progress component is identified using the matrix of direct input coefficients (the matrix of technological coefficients). Some studies (Levitsky et al., 1975; Sayapova, 2016) show only minor changes in technological coefficients and, accordingly, a limited impact on economic growth. For example, the work (Sayapova, 2016) estimates the technological contribution to output dynamics in the Russian economy at about 5% (based on the national input-output table). At the same time, Russia's technological level lags behind Japan – here technological change accounts for about 16% of output growth – by at least 15 years. Japan has its own experience in modeling direct input coefficients. The estimated contribution of technological progress to Japan's economic growth with constant direct input coefficients was 9% for 2006–2020, while with dynamic (expert-set) coefficients it reached 20% (Ono, 2008).

3. Models combining production function methods and input-output tools (Suvorov, Davidkova, 2005; Suvorov et al., 2015).

Estimates of technological progress growth in the Russian economy obtained by two different methods (the production function approach and sectoral material intensity indicators) produced different results. The average annual growth of technological progress estimated using the production function framework over the 23-year forecast period was 3.3%, while growth based on the rates of change in sectoral current material intensity was 2.1% per year. At the same time, the projected economic growth was driven by the technological factor by 81 and 74%, respectively (Suvorov et al., 2015).

As the analysis shows, estimates of scientific and technological progress (STP) vary quite considerably, and there is also wide dispersion in assessments of its impact on economic growth. We therefore draw on the framework developed in (Uzyakov, 2011), which proposes estimates of STP based on indicators of the productivity of primary resource use². Over 1990–2009, the dynamics of this indicator in the Russian economy are estimated at 2.3% in average annual terms (Uzyakov, 2011). As noted in our earlier work³, industries initially have substantially different opportunities for raising the technological level of production. Some sectors – such as oil refining or metallurgy – operate with established, capital-intensive technologies and a conservative output structure, and cannot expect a rapid improvement in their technical level or, accordingly, a large contribution of STP to output growth. At the same time, agriculture and construction can achieve faster changes in the technological level of production through intra-industry and territorial shifts, as well as the introduction of new technologies. Our findings show that the most significant contributions of technological progress to economic growth are observed in activities such as communications and telecommunications, construction, agriculture, and machinery and equipment production, all of which are characterized by faster growth in primary resource productivity.

The need to find new sources of growth makes research on structural interactions in the economy increasingly relevant (Shirov, 2022), and the

assessment of structural constraints on growth is becoming more and more in demand. Although structural changes are not treated as an independent factor, some studies conclude that they can be both a consequence and a cause of economic growth⁴. It was precisely against the backdrop of pronounced structural changes that rapid growth (around 4.5% per capita annually) and stable growth (for at least three decades) occurred in various countries (Rodrik, 2013). Structural shifts were the main driver of the economic transformation of 1991–2008. Some researchers link economic dynamics over the past 25 years to structural shifts and changes in intersectoral linkages⁵. Moreover, shifts in the structure of production largely explain most of the decline in material intensity in developed economies as the influence of changes in the average level of technology slows (Uzyakov, 2011). The economic structure also has a significant impact on inflation, while inflation-targeting policy, by contrast, restrains economic growth and locks in the existing structure of the economy (Sukharev, Voronchikhina, 2025).

According to studies (Glazyev, Sukharev (2024); Maltsev, Chichilimov, 2024), the Russian economy has considerable growth potential, but realizing this potential requires a change in its structure – not only sectoral but also technological. A new growth model should be based on increased fixed capital investment, development of the domestic market, support for aggregate demand, and import substitution. At the same time, other researchers associate the closing of the economy with negative

² The inverse of primary resource intensity (Uzyakov, 2011). Primary resources include the output of the following activities: 1) agriculture, hunting, and forestry; 2) fishing and fish farming; 3) mining and quarrying; 4) wood processing and wood products; 5) coke, refined petroleum products, and nuclear materials; 6) chemical production; 7) other non-metallic mineral products; 8) metallurgical production; 9) electricity, gas, and water supply.

³ Uzyakova E.S., Uzyakov R.M. (2018). Analyzing the impact of scientific and technological development on economic growth using input-output tools. *Problemy prognozirovaniya*, 6(171), 82–92.

⁴ Sukharev O.S. (2020). *Structural and Technological Dynamics of the Russian Economy: A Report*. Moscow: Institute of Economics of the Russian Academy of Sciences. 53 p.; Simachev Yu., Akindinova N., et al. (2018). *Structural Changes in the Russian Economy and Structural Policy: An Analytical Report*. HSE University. 252 p.

⁵ Shirov A.A. (Ed.). (2018). *Transformation of the Economic Structure: Mechanisms and Management*. Moscow: MAKSS Press. 264 p.

trends for economic development and suggest balancing the current forced import substitution by seeking new partners to resume imports from countries that have not joined the sanctions⁶. The key threat to the country's geo-economic sovereignty lies in "the low share of machinery and equipment needed to sustain industrial and technological transformation in Russia's merchandise imports" (Maltsev, Chichilimov, 2024, p. 114).

A transition to sustainable economic growth is impossible without an active state industrial policy, and investment in human capital is a prerequisite for the durability of such growth. Many researchers of structural and technological factors of economic growth emphasize that balanced growth is driven not only by technological improvement but also by the critical importance of human capital (Voskoboinikov, 2023; Maltsev, Chichilimov, 2024). At the same time, systemic measures to transform the economy and modernize its structure must be aimed at raising public welfare (Glazyev, Sukharev, 2024).

Studies of the impact of structural and technological factors on labor productivity growth (Uzyakova, 2026) show that over time the influence of structural factors increases while that of technological factors declines: whereas in 2016 about 70% of labor productivity growth could be explained by technological change, by 2026 their contribution had fallen to 30%, while the influence of structural shifts rose from 10% in 2016 to 37% in 2026. The contribution of the quality component to GDP dynamics in 2013–2024 did not exceed 10%⁷.

We hypothesize that the structural and technological interactions in the Russian economy have

undergone substantial changes since 2014. The most intensive shifts were triggered by changes in relations with the outside world, above all with the Collective West. We define the aim of this study as examining changes in the structural and technological characteristics of the Russian economy in conjunction with sectoral labor productivity dynamics, and identifying the sectors with the greatest and least growth potential to support the long-term development of the economy under the new geoeconomic conditions and in the context of strengthening Russia's sovereignty. In line with this aim, the research objectives were: to analyze changes in the structural and technological characteristics of the Russian economy together with sectoral labor productivity dynamics, as one of the indicators of the quality of economic growth; to identify the sectors with the greatest and least potential for output growth and technological increments; and to reveal growth constraints for sectors that are significant from the standpoint of security and technological sovereignty. Production growth potential is understood here as the possibility of accelerating output expansion driven by significant technological increments, which are traditionally associated with improvements in the quality and efficiency of production. The subject of the study is structural and technological change across economic sectors, considered together with changes in sectoral labor productivity.

Data and methods

The input-output balance provides the most complete information not only on the level and dynamics of direct input coefficients – traditionally associated with technological progress – but also on intersectoral interactions within the economy.

⁶ Akindinova N.V., Avdeeva D.A., Bessonov V.A. et al. (2023). The Russian Economy under Sanctions: From Adaptation to Sustainable Growth. Report to the XXIV Yasin (April) International Academic Conference on Economic and Social Development. Moscow, 2023. Ed. by N.V. Akindinova; HSE University. Moscow: HSE Publishing House. 63 p. P. 5.

⁷ According to: Shirov A.A. (2025). Quality of growth in the modern Russian economy. Paper presented at the Conference on Macroeconomic and Macrostructural Analysis and Forecasting, dedicated to the 90th anniversary of Academicians V.V. Ivanter and Yu.V. Yaremenko, November 20–21, 2025. Available at: <https://ecfor.ru/publication/kachestvo-rosta-rossijskoj-ekonomiki/>

Using input-output tools makes it possible to assess the impact of structural and technological changes on economic growth, thereby constructing a structural and technological profile of the Russian economy as a set of production interactions – such as sectoral gross output, final demand components, and primary input costs – combined with indicators related to the quality of growth, such as labor productivity. Input-output analysis is therefore becoming increasingly relevant.

The availability of up-to-date input-output data⁸ has allowed us to assess the key macroeconomic and structural interactions over the period starting in 2014, when the sanctions regime began. In our view, the content of core economic interactions in Russia has changed quite dynamically since then, driven by the reshaping of external economic relations. Here we do not discuss the sanction “packages” of the Collective West but instead seek to understand how the structural changes that have occurred since 2014 have affected the functioning of the Russian economy.

The initial data consist of Rosstat statistics and updated input-output tables for 2011–2024 developed at the Institute of Economic Forecasting of the Russian Academy of Sciences (IEF RAS) in constant 2011 prices. The findings were obtained through the analysis of input-output statistics using methods and models of mathematical analysis and input-output modeling.

The scientific novelty of this study lies in the use of updated input-output tables for 2011–2024 to analyze technological changes across economic

sectors using the methodology set out in (Uzyakov, 2011), compared with sectoral labor productivity series, as well as in verifying the authors’ structural-technological analysis methodology⁹. Another element of novelty is the calculation of sectoral labor productivity series for 64 economic activities¹⁰ corresponding to the developed input-output tables.

Results and discussion

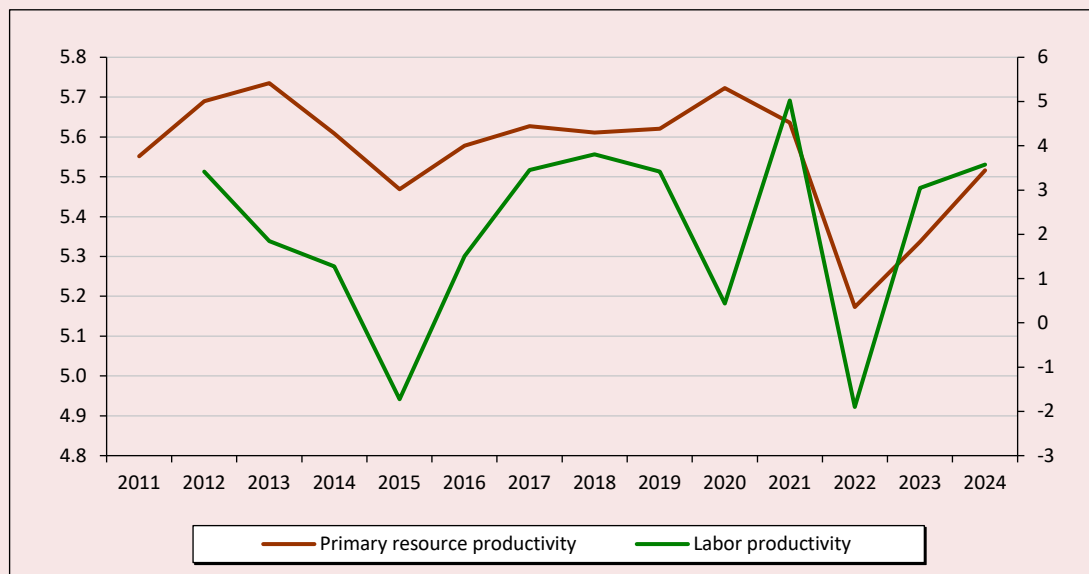
As noted earlier, the dynamics of primary resource productivity are often associated with the dynamics of technological progress or the quality of economic growth. It is therefore of particular interest to compare these dynamics with those of labor productivity across economic activities over the past decade. Primary resource productivity for the economy as a whole declined from 2013 to 2015 (*Fig. 1*). As sanctions pressure intensified after 2014, a significant part of the economy reoriented – or began to reorient – toward other markets or other producers, import substitution gradually developed, and the quality of economic growth, together with primary resource productivity, began to improve; this improvement continued until 2020. According to the hypothesis of synchronized dynamics of productivity and labor efficiency, the efficiency of labor use rose by 13% from 2015 to 2020. Subsequently, under the impact of shocks of a non-economic nature (COVID-19, the special military operation), primary resource productivity declined from 2020 to 2022, but from 2022 both productivity and labor productivity showed a significant acceleration. In 2022–2024, both indicators increased by 3.3% annually.

⁸ The updated input-output tables for 2011–2024 were developed at the Institute of Economic Forecasting of the Russian Academy of Sciences (IEF RAS) in a breakdown of 64 economic activities according to the OKVED2 classification, based on Rosstat data.

⁹ Uzyakov R.M. (2022). *Structural and Technological Changes as a Factor of Economic Growth (Model-Based Analysis on the Example of the Modern Russian Economy)*: Candidate of Sciences (Economics) Dissertation. Moscow. 182 p.

¹⁰ Sectoral labor productivity was calculated as the ratio of sectoral output to employment. To obtain employment series in the 64-activity breakdown, we used Rosstat statistics on the average annual number of employed persons by economic activity for several years, EMISS data on the average payroll number of employees across the full range of organizations by economic activity for several years, and adjusted the latest reporting year using data from the Labor Force Survey (Rosstat)

Figure 1. Primary resource productivity and labor productivity (right axis), annual dynamics, %



Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

Let us now present the results of the sectoral analysis. Within material production, we identify the activities with the highest and lowest relative levels of primary resource productivity (*Tab. 1*). The highest productivity levels are observed in sectors with potential for growth in import-substituting production or in demand on alternative markets (in the case of extractive industries), where productivity is growing at a faster pace. These same sectors, correspondingly, show accelerated labor productivity growth.

As already noted, both the dynamics of technological progress (primary resource productivity) and the dynamics of labor productivity are associated with the quality of economic growth. The sectoral analysis shows that a number of industries, predominantly those with the highest productivity levels, exhibited synchronous dynamics of productivity and labor productivity over the period under review (*Fig. 2–5*).

In addition, synchronous dynamics of productivity and labor productivity are observed in several other sectors: food production (where the elasticity of labor productivity with respect to productivity over 2011–2024 was 2.01¹¹), paper and paper products (0.12), other non-metallic mineral products (3.67), finished metal products except machinery and equipment (0.69), electrical equipment (3.8), and motor vehicles, trailers, and semi-trailers (0.19).

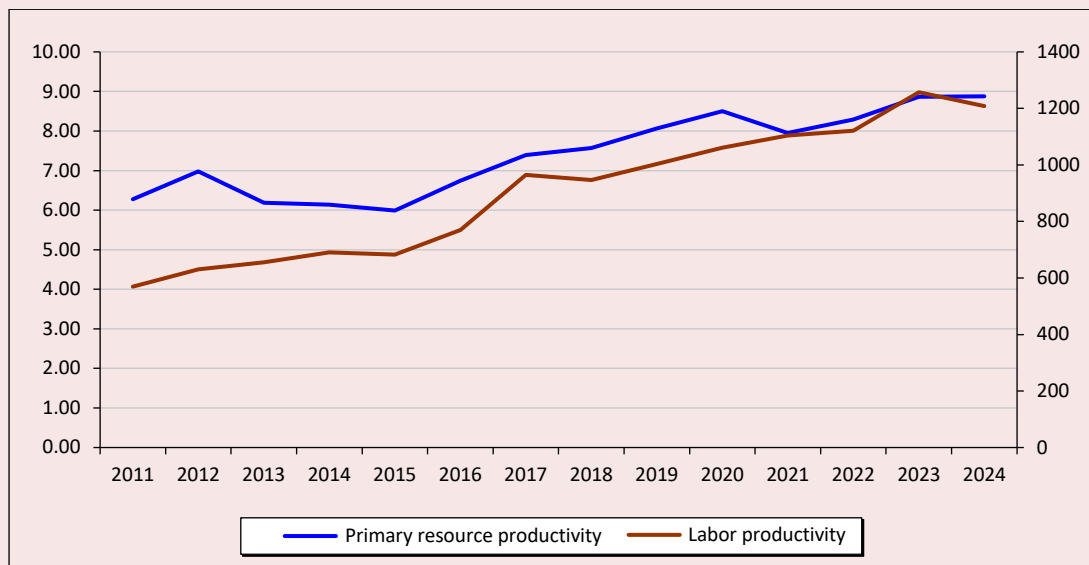
From the standpoint of improving production efficiency in the long term, there is no alternative to qualitative economic growth, including through raising the technological level of production and the consequent increase in labor productivity. Russia's growth model of the 2000s relied predominantly on the growing use of imported equipment and consumer goods, which implied the borrowing of technologies and innovations from abroad. According to some estimates, import dependence

¹¹ A positive elasticity indicates that labor productivity rises (falls) following an increase (decrease) in productivity. A negative relationship reflects opposite movements in the two indicators, which does not match the economic logic proposed here.

Table 1. Activities with the highest and lowest levels of productivity and their dynamic characteristics

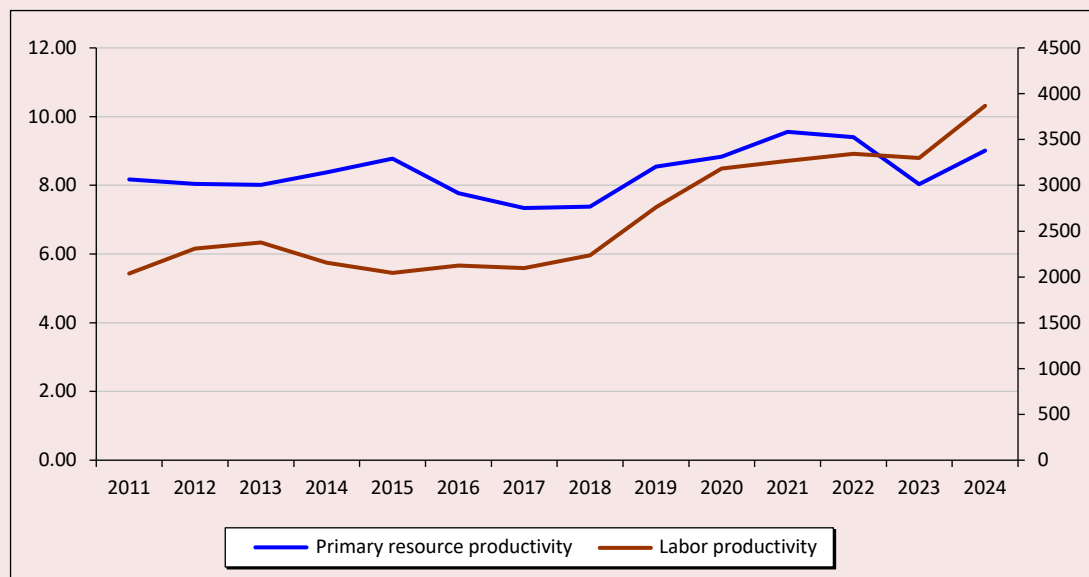
Activity	Productivity level relative to the economy average, 2024, %	Average annual productivity growth rate, 2011–2024, %	Average annual labor productivity growth rate, 2011–2024, %	Ratio of growth rates (elasticity of labor productivity to productivity), times
Highest level				
Coal industry	135	2.16	2.8	1.31
Other minerals, mining services	130	0.38	12.1	31.50
Textiles and textile products, clothing, leather and leather products	162	2.70	6.0	2.20
Medicinal products and materials for medical use	164	0.75	5.1	6.72
C o m p u t e r , electronic, and optical equipment	703	8.33	8.7	1.05
Transport vehicles and other equipment	287	6.11	8.8	1.45
Lowest level				
Agricultural and hunting products and services	48	-2.00	4.9	-2.47
Wood and wood and cork products, except furniture; straw and plaiting materials	36	-2.37	4.6	-1.95
Coke and refined petroleum products	26	-3.08	-0.6	0.20
C h e m i c a l substances and chemical products	40	0.14	2.7	18.57
Rubber and plastic products	30	-1.08	3.5	-3.26
Basic metals	27	-2.55	1.6	-0.62
Electricity, gas, steam, and air conditioning supply	38	0.09	0.8	8.15
Source: own calculations based on IEF RAS input-output tables.				

Figure 2. Primary resource productivity and labor productivity (right axis) in textile production



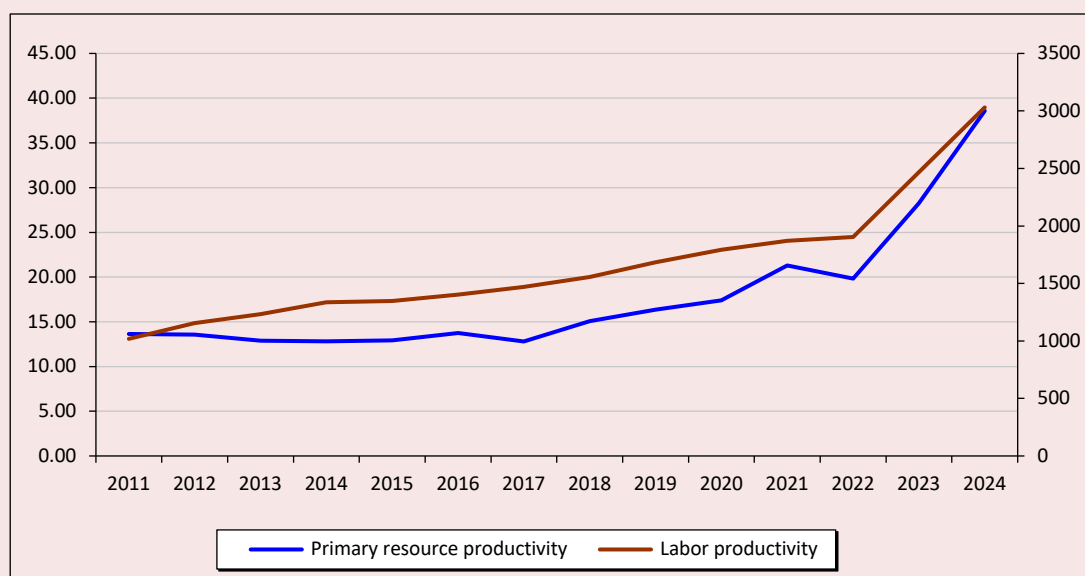
Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

Figure 3. Primary resource productivity and labor productivity (right axis) in the production of medicinal products and materials for medical use



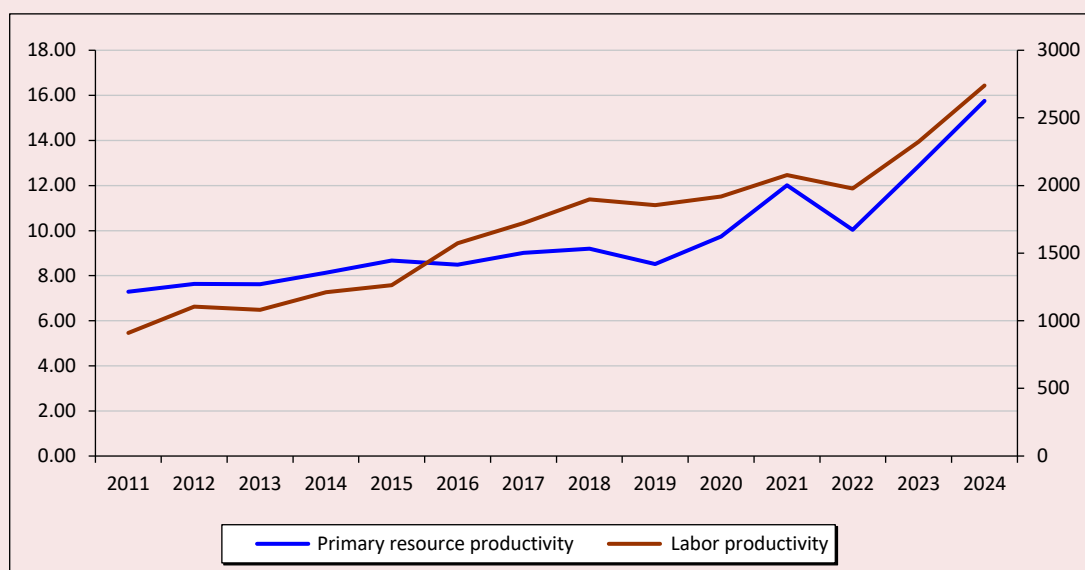
Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

Figure 4. Primary resource productivity and labor productivity (right axis) in the production of computer, electronic, and optical equipment



Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

Figure 5. Primary resource productivity and labor productivity (right axis) in the production of other transport vehicles and equipment



Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

on high-tech goods and services in 2015 reached 90%, compared with 15% in the late Soviet period (Maltsev, Chichilimov, 2024). Changes in relations with the outside world, above all with the Collective West, produced the most intensive shifts in the structure of the Russian economy (Uzyakov, Serebryakov, 2023). The structural and technological profile of the Russian economy has changed substantially, and activities related not only to defense but also to import substitution have begun to develop actively.

Further analysis of structural and technological interactions in the Russian economy will be carried out using the methodology of structural and technological multipliers (STMs)¹². STM indicators are synthetic metrics calculated using a static input-output model. An STM is the model-based response of sectoral output and gross output to a one-percent increase in final demand components¹³. STM values are the product of two factors: a structural factor and a technological factor. The structural factor is the share of the changing final demand component in output. The technological factor is the elasticity of output with respect to the increment in the changing final demand component (elasticity is calculated using a static input-output model, i.e., taking into account the influence of the matrix of direct input coefficients, or the “technological matrix”). Changes in STM characteristics over time reflect how the economy and individual industries adapt to structural and technological shifts in production.

It should also be noted that STM indicators represent the contributions of final demand components to the dynamics of sectoral and gross output. Analysis of STM dynamics shows that

many activities – even among the most efficient, with the highest growth in primary resource productivity – still rely on rising imports and do not exert a significant influence on the quality of the Russian economy. For example, calculations of the contributions of final demand components to output dynamics in activities with a high level and high dynamics of productivity (textiles and pharmaceuticals) reveal a significant dependence of household consumption (HC) on imported products¹⁴ (*Fig. 6, 7*).

The graphs show that the contributions of household consumption and imports have been in counterphase throughout the period under review, in both the textile and pharmaceutical industries. In other words, an increase in the contribution of household consumption occurs only with a corresponding increase in the negative contribution of imports – i.e., consumption of these products is provided by imports.

Analysis of the contribution of final demand components (STMs) to the output dynamics of computer, electronic, and optical equipment (with a productivity level of 703% of the economy average in 2024 and an average annual productivity growth of 8.3% over 2011–2024) confirms that in this industry the relationship between fixed capital accumulation and imports remains strong, which may indicate the limited nature of import substitution (*Fig. 8*). Thus, in the activities considered, output growth is driven by an increasing share of imported goods and equipment, which under current conditions runs counter to the goals and strategic priorities of the country’s long-term development, the main ones being security and technological sovereignty¹⁵.

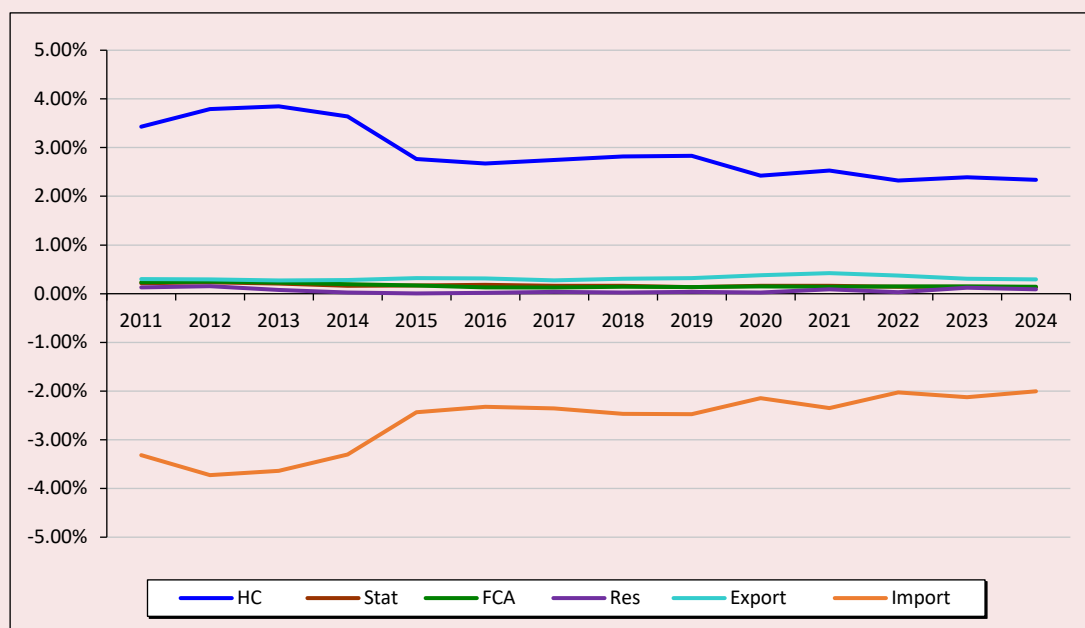
¹² Based on: Uzyakov R.M. (2024). A structural-technological multiplier as a characteristic of the dynamic properties of the economic structure. *Problemy prognozirovaniya*, 1(202), 54–66. DOI: 10.47711/0868-6351-202-54-66

¹³ Based on: Uzyakov R.M. (2018). Possibilities of structural analysis of Russian economic dynamics in 1991–2013 using input-output tools. *Problemy prognozirovaniya*, 3, 13–27.

¹⁴ The overlapping lines on the graphs, which fluctuate near zero, do not provide meaningful information for analysis in this case.

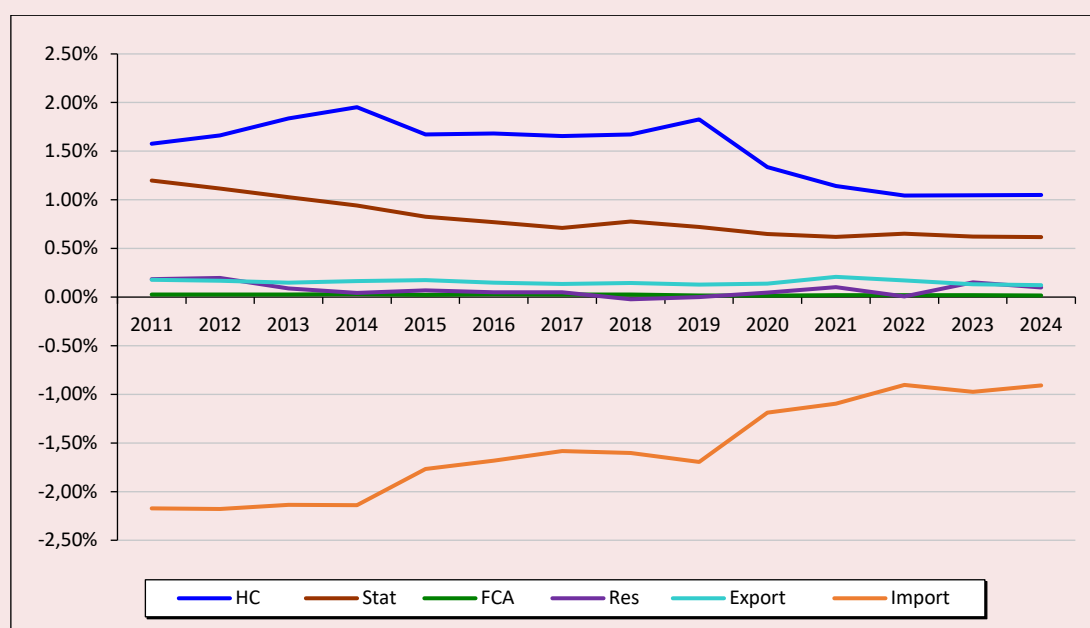
¹⁵ On the National Development Goals of the Russian Federation for the Period up to 2030 and for the Future up to 2036: Presidential Decree 309 of May 7, 2024. ConsultantPlus (accessed: 16.05.2024).

Figure 6. Dynamics of STMs in the textile industry



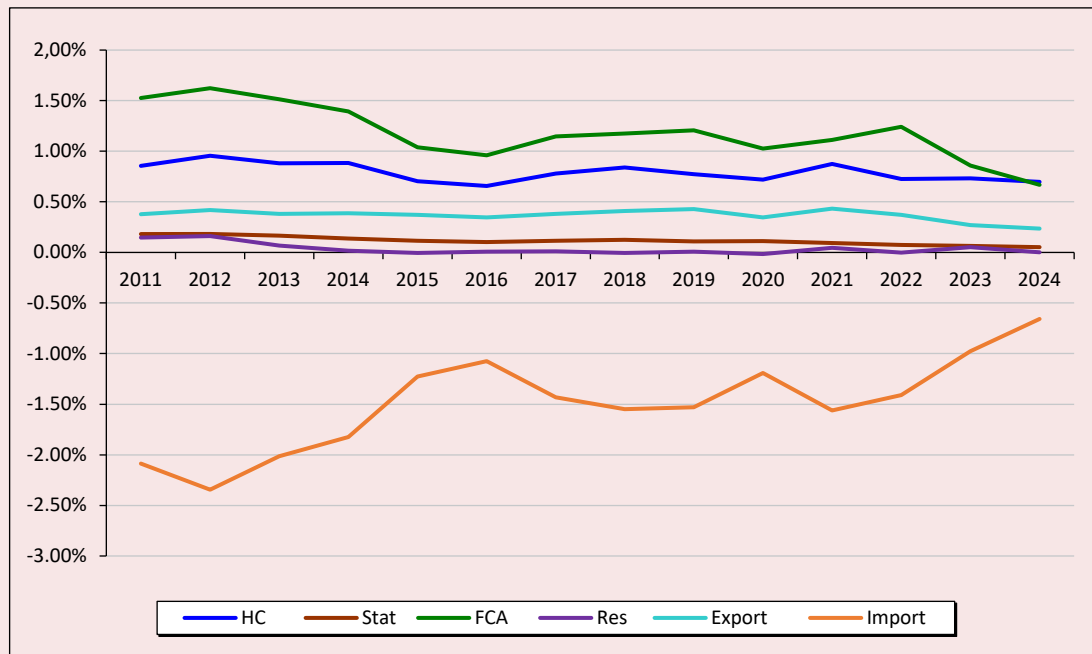
Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

Figure 7. Dynamics of STMs in the production of medicinal products and materials



Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

Figure 8. Dynamics of STMs in the production of computer, electronic, and optical equipment



Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

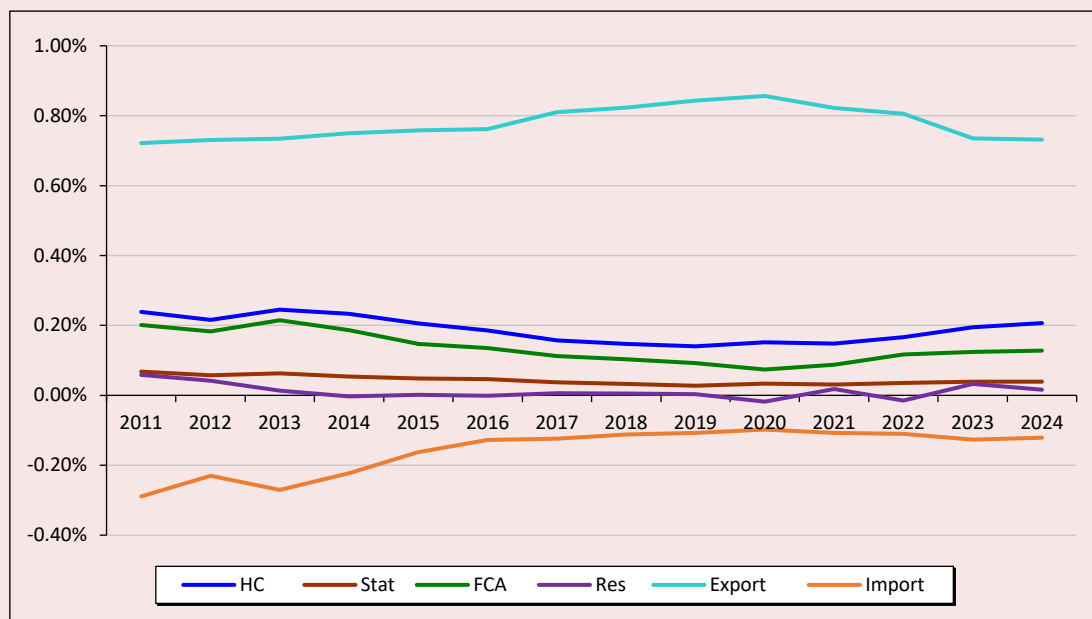
Among the industries with the highest productivity levels, there are some whose adaptation mechanisms under current economic conditions involve reorientation toward the domestic market. These include the coal industry and the extraction of other minerals, where after 2020 the decline in the contribution of exports to the growth of the corresponding outputs (reflecting sanctions and falling external demand) was accompanied by an increase in the contributions of fixed capital accumulation and household consumption (Fig. 9, 10).

Analysis of the sectoral dynamics of structural and technological multipliers shows that, in general, all activities belonging to the real sector of the economy are divided into two types of interaction between the contributions of final demand components to output dynamics. The first type consists of a positive response for the Russian economy to restricted access to external markets

(a decline in the export contribution), expressed in increased contributions from household consumption and/or fixed capital accumulation. The overwhelming majority of economic activities in the real sector received an impetus to reorient production toward the domestic market and increase investment, and responded to it only as a result of restricted access to external markets (Tab. 2).

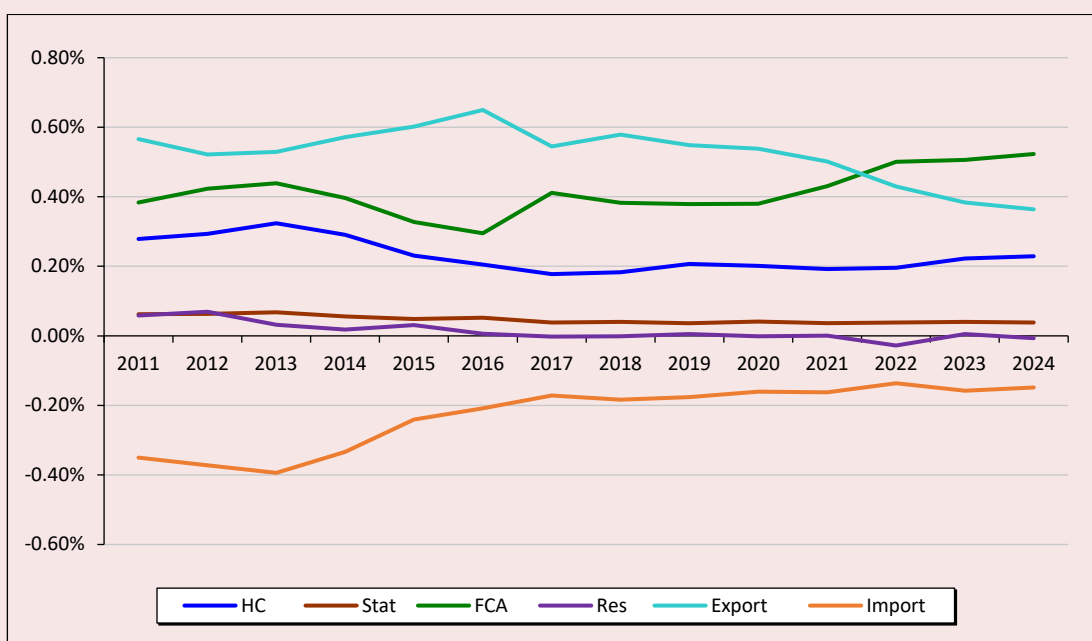
The second type of interaction is expressed in continued dependence on imported goods and components. Economic activities traditionally highly dependent on imports maintain this linkage even during the years of the special military operation (SMO), a period characterized by the strongest sanctions pressure on Russia. Notably, these activities include industries that are truly significant from the standpoint of security and technological sovereignty, such as pharmaceutical production, machine building, and computer equipment.

Figure 9. Dynamics of STMs in the coal industry



Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

Figure 10. Dynamics of STMs in other minerals



Sources: Rosstat data; own calculations based on IEF RAS input-output tables.

Table 2. Interaction of final demand component contributions to output dynamics, 2020–2024

Reorientation to the domestic market	Import dependence
Decline in the export contribution is accompanied by an increase in the contribution of household consumption and/or fixed capital accumulation	Increase in the import contribution is accompanied by an increase in the contribution of household consumption and/or fixed capital accumulation
Agricultural and hunting products and services	Textiles and textile products, clothing, leather and leather products
Fish and other fishing and fish-farming products; services related to fishing and fish farming	Medicinal products and materials for medical use
Coal	Rubber and plastic products
Crude oil and natural gas	Computer, electronic, and optical equipment
Metal ores	Machinery and equipment not elsewhere classified
Other minerals, mining services	Motor vehicles, trailers, and semi-trailers
Food products, beverages, tobacco products	Furniture; other finished goods
Wood and wood and cork products, except furniture; straw and plaiting materials	Water transport services
Paper and paper products	
Coke and refined petroleum products	
Chemical substances and chemical products	
Other non-metallic mineral products	
Basic metals	
Finished metal products, except machinery and equipment	
Transport vehicles and other equipment	
Repair and installation services for machinery and equipment	
Electricity, gas, steam, and air conditioning supply	
Natural water; water treatment and supply services	
Sewerage services; sewage sludge; waste collection, treatment, and disposal services; waste remediation and other waste disposal services	
Buildings and construction works	
Land and pipeline transport services	
Source: own calculations based on IEF RAS input-output tables.	

Overall, the structural and technological characteristics of the Russian economy have changed substantially since 2014. While in the first years after the introduction of anti-Russian sanctions the changes taking place in the structure of the Russian economy were not so obvious and were only marginally reflected in macroeconomic statistics, after the coronavirus pandemic and the start of the SMO their dynamics and scale made it possible to draw substantive economic conclusions using only top-level macrostatistics – final demand components.

Restricted access to external markets became a serious test for the domestic economic system, but it was precisely this tough stance by the Collective West that helped the Russian economy demonstrate flexibility and organize the work of a significant part of the real sector with a focus on domestic demand, both in terms of output produced and in terms of increasing investment.

Conclusion

Our analysis shows that the Russian economy remains highly dependent on imports of goods and equipment. The findings confirm that the

reorientation toward domestic demand was not the realization of the economy's growth potential but rather a forced measure under the current geoeconomic conditions. On the one hand, organizing import substitution in a short period is difficult, almost impossible; on the other hand, economic agents are often interested not in formulating long-term development goals and priorities – and, consequently, in pursuing import-substituting activities aimed at developing domestic production and technological potential – but in extracting short-term gains. Yet while in the short term the possibility of economic growth through increasing the volume of attracted resources may seem an advantageous strategy, in the long term, in the context of strengthening Russia's sovereignty, there is no alternative to improving quality and efficiency, since the production resources available – labor and capital – are limited.

The absence of a long-term economic development strategy, targeted sectoral project financing programs, and other measures of state support for domestic producers devalues any qualitative changes in the economy, whether technological advances or improvements in the quality of human capital (labor productivity). Our calculations show that the growth of primary resource productivity in the economy as a whole has been slowing over time: whereas in 2000–2011 the indicator increased by an average of 2.9% per year, in 2011–2024 it grew by only 0.1%. Looking ahead to 2035, we project average annual growth of no more than 1%.

Undoubtedly, the key factor constraining any qualitative changes in the economy is the excessively tight monetary policy (Uzyakova, Uzyakov, 2026), which should perform a servicing function for the economy and adapt to economic policy, rather than the other way around. An innovation-driven economy, a knowledge economy implies investment in research and development, in technological

innovation, and in the quality of education and human capital. The absence of a long-term socioeconomic policy (together with monetary and fiscal policy), development strategies, and priorities disorients economic agents, replacing the ideas and values of the state's strategic development with short-term interests and gains.

Thus, the following conclusions can be drawn from the study.

1. The structural and technological characteristics of the Russian economy have changed substantially since 2014. The overwhelming majority of economic activities in the real sector received an impetus to reorient production toward the domestic market and increase investment, and responded to this impetus only as a result of restricted access to external markets.

2. The sectoral analysis shows that the activities with the highest level of primary resource productivity – reflecting technological increments in industries such as the coal industry, other minerals, textiles and leather products, pharmaceuticals, computer, electronic, and optical equipment, and other transport vehicles and equipment – may have the greatest potential for output growth owing to accelerated improvements in quality and efficiency. In a significant number of these industries, synchronous dynamics of productivity and labor productivity were observed.

3. The Russian economy remains highly dependent on imports of goods and equipment. Economic activities that have traditionally been heavily import-dependent maintain this dependence even when there is a need to organize import-substituting production aimed at developing domestic production and technological potential. These activities include sectors that are truly significant from the standpoint of security and technological sovereignty, such as pharmaceutical production, machine building, and the production of computer equipment.

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Methodological Problems in Assessing Russia's Food Security: Overcoming the “Average Metrics Trap” and Diagnosing Vulnerabilities



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Abstract. The article focuses on the theoretical substantiation and verification of an optimized system of national food security indicators for the Russian Federation under escalating geo-economic and logistical risks. The aim of the study is to overcome the methodological bottlenecks of redundant regulatory lists of assessment indicators by constructing a concise analytical model for risk express-diagnostics. As a theoretical framework, the author developed a cyclical model of food security (the “matryoshka”) that describes the continuous transformation of the supply structure under the influence of changing consumption patterns. The empirical basis of the study comprises a statistical analysis of Rosstat data across population decile groups for the 2020–2024 period, applying Engel’s law and the decile expenditure ratio. Deep structural imbalances have been revealed between the macro-level of national self-sufficiency and the micro-level of economic food accessibility. It is proved that forced spending of more than 50% of the budget on food by the first decile group leads to a paradoxical qualitative deterioration of the diet due to the transition to cheap, high-calorie substitutes. A matrix grouping of the population by welfare level based on the share of food expenditures was developed and tested. It captured the polarization of society: the transition of the 10th group into the “wealthy society” category while the 1st group stagnates in the low-level zone. The critical role of agflation as a cross-cutting factor accelerating general inflation is substantiated. The necessity of establishing a Situational Analytical Center for Agflation Monitoring under

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the Government of the Russian Federation for preventive interagency modeling of commodity balances (Ministry of Agriculture, Federal Customs Service, Federal Antimonopoly Service, Bank of Russia) is demonstrated. The transition to a compact system of 3–5 key indicators for each dimension of food security (availability, accessibility, utilization, stability) will reduce the burden on state statistics bodies and overcome regulatory overload. The proposed optimized list of indicators ensures high responsiveness and precision of managerial decisions which is critically necessary for protecting the technological and financial sovereignty of the state.

Key words: food security, agflation, economic accessibility, decile groups, Engel's law, average metrics trap, standard of living, import substitution Situational Center.

Introduction

In today's geoeconomic realities, ensuring food security (FS) extends far beyond a purely agricultural or technological discourse, becoming one of the central elements in safeguarding a state's technological and financial sovereignty. The transformation of global logistics chains, unprecedented sanctions pressure, volatility in world commodity markets, and growing climatic anomalies all underscore the need for continuous monitoring of the vulnerabilities of national food systems.

The research problem stems from the methodological flaws in the current monitoring system of Russia's Food Security Doctrine. Because it relies predominantly on aggregate macroeconomic indicators, this system fails to identify latent structural threats in a timely manner – both in terms of economic access to food for the polar groups of the population and at the level of the material and technical contour of the agro-industrial complex (AIC).

The aim of this study is to provide a theoretical justification and verification of an analytical toolkit (an open list of indicators) for the food security of the Russian Federation, one oriented toward the preventive identification of latent structural threats and vulnerabilities.

To achieve this aim, the following objectives must be addressed:

- to synchronize Russian approaches to assessing food security with the basic dimensions of

the FAO concept (availability, access, utilization, stability);

- to overcome the “average metrics trap” by integrating a differentiated analysis of household budgets across decile groups;

- to reflect the unique specifics of socio-economic stratification and the technological contour of the national food system, including the risks of agflation and secondary import dependence.

In this study, the technological contour of the food system is understood as the critically important cross-section of the AIC's physical and technical infrastructure (seed stock, breeding core, veterinary preparations) that determines the sector's ability to function independently of external sanctions and logistical shocks.

The study is structured around the following research questions:

- What are the key flaws of the current macroeconomic model for assessing food security in the Russian Federation?

- How does income-based decile differentiation reshape the real picture of economic access to food?

- Where in the domestic AIC does the import substitution paradox generate risks of secondary technological dependence?

The author's research hypothesis is that the developed “matryoshka” model, together with its cyclical modification, makes it possible to decom-

pose the national monitoring system into compact sets of indicators (3–5 parameters for each FAO dimension). This in turn links macroeconomic market parameters to the microeconomic level of household consumption, overcomes the “average metrics trap”, and enables the preventive diagnosis of latent social and technological risks to the state’s sovereignty.

What are we assessing? Terms and meanings

Food security is a multifaceted phenomenon with numerous characteristics, which makes its precise identification difficult. It is reasonable to agree with the view that “the concept of food security is complex and multifactorial, encompassing behavioral, social, cultural, environmental, and economic factors, which is apparently why there is no terminological consensus among researchers” (Rossinskaya et al., 2022). A search of the Russian National Electronic Library (NEB elibrary) database for “‘food security’ in the title, keywords, and abstract of a scholarly journal article” returns more than 5,000 articles published in 2022–2026 alone (as of June 19, 2026).

The generic feature of food security as a distinctive phenomenon is security as such – namely: a) the current level of protection of the individual, society, and the state from internal and external threats, and b) the ability of the object of protection to withstand internal and external threats and destructive impacts without losing its qualitative characteristics¹. The corresponding conceptual apparatus is closely tied to risks and threats to national interests in various spheres, as well as to measures for neutralizing and eliminating them.

Food security, as one type of security, means the protection of the vital interests of the individual, society, and the state in the specific sphere of food provision for the population; its object is food systems at various levels², from national to local.

The subject area of food security represents a zone of intersection among the problematics of three independent concepts: the universal right to adequate food, national security, and sustainable development. It develops, details, and integrates into a single whole individual elements of these concepts that are directly related to the development of food systems (*Fig. 1*).

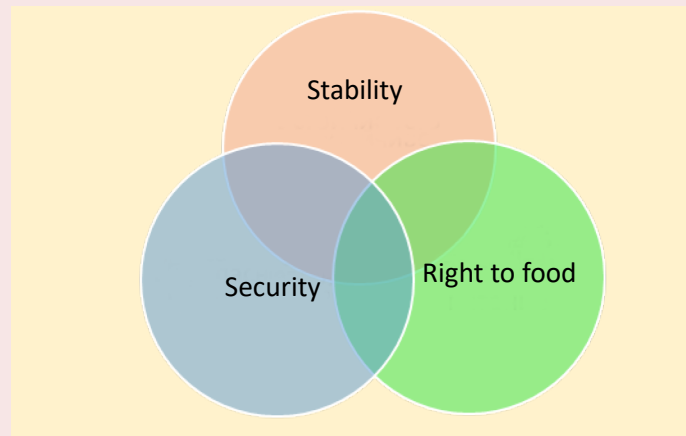
The substantive ambiguity of the concept of FS is indirectly confirmed by the polysemy of the authentic term “food security”: security, provision, confidence (Gumerov, 2013). This polysemy is lost in the Russian translation, and in Russian scholarly and legal discourse the term “food security”, as enshrined in normative acts, holds unchallenged dominance. Unfortunately, linguistic limitations do not allow the essence of FS to be fully captured at different levels of its manifestation: whereas the macrostructural and geopolitical aspects of FS are traditionally – and quite rightly – described by the term “security”, at the level of individual social groups and households it would be more appropriate to use the category “provision/sufficiency”, with its connotation of the right to food.

The core of the food security concept is the universal right to food. The Rome Declaration on World Food Security opens by affirming the right of everyone to have access to safe and nutritious food, consistent with the right to adequate food and

¹ See, for example: Puchkov V.A. (Ed.). (2015). Civil Protection: An Encyclopedic Dictionary. EMERCOM of Russia. 3rd ed., revised and expanded. Moscow: FGBU VNII GOChS (FTs). 664 p. P. 40.

² A food system encompasses all elements (environment, human resources, factors of production, processes, infrastructure, organizations, etc.) and all activities related to the production, processing, distribution, preparation, and consumption of food, as well as the outcomes of such activities, including socio-economic and environmental ones. Source: HLPE 2017. (2017). Nutrition and Food Systems: A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome. 152 p. P. 13.

Figure 1. Subject area of the food security concept*



*The subject area of the FS concept is presented as the area of intersection of three initial circles.
Source: own compilation.

the fundamental right of everyone to be free from hunger³. This right must be ensured in ways that are safe for national interests and do not undermine sustainable development “for the benefit of future generations”. It is also evident that the issue of food security is semantically closely linked to the issue of poverty and destitution.

The classic definition of food security is recognized as the formulation set out in the Plan of Action adopted at the 1996 World Food Summit: “Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (Plan of Action)⁴. This definition is the product of a sustained rethinking of food security by the world community – a rethinking that gradually moved from predominantly

technical issues of food provision (reliability of supplies, volumes of supply and reserves at the national level) toward the idea of securing one of the fundamental human rights: the right to adequate nutrition for an active life at the level of the family and the individual⁵.

In accordance with this definition, four attributes, or dimensions, of FS are distinguished: 1) availability, 2) physical and economic access, 3) utilization, and 4) stability (Biswas et al., 2024). Recently, FAO bodies have begun to use two additional criterial attributes alongside the four traditional dimensions of food security: agency and sustainability. These two new aspects, including their precise formulations, have not been officially endorsed by the FAO but are actively promoted by the High Level Panel of Experts of the Committee on World Food Security⁶.

³ Rome Declaration on World Food Security and World Food Summit Plan of Action (1996). FAO UN. Available at: <https://www.fao.org/4/w3613e/w3613e00.htm> (accessed: 30.07.2026).

⁴ Available at: <https://www.fao.org/4/w3613e/w3613e00.htm> (accessed: 26.06.2025).

⁵ The evolution of the term “food security” is traced, for example, in (Belugin, 2019; Bolotnova, 2025); FAO Policy Brief: Food Security (2006). Issue 2. 4 p. Available at: https://www.fao.org/fileadmin/templates/faoitally/documents/pdf/pdf_Food_Security_Cocept_Note.pdf (accessed: 30.07.2026).

⁶ HLPE 2020 (2020). Building a Global Food Security and Nutrition Concept for 2030: A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome. 91 p. P. 7.

Expanding the FAO methodological framework with the categories of “agency” and “sustainability” appears redundant. The first of these criteria shifts the focus of monitoring from the physical and economic access to food to an assessment of sociopolitical institutions (the population’s right to influence food systems). Including this factor turns the assessment of FS from a technological audit into a subjective political rating. The attempt to single out “sustainability” as a separate, sixth dimension is likewise redundant. Sustainability is already latently present in the classical FAO 1996 criterion of “stability”, and is also fully covered by the global concept of Sustainable Development (ESG / UN SDGs). One could say that stability in the short and medium term guarantees sustainability in the long term. Both criteria are non-operational and cannot be measured using objective quantitative indicators (in tons, calories, monetary units, or shares). As a result, the practical tasks of eradicating hunger – in particular, achieving SDG 2 – are replaced by “false goals” that lack a technological toolkit for quantitative measurement.

On the methodology for assessing the state of food security

Let us establish several preliminary points.

1. The formula “all people have physical, social, and economic access at all times to sufficient, safe, and nutritious food” is an abstract target benchmark and should not be taken literally. It refers to a theoretical model – a state-guaranteed right to “equal and constant access to adequate food” for all population groups, regardless of income level, property status, or social standing. Naturally, within any population group there will always be individuals who do not have constant access to adequate food due to one or another life circumstance. FS may, for example, be ensured at the level of the family (household) rather than of the individual taken separately. To illustrate this point, in one of his earlier articles the author drew a figurative parallel

between the target state of FS and the condition of a perfectly healthy person, which in practice, as a rule, does not occur. This does not mean, however, that a sick person should not be treated. In our case, the “treatment process” consists in identifying the signs and risks of food insecurity and developing measures to eliminate, mitigate, and/or prevent them. As a cutoff operational criterion of “absolute health”, we can use the norms of consumption of basic food products accepted as consumption standards (scientifically grounded norms, rational norms) in a given territory at a given point in time.

2. The concept of FS is relative, not least because our very ideas about adequate nutrition and rational consumption norms change. According to the well-known assertion of the American cryptographer and computer security specialist B. Schneier, “security is a process, not a result”. Translating this thesis to FS, we can say that ensuring food security is a continuous process characterized by changing tactical objectives and benchmarks, and by changing mechanisms for achieving them as consumption standards and the capacity to meet them evolve.

3. Given its polymorphic nature, FS manifests at several independent levels—and, correspondingly, at several levels of control, assessment, and management intervention: global, national, subnational, group (household), and individual. Situations may arise in which the objectives pursued at different FS levels come into conflict with one another, though not antagonistically. For example, a protectionist policy (national level) may temporarily restrict the variety of goods or raise prices for a family or an individual (micro level).

The dimensions of FS can be visualized as four equivalent “pillars” (Clapp et al., 2022, p. 1; El Bilali et al., 2018). In a certain sense this is indeed the case: the absence of any one of these attributes should be regarded as an absence of food security, or a state of food insecurity in the strict sense of

these concepts. However, such a visualization does not give a full picture of the interconnections and interdependencies among these dimensions of FS. A more apt analogy is to represent the four dimensions as a kind of “matryoshka” (Fig. 2), in which each nested “doll” is smaller than the previous one – from the stage of production (availability) through the stages of distribution (access) and utilization to the smallest “doll” of stability (assessment of vulnerabilities and risks of food insecurity).

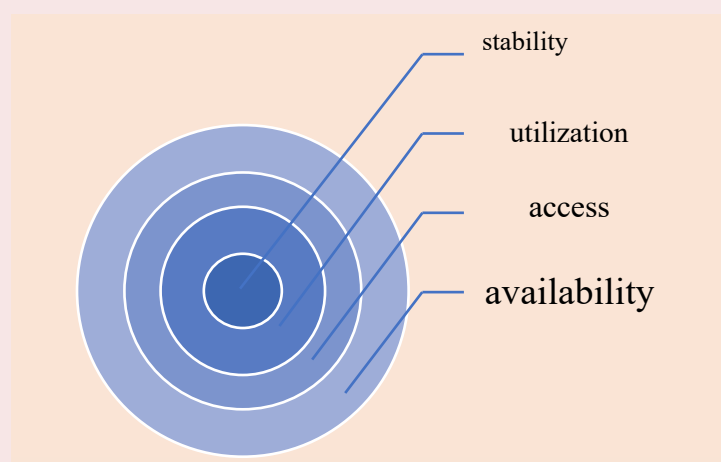
The “matryoshka” model makes it possible to partially address the fair criticism voiced by Ya. Pappe and co-authors regarding the FS criteria formulated in the Food Security Doctrine of the Russian Federation: “...if the definition of a concept employs two or more juxtaposed and equally prioritized propositions without a prior analysis of the relations between them (compatibility, subordination, and so on), this immediately raises justified doubts about its methodological correctness. This is all the more so when these propositions concern fundamentally different objects or subjects” (Pappe et al., 2017).

The model clearly illustrates the subordination of the dimensions of food security and the

corresponding vector for the sequential assessment of its indicators: from the fundamental indicators of food availability to the indicators of the stability of national systems; each subsequent dimension captures the “bottlenecks” of national food systems in ensuring FS. The “matryoshka” also makes it possible to differentiate the levels of FS assessment: assessment at the national level (availability), the household level (access), and the individual level (utilization).

However, the “matryoshka” format does not convey the cyclical nature of FS. Let us return to one of the conclusions formulated above: ensuring food security is not a result but a continuous process, since the notion of food sufficiency is subjective and relative. The most obvious illustration of the cyclical nature of FS is the change in consumption patterns, whereby, as food resources, incomes, and state support measures for food systems grow, the population begins to place new, higher demands on the availability, access, and utilization of high-quality and diverse food. To characterize different consumption patterns as a measure of FS, Yu.M. Ksenofontov and co-authors introduced the special term “food well-being” (Ksenofontov et

Figure 2. The “matryoshka” of food security



Source: own compilation.

al., 2018, p. 128). The transition from the static “matryoshka” to a cyclical model of dynamically evolving needs resolves this contradiction (*Fig. 3*). The gradual decrease in the diameters of the circles from “availability” to “stability” indeed conveys the idea of narrowing and filtering the elements of FS, as well as the subordination of its levels: from the macro level (availability) to the micro level of individual consumption.

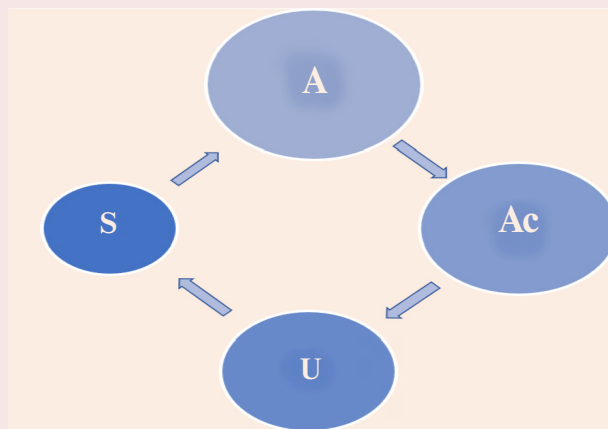
The cyclical model also clearly illustrates the operation of feedback mechanisms. As food passes through the entire chain from production to final assimilation by the body, new social needs come to light, forcing a reshaping of the supply structure in the next turn of the cycle – a response to the accumulated changes at the levels of access, utilization, and the overall stability of the system⁷.

Justification and assessment of the set of national FS indicators of the Russian Federation: Methodological “dead ends” and “forks”

International indicators

In 2015, within the framework of the 2030 Agenda for Sustainable Development, the UN launched the implementation of seventeen Sustainable Development Goals (SDGs). Goal 2, “End hunger, achieve food security and improved nutrition, and promote sustainable agriculture”, is directly aimed at eliminating hunger and malnutrition in all its forms by 2030. Monitoring of the goal’s implementation is carried out using thirteen indicators grouped under eight targets⁸. The Russian national set of SDG 2 indicators includes five indicators assigned to four targets⁹.

Figure 3. The cyclical “matryoshka” model of FS, where:
A – availability, Ac – access, U – utilization, S – stability



Source: own compilation.

⁷ These processes are most clearly visible in the case of the People’s Republic of China, where shifts in the food structure were driven by rapid urbanization, the formation of a large middle class, and overall growth in household incomes. Over recent decades, China’s food basket has undergone a fundamental transformation: the country has moved from a traditional carbohydrate-based diet (rice and grains) to a Western-type consumption pattern with a high share of proteins, fats, and processed products. There has also been an increase in the share of beef and poultry in total meat consumption and a surge in the consumption of eggs, milk, and seafood (Zhu, 2026; Sun et al., 2024; Gale, Dong, 2023).

⁸ Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development. Available at: https://unstats.un.org/sdgs/indicators/Global%20Indicator%20Framework%20after%20refinement_Rus.pdf (accessed: 21.06.2026).

⁹ National list of SDG indicators. Available at: https://rosstat.gov.ru/storage/mediabank/NPP_ZUR-2026.xlsx (accessed: 21.06.2026).

The Global Food Security Index (GFSI), developed by the Economist Group, assesses the availability, accessibility, quality, and safety of food, as well as sustainability and adaptation, using 68 indicators. According to the developers, these indicators measure the factors affecting food security in both developing and developed countries¹⁰.

The specific feature of these lists is that they do not fully correspond to the four dimensions of FS in the generally accepted UN/FAO concept. A corresponding set of indicators, fully harmonized with the four dimensions, was first proposed in the joint report “The State of Food Insecurity in the World 2014: Strengthening the Enabling Environment for Food Security and Nutrition”¹¹. The list consists of 31 indicators, including 5 availability indicators, 9 access indicators (3 of which concern physical access), 10 utilization indicators, and 7 stability indicators.

All of the above lists are unified sets of the most general indicators intended to assess FS in both developing and developed countries. At the same time, the FAO list, quite naturally, places greater emphasis on assessing the state of FS in developing countries, and a significant number of its indicators are not relevant to the developed countries of Europe and North America. This applies, in particular, to the high share of utilization indicators and to the presence among them of such indicators as “access to improved water sources”, “access to improved sanitation facilities”, “percentage of children under five years of age suffering from wasting”, and “percentage of the adult population with

low body mass index”. The same prioritization of FS indicators is characteristic of the SDG 2 indicators. As for the individual GFSI indicators, they are maximally unified and focused on cross-country comparisons (indexing and ranking), and therefore give little consideration to country-specific features of the state of FS “here and now”. To be sure, for a number of Russia's regions, indicators of infrastructural access to water supply remain relevant; however, within the framework of building a compact nationwide model for the prompt diagnosis of risks, they cannot be recognized as cross-cutting limiting factors.

Indicators of the RF Food Security Doctrine

The overloading of the current regulatory contour of the FS Doctrine of the Russian Federation, noted above, dictates the need for a change in the analytical paradigm¹². A national list of indicators should methodologically be built on a combination of universal approaches to identifying FS with an operational analysis of the specific food situation in the country “here and now”. Accordingly, the indicators we propose have been strictly structured according to the four classical FAO dimensions.

The author's position is that the number of indicators in the national list for each dimension should fall within the range of three to five. Limiting the analytical contour to 3–5 key indicators for each of the four dimensions of the FAO concept is dictated by the requirements of managerial ergonomics (triangulation, Miller's law), which make it possible to identify threats promptly

¹⁰ Global Food Security Index 2022 (2022). The Economist Group. 29 p. Available at: https://impact.economist.com/sustainability/project/food-security-index/resources/Economist_Impact_GFSI_2022_Global_Report_Sep_2022.pdf (accessed: 30.07.2026).

¹¹ FAO, IFAD, WFP (2014). The State of Food Insecurity in the World 2014: Strengthening the Enabling Environment for Food Security and Nutrition. Rome: FAO. 58 p., p. 54. Available at: <https://openknowledge.fao.org/server/api/core/bitstreams/3647342f-9f40-4bb7-94a2-996e8fe80d67/content> (accessed: 30.07.2026).

¹² The normative list of indicators for assessing the FS of the Russian Federation, developed in furtherance of the Food Security Doctrine of the Russian Federation, runs to 27 pages. The indicators presented in the list can be tentatively divided into the following subgroups, which have varying relevance to FS proper: macroeconomic indicators; indicators of FS proper; and indicators characterizing the factors and risks of ensuring FS. See RF Government Resolution 296-r of February 10, 2021, “On Approval of the List of Indicators in the Sphere of Ensuring Food Security of the Russian Federation”.

without excessively overloading the analytical system. Priority in assessment is given to indicators that identify problem areas within a compressed timeframe. The following qualitative selection criteria were used jointly:

- relevance of the indicators to the four basic dimensions of food security (availability, access, utilization, stability);
- regular end-to-end observability, presupposing reliance on continuous series of official Rosstat data or the simplest calculations based on them, which excludes expert subjectivity and ensures verifiability of results;
- logical representativeness, based on heuristic methods of analysis, including SWOT metrics (to capture the strengths and weaknesses of the AIC contour), abduction (as a method of finding the best explanation for the hidden causes of latent risks), and the Theory of Change for modeling chains of cause-and-effect relationships.

In essence, the proposed system of indicators serves to diagnose the risks of food insecurity. *Table 1* consolidates indicators that are either drawn from official databases or require minimal calculations derived from them. This system is intended primarily not to produce a snapshot, or “instant image”, of FS, but to assess problem areas, trends, and risks with a view to subsequent management decision-making. Given the limited length of the article, the focus below is on the indicators and criteria of greatest theoretical and practical interest.

Availability. In the system of balance indicators of food resources, the security criteria are: 1) no decline in the annual aggregate volumes of available food resources (production, imports, balance of stocks), and 2) compliance with the threshold ratio

of grain stocks at year-end to the volumes of their aggregate consumption in the following year. The second indicator is an emulation of the “stock-to-use ratio” used by FAO experts to assess global FS. A ratio of 17–18% is estimated to be the minimum necessary to ensure world food security¹³.

Unfortunately, we are compelled to limit the horizon of our analysis of food balances to 2021, since Rosstat ceased their official publication thereafter¹⁴. Within this study, therefore, the corresponding conclusions are more illustrative than evidentiary. Over 2017–2021, the criterion of non-declining resources was met for most types of products. The exceptions were potatoes and vegetables (a declining trend) and grain (unstable dynamics). Genuine concern may be warranted only by the decline in resources of vegetables and food melons and gourds, for which a consumption deficit is observed. In this study, the classical stock-to-use ratio has been modified by the author into an “intermediate (winter) reserve sufficiency coefficient”. It is calculated as the ratio of grain volumes held in storage at the intermediate peak moment (December 31 of the reporting year) to actual utilization in the subsequent calendar year. The resulting high values (in the range of 60–70%) are not methodologically comparable directly with the UN FAO summer carryover stocks (17–18%); however, they clearly illustrate the colossal concentration of food resources at the midpoint of the management cycle and testify to a high degree of short-term resource sufficiency of the domestic grain market in the winter–spring period. The deliberate use of the modified indicator is due, among other things, to the need to harmonize the data with other calendar-based Rosstat indicators.

¹³ Trade Reforms and Food Security: Conceptualizing the Linkages (2002). FAO UN. Rome. P. 6. Available at: <https://www.fao.org/4/y4671e/y4671e00.htm> (accessed: 30.07.2026).

¹⁴ Federal Law 55-FZ of February 28, 2023, “On Amending Article 5 and Suspending the Operation of Part 7 of Article 8 of the Federal Law ‘On Official Statistical Accounting and the System of State Statistics in the Russian Federation’ and on the Specifics of Conducting Official Statistical Accounting in the Territories of Certain Constituent Entities of the Russian Federation”, introduced amendments permitting the Government to temporarily suspend the dissemination of official statistical information.

Table 1. List of indicators for monitoring and controlling the state of food security of the Russian Federation

FS dimension	FS indicators	Corresponding measures
Availability	Balances of individual types of food resources	Volume of available food resources (by individual commodity groups)
	Modified “ <i>stock-to-use ratio</i> ” indicator used by FAO experts to assess global FS (17–18%)	Calculation based on Rosstat indicators (food balances)
	Gross agricultural output per capita, dynamics	Calculation based on Rosstat indicators
Access	Ratio of actual expenditures on food purchases (by decile groups) to the cost of a minimum (conditional) food basket	Calculated indicator based on Rosstat source data
	Share of food purchase expenditures: – per capita on average; – in the first decile group	Rosstat indicators
	Decile coefficient of food purchase expenditures (expenditures of the first group relative to those of the tenth group)	Calculated indicator based on Rosstat source data
	Level of moderate or severe food insecurity of the population, according to the Food Insecurity Experience Scale, %	Position in the national list of SDG indicators. Calculated using the Food Insecurity Experience Scale (FIES)
	Density of retail space per 1,000 people	Regional statistics indicators
Utilization	Per capita consumption of basic food products	Rosstat indicators
	Consumption by decile groups	Rosstat indicators
	Decile coefficient of per capita consumption of the most valuable food products (consumption of the first group relative to that of the tenth group)	Calculated indicator based on Rosstat source data
	Energy and nutritional value of food consumed, including the ratio of proteins, fats, and carbohydrates in the diet	Rosstat indicators
Stability	1. Production and consumption: – fluctuations in gross grain harvests within a five-year period (lowest to average); – share of domestically produced products in total resources of basic types of agricultural raw materials and food, %, by value (dynamics); – level of monopolization of food markets	Rosstat indicators and calculated indicators based on Rosstat source data. The FAS methodology for analyzing the state of competition in a commodity market makes it possible to assess the monopolization of individual markets
	2. Technology: – share of domestically produced seeds (a); – share of animals of domestic reproduction used for agricultural production on the territory of the Russian Federation (b)	Indicator of the FS Doctrine of the Russian Federation (a) Position in the national list of SDG indicators (b)
	3. Finance: – volume of state support for agriculture; – level of agflation	Data from the Ministry of Agriculture of Russia and Rosstat
Source: own compilation.		

Access. Statistical analysis verifies the “cyclical matryoshka” model: although at the upper level (“availability”) food resources in the country are largely in place, at the next level (“access”) the volumes and economic conditions for purchasing food differ markedly across decile groups.

A first approximate assessment of the economic access to food is provided by the ratio of actual household expenditures on food purchases to the cost of a minimum (conditional) food basket (FE/CB), not only for the population as a whole but also broken down by decile groups¹⁵. As can be seen from *Table 2*, in 2020–2024 the first decile group of the country’s population found itself in a conditional zone of absolute deprivation: its food purchase expenditures were below the cost of the conditional basket. The second group was in a conditional zone of vulnerability (heightened risk), or relative deprivation, periodically “falling” into the zone of absolute deprivation: actual food purchase expenditures in this group only marginally exceeded the cost of the minimum basket (2020, 2023, 2024) or fell below it (2021, 2022).

The limitation of the FE/CB indicator is that it is conditional in nature and does not take into

account shifts in consumption structure – whether between or within groups. A more nuanced picture of the economic access to food for different groups of the Russian population can be obtained by examining their share of food purchase expenditures in total consumption expenditures.

In the theory and practice of international relations, the principle of the indivisibility of security is widely applied, meaning that it is impossible to ensure one’s own security at the expense of the interests of other actors. Within our study, this principle is transposed onto the system of basic human needs. Food security can be considered achieved only when a consumer not only has sufficient means to purchase a desired set of quality products, but also uses them without detriment to the satisfaction of other basic material and spiritual needs¹⁶. Infringement of any of these spheres for the sake of survival devalues the individual’s overall security.

As an evaluative criterion for the economic access to food, the author used the UN living standards scale based on Engel coefficients. A high share of food expenditures (above 50%) represents another form of food insecurity, since in this

Table 2. Actual household food expenditures by decile group compared with the annual average cost of the conditional (minimum) food basket, 2020–2024, rubles per month

Year	Actual food purchase expenditures, by decile group			Annual average cost of the conditional (minimum) basket
	Group 1	Group 2	Group 3	
2020	3263.6	4334.9	4950.0	4320.1
2021	3557.8	4681.8	5485.4	4911.7
2022	4126.3	5397.5	6330.2	5775.6
2023	4466.0	5997.8	6990.0	5788.7
2024	5075.3	6820.0	7987.2	6495.3
Note: zones of absolute deprivation (expenditures below the cost of the minimum basket) are highlighted in red; zones of relative deprivation/vulnerability are highlighted in yellow. Source: own calculations based on Rosstat data.				

¹⁵ The conditional (minimum) food basket comprises 33 items of food products. Data on the cost of the basket are determined per person per month. Its calculation uses the uniform conditional volumes of food consumption established for the Russian Federation as a whole and the average consumer prices for them by constituent entity of the Russian Federation (“Official Statistical Methodology for Monitoring Consumer Prices for Goods and Services and Calculating Consumer Price Indices”, approved by Rosstat Order 915 of December 15, 2021).

¹⁶ Committee on Economic, Social and Cultural Rights. General Comment No. 12 (1999): The Right to Adequate Food (Art. 11). UN. Doc. E/C.12/1999/5. May 12, 1999. Available at: <https://docs.un.org/ru/E/C.12/1999/5> (accessed: 30.07.2026).

case food purchases cannot be made without detriment to expenditures on other basic needs, rehabilitation, and development. This is a very important nuance¹⁷.

In the Russian Federation as a whole, the share of food expenditures in total household consumption expenditures is at an acceptable level, corresponding to the average level of development of society and a relatively well-off population, and in recent years it has shown a weak downward trend. In previous years, by contrast, this indicator grew – from 33.2% in 2013 to 37.0% in 2020. Within the period 2013–2020, two spikes in food purchase expenditures can be noted – in 2014 and 2020. In the first case, the share rose from 33.2 to 33.9% in connection with the adoption of retaliatory protective measures in foreign food trade; in the second, the increase from 34.6 to 37.0% was driven mainly by the logistical consequences of the COVID-19 pandemic.

The data obtained allow us to state, with a certain degree of caution, that an institutional

turning point has occurred in the long-term dynamics of the indicator in question, insofar as average values are concerned. At the same time, detailed statistical data confirm the viability and practical significance of the cyclical “matryoshka” model we have developed, not only with respect to the interrelations among the four FS dimensions but also for the analysis of each dimension individually. The methodological trap of “average well-being” masks the fact of pronounced stratification of the Russian population.

As can be seen from *Table 3*, in 2024, in five out of ten groups the share of food expenditures was in the 40–50% range, which, according to our hypothesis, corresponds to a below-average standard of living, while 10% of the country's population (the first decile group) spends more than half of its consumer budget on food, which corresponds to a low level of well-being. It is precisely the indicators of this group, and not average indicators, that should be the primary focus of FS monitoring and control (control of the limiting link).

Table 3. Grouping of the Russian population by welfare level based on the share of food expenditures (2020 and 2024)

Food expenditure scale, % of total expenditures	Interpretation (living standards)	Distribution of decile groups of the Russian population by category	
		2020	2024
> 60	extreme poverty		
50–60	low level, basic needs barely met	Group 1	Group 1
40–50	below-average level, basic needs met	Groups 2, 3, 4, 5, 6, 7	Groups 2, 3, 4, 5, 6
30–40	average level, relatively well-off population	Groups 8, 9	Groups 7, 8
20–30	above-average level, affluent society	Group 10	Group 9
< 20	high level, rich society		Group 10
Source: Rosstat data.			

¹⁷ Recently, publications have appeared claiming that a significant portion of food—meat, sugar, eggs, butter—has become more accessible compared with the Soviet period on the grounds that the ratios between average Russian wages and prices for these products have changed. This conclusion was reached, in particular, by experts interviewed following an analysis conducted specifically for TASS. See: “Price/Income”: How the affordability of food in Russia has changed compared with the USSR. Available at: <https://tass.ru/obschestvo/26443829> (accessed: 06.07.2026). This is a major methodological error leading to incorrect practical conclusions. All that can be considered proven is that the aforementioned ratios have changed. Such an assessment fails to take into account that housing and utility tariffs and public transport fares, along with many other types of expenses, have simultaneously risen and now absorb a noticeable share of the expenditures of contemporary Russian households compared with the Soviet period. This is to say nothing of the fact that it is improper to assess the affordability of food for the Russian population on the basis of average wages.

The decile coefficient of food expenditures proposed by the author has fluctuated in recent years within the range of 3.08–3.27 (*Fig. 4*). The decile coefficient of food expenditures, K_{fe} , is calculated as:

$$K_{fe} = E_{10} / E_1,$$

where K_{fe} is the decile coefficient of food expenditures,

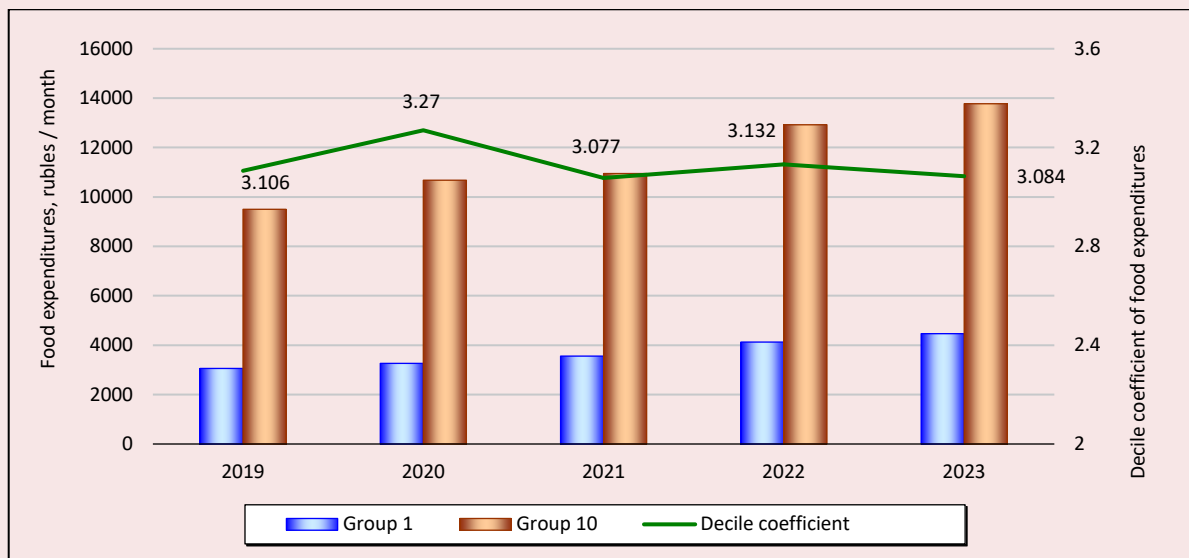
and E_{10}, E_1 are the monthly food expenditures in the tenth and first decile groups, respectively.

Fluctuations of the decile coefficient of food purchase expenditures within a narrow range of values may indicate the diminishing marginal efficiency of traditional instruments of targeted support for low-income groups and the need to search for new forms.

In the Russian literature, a fairly widespread interpretation of the physical accessibility of food treats it as the presence/sufficiency of food in accordance with rational norms of consumption of its basic types (Kireeva et al., 2020; Shchetinina, 2024; Yashkova, 2020).

Methodological triangulation does not confirm this approach: both the FAO methodology and the GFSI, as well as the Food Security Doctrine of the Russian Federation, use other indicators as criteria for physical accessibility. Here we are dealing with a methodological conflation of different FS dimensions – availability, access, and utilization. In reality, the term “physical accessibility” has an obvious connotation with the possibility of purchasing food in one’s place of residence, within reach. The High Level Panel of Experts on Food Security and Nutrition of the Committee on World

Figure 4. Food expenditures of the first and tenth decile groups and the decile expenditure coefficient in 2019–2023



Source: own calculations based on Rosstat data.

Food Security defines physical accessibility as the “physical proximity” of food¹⁸. To assess physical accessibility, the author proposes using a fairly neutral indicator from the Doctrine, “the level of development of the distribution infrastructure”. Since, in accordance with legislation, the minimum standards for the provision of the population with retail space for the constituent entities of the Russian Federation are developed by the authorized executive bodies of the respective constituent entities, it would be advisable to delegate to them the authority to monitor and assess this parameter as well.

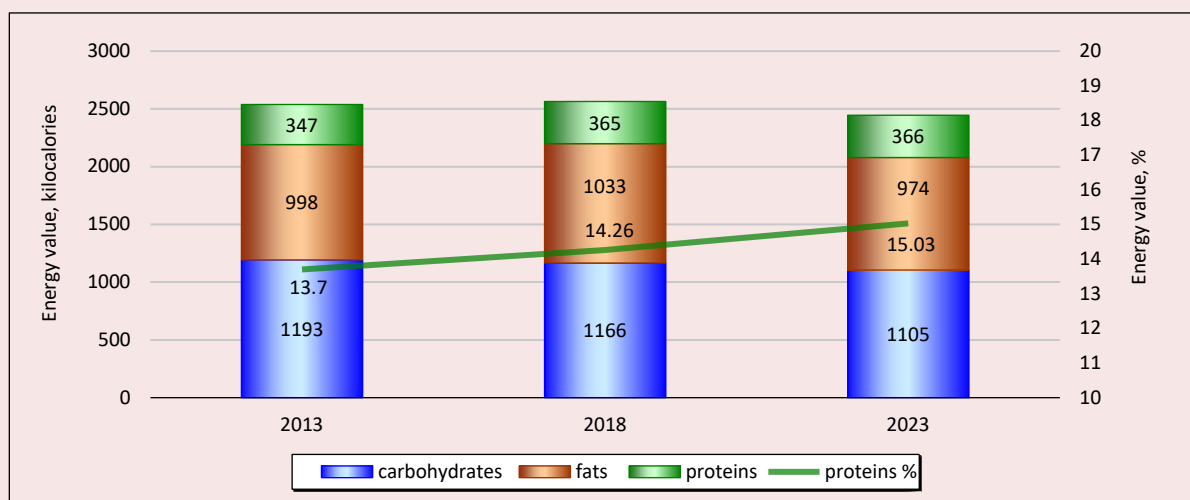
Utilization. Utilization assesses the energy value, balance, and diversity of the diet, its digestibility, and its correspondence to the traditions, customs, and ideas about nutrition in a specific cultural environment.

A retrospective analysis of the energy and nutritional value of food consumed records two trends (Fig. 5): 1) stabilization of the energy value

of the daily diet of the average Russian (a decline of less than 4% can be disregarded), alongside 2) a qualitative improvement of the diet through a certain increase in the share of kilocalories obtained in the form of proteins.

Another indicator of utilization is the degree to which the consumption diet corresponds to rational (scientifically grounded) norms, which characterizes the material and physical form in which the necessary macronutrients (proteins, fats, carbohydrates) with sufficient energy value are consumed. Let us emphasize the conditional nature of rational consumption norms. The recommended rational norms of the Russian Ministry of Health are nothing other than a scientific notion (hypothesis) of a set of food products that best meet the criteria of balance, diversity, and digestibility under existing assumptions and constraints – primarily the actual availability and economic accessibility of food. There are known studies that used other criteria to assess the diet: the total caloric content of the

Figure 5. Dynamics of the nutritional and energy value of the daily diet of persons aged 14 and older



Sources: data from sample surveys of the population's diet in 2013, 2018, and 2023; own calculations based on them.

¹⁸ HLPE 2020 (2020). Building a Global Food Security and Nutrition Concept for 2030: A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome. 91 p., P. 90.

diet (Pradhan et al., 2014; Kinnunen et al., 2020) or an alternative set of products (Stehl et al., 2025). Additional components of utilization are conventionally considered to be free access to clean water, sanitation, and healthcare, which promote better assimilation of nutrients.

The volumes of per capita consumption of all basic food products showed positive dynamics in the 2000s; nevertheless, actual consumption of vegetables, fruits and berries, and dairy products lags noticeably behind the norms recommended by the Russian Ministry of Health; this applies to a lesser extent to fish consumption. A mirror image is observed with respect to sugar: its actual per capita consumption is more than four times the recommended rational norm. In fairness, we should note that the recommended norm is considerably lower than the historically established consumption standards of the Russian population; it was revised substantially downward in 2020 and can for now be classed as unrealistic.

The existing inequality in the consumption of the most valuable food products across decile groups (Tab. 4) corresponds to the differentiation in these groups' expenditures on food purchases.

Here we once again fall into the average metrics trap and observe a certain paradox: the larger the share of their expenditures that households devote

to purchasing food, the less nutritious and healthy their diet is.

Stability. The dimension of stability (sustainability) in the food security system has a dual, dualistic nature. On the one hand, within the FAO cluster approach, stability acts as an independent, fourth dimension of FS, assessing the system's vulnerability to short-term shocks and long-term risks. On the other hand, stability is a cross-cutting factor and a necessary condition for the realization of all the other dimensions – availability, access, and utilization. This methodological feature can be compared to the projections of a geometric body (a pencil, for instance): viewed end-on, we see only an isolated point (an independent dimension), but viewed from the side, we see an extended segment running through the entire structure of the “cyclical matryoshka” (a cross-cutting factor). Stability as a “point” is measured by specific markers, such as the share of domestically produced products in the total resources of basic types of agricultural raw materials and food, or fluctuations in gross grain harvests within a five-year period. At the same time, stability as a “segment” determines how sustainable over time are the economic access for decile groups, the physical continuity of supplies to retail chains, or the balance of the diet.

Table 4. Food consumption by decile (ten-percent) groups of the population in 2023

Consumption of basic food products, average per consumer per year, kg	First group	Second group	Fourth group	Seventh group	Tenth group
bread products	75.1	82.4	87.3	89.0	86.0
potatoes	46.2	52.7	55.8	55.9	51.9
vegetables and melons and gourds	68.7	86.9	101.3	116.7	129.6
fruits and berries	39.1	51.2	63.9	77.7	104.1
meat and meat products	63.9	80.1	91.9	105.9	117.5
milk and dairy products	169.7	212.9	249.3	274.7	321.6
eggs, units	171	204	225	241	288
fish and fish products	13.8	17.0	20.2	23.1	33.2
sugar and confectionery	22.3	26.3	28.5	30.9	29.8
vegetable oil and other fats	7.7	8.8	9.6	9.3	9.3
Source: Rosstat data.					

In this study, we would like to focus attention on two basic indicators of stability: the share of domestically bred seeds (technological stability of the food system as an expression of technological sovereignty) and the level of agflation (financial stability as an expression of financial sovereignty).

Earlier (Gumerov, Guseva, 2018), the so-called “import substitution paradox” was formulated: given the established volumes of supplies of production resources for agriculture (seeds, breeding material, plant protection products, feed premixes), import substitution in the sphere of agricultural products, all other things being equal, will be accompanied by growing secondary resource dependence; other Russian researchers have also drawn attention to this feature (Potapov, 2019). Growing secondary dependence is understood as a situation in which the expansion of domestic volumes of final output critically relies on a proportionally growing import of first-level material and technical resources (genetic material, hatching eggs, veterinary preparations, premixes, and seed material), which under external shocks creates latent vulnerabilities for the entire food system.

The updated 2020 edition of Russia's Food Security Doctrine, alongside threshold values for self-sufficiency in basic types of agricultural products and food, includes an indicator for the provision of domestically bred seeds of major crops at a level of no less than 75%. Here, too, it is important not to fall into the “average values” trap: while self-sufficiency in seeds of wheat, rice, and barley is high, the provision of domestically bred seeds for crops such as potatoes and sugar beets looks positively catastrophic – at 10 and

2%, respectively (2024)¹⁹. On the whole, the import substitution process has been structured and regulated. By RF Government Resolution 4133-r of December 23, 2022, a schedule for increasing the share of domestically bred seeds by major crop has been approved; under the State Program for Agricultural Development, subsidies are paid for the purchase of elite seeds of domestic breeding to producers of grain and sunflower, and for producers of vegetables from elite seeds of domestic breeding, increasing coefficients for subsidization are provided. In parallel, quotas on the import of potatoes, malting barley, and hybrid sugar beet seeds are being reduced. It is important to monitor the target indicators of the Doctrine and to extend the import substitution policy to other production resources of agriculture within the framework of the Federal Scientific and Technical Program for Agricultural Development (FSTP) for 2017–2030.

The food price index (the level of agflation) is an informative indicator of the stability of the food system at the “first level”. As the experience of the global food crisis of 2007–2008 showed, food price growth may be driven by a whole set of heterogeneous factors: climatic change and weather fluctuations, political decisions, population growth and changing consumption patterns, and shortages of production resources. In recent years, the risks of military-political conflicts and the logistical problems associated with them have grown substantially. A detailed analysis of the nature, triggers, and macroeconomic consequences of such price spikes in the domestic food market has been carried out in detail by the author in a dedicated study (Gumerov, 2021).

¹⁹ Results of the Year in Plant Breeding and Seed Production – 2024. Available at: <https://поле.рф/journal/publication/itogi-goda-v-selekcii-i-semenovodstve-2024> (accessed: 05.07.2026).

On the basis of the presented graph (Fig. 6), three key stages in the dynamics of agflation in the Russian Federation over the period 2019–2025 can be identified.

1. The period of outpacing growth (2019–2021). The onset of the COVID-19 pandemic and disruptions in global logistics chains led to a sharp spike in food prices (Gumerov, 2021). The orange line climbs steeply, peaking in 2021 (around 112.5%). At this time, general inflation (the blue area) grew much more slowly, producing a wide gap (“price scissors”) in favor of agflation, which placed excessive economic pressure on the least protected segments of the population.

2. The catch-up inflation effect (2022). In 2022, the trend temporarily reversed. Food prices

stabilized and even declined slightly, while the overall consumer price index (the blue area) reached its peak (around 111.8%). This is explained by the fact that the agflation surge of previous years spilled over into other sectors of the economy (fuel, services, and non-food prices rose), and general inflation “caught up” with food inflation (the scissors “closed”).

3. The second wave of agflation (2023–2024). After a brief decline in 2023, the orange line of food prices surged upward again, forming a second peak in 2024 (around 111.8%). The blue area of general inflation was lower at the time. This confirms that the chronic structural imbalances of the food market are regularly exacerbated under the influence of external shocks.

Figure 6. Consumer price indices



Source: Rosstat data.

In 2025, a synchronous slowdown of both indicators was observed; however, the food price index fell faster than general inflation. At present, we cannot say how stable this dynamic is or whether it will develop into a trend; subsequent observations will show.

The obvious complex nature of agricultural inflation, which originates at the intersection of macroeconomic, monetary, transport, and phytosanitary triggers, requires the integration of interdepartmental analytical competencies through the creation of a special institution – for example, an Interdepartmental Coordination Council or a Situational Center for Food Markets under the Government of the Russian Federation. The main functions of such a center, in the context of the proposed system of indicators, should be: 1) the consolidation and end-to-end monitoring of departmental information flows to form a unified database on the state of the food market; 2) the development of short-term operational supply and demand balances for critically important food groups, making it possible to identify latent imbalances before they manifest in the retail price contour; and 3) scenario modeling of the risks of agflation and secondary technological dependence of the AIC for the prompt adoption of tariff, customs, and monetary regulation measures.

Conclusion

In accordance with the stated aim of the study (the development of a compact model for the

prompt diagnosis of food security risks based on polar intergroup analysis), the following main results were obtained, mirroring the resolution of the key objectives.

1. With respect to synchronization with international approaches: the transition from aggregate indicators to the four-component FAO framework has been substantiated, making it possible to identify latent threats masked by the average indicators of the national doctrine.

2. With respect to overcoming the “average metrics trap”: on the basis of the author's decile coefficient of food expenditures (Kfe), the critical depth of socioeconomic differentiation has been empirically demonstrated – where the inflationary compression of the diets of the least well-off groups occurs against a backdrop of stable average indicators.

3. With respect to the technological contour and stability: a two-stage “matryoshka” model (in its static and cyclical modifications) has been developed and verified, and the need to create a Situational Center under the Government of the Russian Federation for scenario modeling of agflation shocks and related functions has been substantiated.

The developed methodological approach possesses conceptual completeness and shifts the focus of monitoring from ascertaining crises that have already occurred to the preventive management of latent risks.

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Modeling the Impact of Key Regional Socio-Economic Factors on the Development of Creative Industries in the Russian Far East



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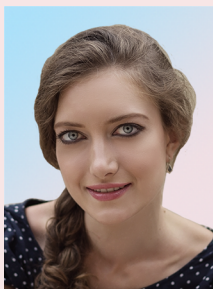
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Abstract. Amid the growing role of intangible factors of production and the shift toward a knowledge economy, the development of creative industries is becoming an important avenue for diversifying the national economy and stimulating economic growth. For Russia, marked by considerable territorial and socioeconomic heterogeneity, it is particularly important to identify the factors shaping the emergence and dynamics of the creative sector at the subregional and municipal levels. The study aims to assess how socioeconomic factors affect the likelihood of new creative industry organizations being established at the municipal level, taking into account the regional context and the center–periphery hierarchy. The empirical base consists of panel data for 220 municipalities of the Far Eastern Federal District of the Russian Federation for 2012–2020, compiled from the SPARK system and official statistics. We apply linear probability models with fixed effects, which account for unobserved territorial heterogeneity and capture the influence of key factors in creative sector development. The regression results reveal a statistically significant U-shaped relationship between the number of students and the likelihood of creative industry organizations being established, pointing to a threshold effect of human capital. The associations with wages and entrepreneurial activity are less robust and depend on the model specification and territorial context: in peripheral areas their statistical significance weakens, while the U-shaped effect of educational potential persists. These findings confirm the spatial heterogeneity of the factors behind creative sector formation and underscore the central role of local educational potential. The results contribute to understanding how the creative economy emerges in Russia and can inform further empirical research, as well as provide indicative benchmarks for designing differentiated regional policies to support the creative sector.

Key words: creative industries, creative economy, socio-economic development of territories, Far Eastern Federal District, regression analysis.

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Introduction

Creative industries represent one of the most dynamically developing sectors, generating value added through the capitalization of intellectual and creative potential (Gushchina, Tarabanova, 2022; Gouvea, Vora, 2018) and contributing to social cohesion, municipal development, and technological innovation (Borre et al., 2023; Gustafsson, Lazzaro, 2021). For Russia, whose transition to a post-industrial economy is complicated by numerous sanctions and accumulated socio-economic imbalances,

developing the creative sector is a strategic task aimed at reducing resource dependence (Shlychkov et al., 2023) and ensuring economic growth. Indeed, sovereign development – a subject raised in recent years both by the academic community (Ilyin, Morev, 2024) and by the country’s political leadership¹ – is impossible in a stagnating and/or unbalanced economy.

In 2022, creative industries accounted for 3.1% of global GDP and 6.2% of global employment (about 50 million jobs)². According to HSE

¹ Putin said Russia will protect its sovereignty just as in 1612. Available at: <https://www.rbc.ru/rbcfreenews/690a45139a794784717fa451>

² UNCTAD: Creative Economy Outlook 2024. Available at: https://unctad.org/system/files/official-document/ditctsce2024d2_en.pdf

University forecasts, their share in global GDP will triple to 10% by 2030³. In 2024, according to the WIPO ranking, the world leaders of the creative economy were Switzerland, South Korea, and the United Kingdom⁴. Despite the growth of the creative economy's contribution to Russia's GDP to 4.1% in 2024⁵, the country ranked only 53rd in that same ranking. The reliability of foreign organizations' estimates and rankings can be debated, but at present there is no basis for claiming global leadership in the development of creative industries. On the contrary, in his May 2024 decrees⁶, the President of Russia emphasized the need to further strengthen the role of creative industries in the national economy, which indicates that the limits of growth have not yet been reached.

The Russian Ministry of Economic Development classifies 16 enlarged types of economic activity as belonging to the creative sector, including fashion, film, television programs and movies, music, architecture and urban studies, design, and others⁷. However, the published draft Strategy for the Development of the Creative Economy in the Russian Federation up to 2036 notes that the boundaries and composition of these industries remain blurred⁸, pointing to the possibility of revising the list in the future. In addition to methodological heterogeneity, a number of other problems in the development of the creative sector can be identified, related to the protection (transfer and valuation) of intellectual property

rights (Domnin, Domnina, 2025), weak investment dynamics⁹, underdeveloped infrastructure, and a shortage of personnel (Koroleva, Sokolova, 2022).

It is important to note that the creative sector is also affected by the heterogeneity of regional socio-economic development levels and rates (Rumyantsev, Lukin, 2025), by geographic location, and by ongoing agglomeration processes (Kozhevnikov, Voroshilov, 2024). The compression of economic space, characteristic of current realities (Popov, 2023), reduces not only the potential production of creative goods but also their consumption. At the same time, in a rapidly changing environment and with the fluid nature of the creative market (Montalto et al., 2021), creative industries must adapt and develop quickly if they are to remain competitive (Kalfas et al., 2024).

Despite extensive coverage of the topic in Russian and international literature, the determinants behind the emergence of creative organizations in particular regions and municipalities of Russia remain underexplored. For example, scholars from Volgograd State Technical University do not consider the municipal level when assessing the growth potential of creative industries (Akimova et al., 2022), while in foreign studies the composition of creative industry activities differs significantly from Russian institutional definitions (Che Arshad, Irijanto, 2023; Campi et al., 2024), making their findings difficult to interpret for Russian territories.

³ Development of the creative economy. Available at: https://ncmu.hse.ru/chelpoten_trends/creat_economy

⁴ Global Innovation Index 2024. Unlocking the Promise of Social Entrepreneurship. Available at: https://www.wipo.int/web-publications/global-innovation-index-2024/assets/67729/2000%20Global%20Innovation%20Index%202024_WEB3lite.pdf

⁵ The creative economy's contribution to GDP in 2024 amounted to 7.5 trillion rubles. Available at: https://economy.gov.ru/material/news/vklad_kreativnoy_ekonomiki_v_vvp_v_2024_godu_sostavil_75_trln_rubley.html

⁶ On the National Development Goals of the Russian Federation for the period up to 2030 and for the future up to 2036: Presidential Decree of May 7, 2024. Available at: <http://kremlin.ru/events/president/news/73986>

⁷ On approval of the list of economic activities in the sphere of creative industries based on the All-Russian Classifier of Economic Activities: Order of the Ministry of Economic Development of the Russian Federation of April 23, 2025 No. 266.

⁸ Draft Strategy for the Development of the Creative Economy in the Russian Federation up to 2036. Available at: https://www.economy.gov.ru/material/departments/d04/kreativnaya_ekonomika/proekt_strategii_razvitiya_kreativnoy_ekonomiki_v_rossiyskoy_federacii_do_2036_goda.html

⁹ Creative industries in Russia: Trends and development prospects. Available at: https://www.hse.ru/data/2021/07/11/1434062388/CI_1.pdf

The issue of creative sector development is especially relevant for the Far Eastern Federal District (FEFD). The macroregion possesses both vast natural resources, unique cultural features, and proximity to developed Asian countries. This largely explains why provisions on creative industry development have been included in the draft Strategy for the Socio-Economic Development of the Far Eastern Federal District up to 2030 with a forecast to 2026¹⁰. Nevertheless, the overall socio-economic situation in the FEFD remains tense. There is a steady outflow of population, especially highly skilled young people, not only to other regions of the country but also abroad (Stroeve, 2025). Young professionals cite the desire for high incomes and the opportunity to realize their creative potential as key emigration factors (Oleinik et al., 2024). Negative net migration against the backdrop of depopulation of the Far Eastern territories means that, as of the second quarter of 2025, the FEFD is experiencing a significant labor shortage, and the average job search time (6.1 months) is almost a month longer than the national average (5.2 months) (Bravok, Naiden, 2025). Moreover, the economic development of the FEFD is further complicated by an unbalanced economic structure. Its resource-based orientation – expressed in the dominance of mining in the structure of shipped industrial output – and the absence of clear growth trends in deep-processing manufacturing reinforce the existing technological dependence of local production (Bukhvald, Kizil, 2026).

Under these conditions, the development of the creative sector is becoming a strategic priority, as it draws on the cultural capital of the FEFD, responds to young people's demand for self-fulfillment, and at the same time increases the share of non-resource output in GRP. Research confirms that the number of creative organizations, their revenue,

and employment have the greatest impact on the sector's contribution to GRP (Akimova et al., 2022). The development of creative industries also helps to address the chronic decline of peripheral territories (Bufetova, 2009; Kozhevnikov, 2019). The Italian experience shows that an increase in the number of creative firms has a positive effect on employment and value added dynamics (Piergiovanni et al., 2012). Thus, the development of creative industries in the FEFD will not only help mitigate the emigration problem but also stimulate more balanced economic development of the macroregion.

Given the above, it is worth assessing how socio-economic determinants influence the emergence of organizations in the creative industries across regions and municipalities. The analysis takes the Far Eastern Federal District as an example and accounts for the center–periphery hierarchy, thereby helping to inform regional policy aimed at developing the creative economy.

The scientific novelty of this study lies in filling the gaps in research on the dependence of creative industry development on regional and municipal socio-economic development. Specifically, it empirically substantiates the non-linear threshold effects of human capital and the context-dependent nature of the socio-economic determinants of creative industry firm creation at the regional and municipal levels, taking into account the center–periphery hierarchy.

Literature review

Theoretical approaches to explaining the emergence and growth of firms traditionally rest on several conceptual frameworks. The resource-based theory of the firm emphasizes the role of unique resources and capabilities in securing competitive advantages and growth (Kleiner, 2011). Human capital theory focuses on the knowledge, skills,

¹⁰ Strategy for the Socio-Economic Development of the Far Eastern Federal District up to 2030 with a forecast to 2036. Available at: <https://dfostrategy.vostokgosplan.ru/> (accessed: 27.07.2026).

and experience of entrepreneurs and employees as key determinants of success (Dyatlov, 1994). Institutional theory examines the influence of formal and informal institutions on entrepreneurial activity and growth of the number of firms (Sazanova, 2015).

Creative industries exhibit specific growth patterns (Loots, van Witteloostuijn, 2018) that distinguish them from other commercial organizations. In particular, creative organizations grow along separate dimensions – sales, assets, and employment – independently of one another, which contrasts with traditional models of balanced growth (Pfeifer et al., 2016). For example, in Croatia only 2.2% of creative enterprises showed simultaneous growth in sales, assets, and employment (Pfeifer et al., 2016). Moreover, even the nature of entrepreneurs' motivation differs: it is shaped not only by economic attitudes and goals but also by personal factors such as passion and inspiration (Bhansing et al., 2018).

Human capital is recognized as a key component of creative industries (Rustiadi, 2015). The share of highly educated employees is positively correlated with growth in knowledge- and technology-intensive sectors, including the creative industries (Pfeifer et al., 2016). The qualifications of workers, their creative abilities, and professional skills determine a firm's capacity to create innovative products and services (Gushchina, Tarabanova, 2022), while the gender and age characteristics of founders and entrepreneurs directly influence the development trajectory of such organizations (Protogerou et al., 2024).

However, a number of Russian and international researchers link the development of creative industries to educational trends in a particular territory. This issue is examined both from the perspective of training personnel who will later work as employees (Efimova, Bryukhanova, 2023) or establish creative organizations and ecosystems (Dent et al., 2024; Kim, Comunian, 2024), and

from the viewpoint of public consumption of cultural products (Zhang, Kloudova, 2011).

In addition to training personnel, higher education institutions serve as nodes of entrepreneurial ecosystems, facilitating the translation of knowledge into commercial products (Audretsch et al., 2022). For example, in the Republic of Sakha (Yakutia), the introduction of specialized educational programs and support for student initiatives laid the groundwork for the development of the IT sector and media industries (Verkhovtseva, 2024). The network interactions of creative companies are not limited to ties with other firms or universities but also extend to government bodies, which can interact with them directly (Gushchina, Tarabanova, 2022) or by designing institutional conditions (Gushchina, Tarabanova, 2022; Glebova et al., 2021).

It is also worth emphasizing that a substantial body of work studies creative industries through the lens of culture (De Bernard et al., 2022), whose relationship with education is linear (Dobrova, 2024). As a result, science is often regarded as a separate factor in the development of cultural industries (Martinaityte, Kregzdaite, 2015). Although scientific research is not included in the Russian list of creative industry activities, there is a phenomenon of scientific creativity that, according to some researchers, is fundamental to the entire creative sector (Martinaityte, Kregzdaite, 2015). Thus, G. Stumpf's work suggests that scientific research depends heavily on the individual (including their motivation and personal characteristics), and that scientific inquiry becomes the product of intellectual labor, although its originality may be subject to debate (Stumpf, 1995). We agree with A. Sviridenok's view that scientific creativity involves the emergence of an idea as a result, as well as creative realization based on existing knowledge, research methods, technologies, and material products (Sviridenok, 2014).

Another factor shaping the development of creative industries is the presence of tourism and historical-cultural potential (Kryukov, 2024). Its special role is particularly visible in industries whose value lies not in producing something entirely new but in preserving and interpreting cultural heritage. Libraries, archives, and museums are a case in point: their core activities center on safeguarding and disseminating heritage, although some scholars propose models for engaging museums in innovation processes (Nogare, Murzyn-Kupisz, 2022). Unlocking this potential requires both infrastructure and qualified specialists. Research shows that service infrastructure helps revitalize local economies (Sharp et al., 2002), while the development of tourist routes and the availability of qualified guides stimulate demand for related creative services (Lin et al., 2022).

Researchers also identify several purely economic factors behind the emergence and growth of organizations in general. Wages, in particular, act as the main economic stimulus for migration (Boldenkov et al., 2025) and for the concentration of talent (Leonidova, 2024). Growth in the creative sector raises overall wage levels in municipal economies but pushes the least productive industries out of cities (Lee, 2014). In addition, creative industries are closely linked to entrepreneurial activity (Muzychuk, 2023) and to the degree of market concentration. Empirical evidence shows that access to internal and external financing at the early stages is critical (Yudanov, 2010), while prudent use of resources and profit retention are associated with a higher probability of sales and asset growth (Pfeifer et al., 2016). Agglomeration effects, in turn, encourage the concentration of startups and creative firms in large cities, where access to markets and digital infrastructure is greater (Zemtsov et al., 2021); similarly, interaction among actors within regional clusters and art residencies supports creative development at the sub-federal level (Efimova, Bryukhanova, 2023).

Drawing on the literature review and current understanding of how socio-economic factors shape the emergence of creative industry organizations, we put forward the following hypotheses.

H1. The influence of human capital, proxied by the number of students, on the likelihood of creative industry growth is non-linear.

H2. The level of wages has a positive effect on the development of the creative sector, acting as a factor attracting talent, but this effect is stronger under the agglomeration advantages of regional centers and weaker in peripheral territories.

H3. Employment in science and culture has a complex non-linear relationship with the dynamics of creative industries, reflecting the specific nature of scientific creativity and differences in the mechanisms of knowledge transfer to the commercial sector.

H4. Overall entrepreneurial activity stimulates the growth of the number of creative industry organizations primarily through a linear mechanism, without pronounced non-linear effects, indicating a direct relationship between the general business climate and the entry of firms into the creative sector.

H5. The structure of determinants of creative industry growth is spatially heterogeneous and depends on the hierarchical position of a territory in the settlement system, confirming differences in development mechanisms between regional centers and the periphery.

Materials and methods

The empirical base of the study includes panel data on municipal entities (urban okrugs, municipal okrugs, and municipal districts) of the Far Eastern Federal District (FEFD) for 2012–2020. The choice of the municipal level of analysis is consistent with established practice in research on regional entrepreneurial dynamics and innovation (Anokhin et al., 2018). The FEFD is a strategically important and socio-economically heterogeneous macroregion of Russia (Ilchenko, Sirazhdinov,

2024), encompassing urban, suburban, and rural territories, which ensures variability in the data and generalizability of the conclusions.

The data were compiled from two sources. The first was information from the SPARK information and analytical system for 1999–2023 on organizations and individual entrepreneurs registered in the regions of the Far East, including industry affiliation, financial reporting indicators, and registration and liquidation dates. Business entities whose main activity code belongs to the official consolidated classification grouping of creative industries according to OKVED2 (Resolution of the Ministry of Economic Development of Russia No. 266) were classified as creative industries; this classification is a mandatory condition for receiving state support. At the municipal level, we calculated creative sector indicators for organizations and individual entrepreneurs: the number of established, operating, and liquidated entities, as well as the Herfindahl–Hirschman index. The second source was socio-economic indicators of municipalities from open data of Rosstat and regional government bodies. Administrative units were matched using the OKATO/OKTMO code directory; the matrix of geographic distances between municipalities was constructed on the basis of the coordinates of their administrative centers. The empirical models are estimated on a balanced panel for 2012–2020.

To analyze the factors behind the emergence of creative industries, we use linear probability models (LPMs) with fixed effects. The estimated coefficients are interpreted as changes in the probability of an event, which makes marginal effects easier to interpret substantively (Angrist, Pischke, 2009). For panels with many units and few time periods, fixed-effects LPMs yield consistent estimates even in the presence of unobserved heterogeneity specific to a municipality or region (Wooldridge, 2010). Non-linear fixed-effects models (including conditional logit) often produce biased estimates on short panels, because a large

number of individual effects must be estimated from a small number of years, especially when the dependent variable barely changes within units over time. Given that positive outcomes account for about 19% of observations, a linear probability model with fixed effects is preferable to a logit specification for these panel data (Timoneda, 2021). In all models, standard errors are clustered at the municipality level.

The dependent variable is the binary variable of creative industry emergence, (CI_create_{it}). It takes the value 1 if the number of operating creative industry organizations in municipality i in year t exceeds their number in year $t - 1$, and 0 otherwise:

$$CI_create_{it} = \begin{cases} 1, & CI_Ex_E_{it} > CI_Ex_E_{it-1}, \\ 0, & otherwise \end{cases}$$

where $CI_Ex_E_{it}$ is the number of creative industry organizations in municipality i in year t .

The distribution of the variable shows that 18.9% of observations in the panel correspond to cases of creative industry emergence, and no municipality exhibited sustained growth throughout the entire study period.

Thus, the model explains not the scale of the sector but the probability of the very fact of its emergence at the municipal level. Moving to continuous indicators (the logarithm of the number of organizations, revenue, employment) shifts the focus to models of creative industry development, which are more common in the literature. The main dependent variable is constructed from the dynamics of the number of operating organizations registered as legal entities. We deliberately excluded the number of newly emerged individual entrepreneurs from this indicator, since it is the establishment of a legal entity that makes it possible to obtain grants for supporting creative industries. Legal entities have the potential for scaling and corporate development that individual entrepreneurs do not possess; therefore, the emergence of a legal entity, primarily an LLC, signals the development of the commercial

potential of the creative industries, whereas establishing an individual entrepreneurship is an attempt to “stay in the shadows” of small business.

The set of independent variables was formed on the basis of theoretical ideas about the determinants of creative business emergence and includes indicators of human capital, economic conditions, entrepreneurial activity, and market structure.

The number of students (*students*) is measured as the number of university students per capita and is used as the main indicator of a territory’s educational potential. The wage fund (*wages*) is converted to constant prices and normalized per capita as a proxy for the state of the local labor market. Entrepreneurial activity (*firms*) is measured by the number of newly created enterprises in all industries per capita. The market concentration of creative industries (*HHIciRev*) is assessed using the Herfindahl – Hirschman index based on sector organizations’ revenue. Separately considered is the number of researchers and museum guides per capita (*sci_cult*). This indicator reflects employment in science and culture using available municipal data and is not used as a proxy for the number of researchers or R&D employment: the corresponding Rosstat indicators are not available at the municipal level in the database used. The main models focus on educational potential and

economic conditions; the *sci_cult* indicator is analyzed separately and interpreted with due regard to its aggregate nature.

The total proportion of missing values in the original dataset was 7.28%. To ensure methodological rigor and minimize bias, we developed a differentiated strategy based on analyzing the nature of the gaps (*Tab. 1*). The approach distinguished between cases where a missing value could reflect the actual absence of a phenomenon and cases resulting from systemic data collection issues. After applying this strategy, the final dataset was formed: a balanced panel of 220 municipalities over 9 years (2012–2020), yielding 1,980 municipality-year observations. All financial indicators were converted to constant prices using the inflation index.

It should be noted that to account for potential bias and control quality, we created a comprehensive system of binary indicators for each type of gap, which were then used in diagnostic analyses. Including these indicators in regression models as additional control variables did not change the main results, indicating the robustness of the estimates.

The mean of the dependent variable *CI_create* is 0.189, meaning that in 18.9% of observations an increase in the number of creative industry organizations was recorded (*Tab. 2*). All variables show sufficient variation for regression analysis.

Table 1. Missing data handling strategy

Indicator	Strategy applied
<i>students</i>	A differentiated approach was used for 33.41% of missing values: for 18 municipalities with no educational infrastructure, gaps were replaced with 0; for two municipalities with infrastructure, the median for small municipalities was used; for 212 municipalities with historical data, gaps during the systemic failure period (2018–2020) were filled by extrapolating the 2009–2017 trend.
<i>wages</i>	The first three years of observations (2009–2011) with systematic gaps and 12 municipalities with complete absence of data were excluded to form a balanced panel suitable for fixed-effects models. Remaining partial gaps were filled with the municipality median.
<i>sci_cult</i>	Missing values (3.20% of observations) were replaced with 0 based on an analysis of the data structure. The analysis showed that most observations already have zero values, and municipalities with gaps lack the corresponding cultural infrastructure. For population, minor gaps (0.86%) were restored using linear interpolation and the regional median.
<i>firms</i>	Missing values (6.29% of observations) were interpreted as no new firm creation in a given year, consistent with the logic of an indicator recording creation events.
Source: own compilation.	

Table 2. Descriptive statistics and correlations*

Indicator	Mean	Std. dev.	(1)	(2)	(3)	(4)	(5)
(1) CI_create	0.189	0.392	1.000				
(2) students	4252.95	6687.21	0.148	1.000			
(3) wages	475.4	2610.6	0.054	0.328	1.000		
(4) sci_cult	4.36	15.67	0.203	0.196	0.184	1.000	
(5) firms	56.52	227.41	0.160	0.412	0.421	0.195	1.000
(6) HHlciRev	0.15	0.22	-0.022	-0.178	-0.132	-0.098	-0.104

* wages – wage fund; sci_cult – number of researchers and museum guides; firms – number of newly created enterprises; HHlciRev – Herfindahl – Hirschman index of creative industry market concentration.
Source: own calculation.

The composition of the final specifications was determined on the basis of theoretical considerations and econometric requirements. To check robustness and the risk of bias from excessive or highly correlated regressors, we performed diagnostic analyses of alternative sets of control variables. The key criterion was the stability of estimates for the variables of primary interest, especially the quadratic effect of the number of students. If the signs of key coefficients changed or standard errors increased sharply when adding controls, the specification was additionally tested for multicollinearity. To control for bias related to missing data, binary indicators for gaps were included in all regressions; their inclusion did not alter the main results.

Two groups of models were constructed: the main models (1–4) to test the influence of human capital and economic conditions, and additional models (5–6) to analyze non-linear effects of employment in science and culture and entrepreneurial activity. Specifications with municipality fixed effects include year effects to control for nationwide trends and macroeconomic shocks. In Model 3, with region fixed effects, year effects are also included. Regional and time dummies are estimated jointly. Municipality and region fixed effects are not combined within the same model. To test non-linear effects, the relevant variables (number of students, employment in science and culture, entrepreneurial activity) were standardized in advance and included in the models in both linear and quadratic form.

The analysis was conducted in two stages. In the first stage, models were estimated on the full sample of all municipalities. In the second stage, the analysis was performed on a sub-sample excluding the administrative centers of the FEFD constituent entities, in order to check the robustness of the results and identify the specific features of growth factors in peripheral territories.

Research results

Table 3 presents the results of estimating linear probability models with fixed effects. The subscript *sq* denotes the quadratic term of the corresponding centered variable included in the model to test the hypothesis of a non-linear relationship. Column 1 presents a simplified specification including only the variables related to human capital (*students*, *students_{sq}*). Column 2 shows the baseline full model, which contains all the independent variables under consideration and uses municipality fixed effects and time effects. Column 3 provides a robustness check: municipality fixed effects are replaced with region fixed effects while retaining year effects. Column 4 reports the results of estimating the full model on a subsample excluding the administrative centers of the FEFD constituent entities.

Model 2 is adopted as the baseline specification. It includes the full set of independent variables and controls for both unobserved municipal heterogeneity and nationwide time trends. Its estimation results reveal a statistically significant U-shaped relationship between the number of students and the probability of creative industry

Table 3. Regression analysis results*

Variable	Model 1	Model 2	Model 3	Model 4
	Simplified specification (students only)	Baseline full model (all factors)	Robustness: region fixed effects (all factors)	Robustness: periphery subsample (all factors)
<i>students</i>	-0.0097 (0.0167)	-0.0085 (0.0169)	-0.0193 (0.0128)	-0.0013 (0.0178)
<i>students_{sq}</i>	0.3804** (0.1532)	0.3816** (0.1557)	0.4067*** (0.1122)	0.3336** (0.1539)
<i>wages_z</i>		-0.0255 (0.0190)	-0.0333** (0.0156)	-0.0053 (0.0283)
<i>wages_{sq}</i>		2.477e-12*** (6.195e-13)	2.497e-12*** (5.814e-13)	7.81e-13 (3.352e-12)
<i>firms</i>		0.0297 (0.0189)	0.0684*** (0.0100)	0.0268 (0.0237)
<i>HHIciRev</i>		0.0174 (0.0140)	0.0025 (0.0095)	0.0186 (0.0154)
Fixed effects	Municipality	Municipality	Region	Municipality
Time effects	Yes	Yes	Yes	Yes
Sample	Full	Full	Full	Periphery
R^2_{within}	0.0039	0.0135	0.0470	0.0089

* Dependent variable: CI_create. Standard errors clustered at the municipality level are in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Columns (2)–(4) present models with the full set of independent variables.
Source: own calculation.

emergence (the coefficient on *students_{sq}* is 0.3816, $p < 0.05$). Importantly, this non-linear effect appears already in the simplified specification containing only human capital variables (Model 1) and remains robust in both magnitude and significance when controls for economic conditions, entrepreneurial activity, and market structure are successively added.

The U-shaped relationship points to the threshold character of the influence of educational potential: near the mean level of the standardized number of students per capita, the marginal effect is minimal, while further growth in the indicator increases the probability of expansion in the number of creative industry organizations. The positive contribution of human capital thus materializes after the formation of a local critical mass rather than evenly across the entire range of values.

To check the robustness of the estimates to a change in the level of aggregation of unobserved characteristics, a specification with region fixed effects and year effects was estimated (Model 3).

As expected, moving control to the regional level affected the coefficient estimates, but the key finding of a significant U-shaped relationship with human capital (*students_{sq}* = 0.4067, $p < 0.01$) was confirmed. In this specification, the non-linear effect of wages and the positive coefficient on entrepreneurial activity are also significant. In baseline Model 2 with municipality fixed effects, the quadratic effect of wages is significant, while the linear effect of *firms_z* does not reach standard significance levels.

The final check was aimed at identifying territorial specificity. Estimating the full model on the sample excluding the administrative centers of the FEFD constituent entities (Column 4) revealed the context-dependent nature of factor effects. Whereas the U-shaped relationship with the number of students remains statistically significant even in peripheral territories (*students_{sq}* = 0.3336, $p < 0.05$), the non-linear effect of wages, significant in the full sample (Models 2–3), loses significance

in the periphery. The coefficient on entrepreneurial activity, significant in Model 3, also becomes insignificant. Thus, educational potential is robustly associated with the probability of an increase in the number of creative industry organizations both in the full sample and in the periphery, whereas the effects of wages and entrepreneurial activity are more sensitive to specification and sample composition.

It should be noted that the R^2_{within} values in all specifications are relatively low (e.g., 0.0135 in baseline Model 2). This indicates that the annual changes (within-municipality variation) in the socio-economic indicators used in the model explain only a small share of the annual fluctuations in creative industry growth. However, this result is expected for research based on panel data with fixed effects, where R^2_{within} is often low because the model absorbs all stable between-municipality heterogeneity. The low value underscores that the short-term dynamics of the creative sector are largely driven by factors not captured in the model (e.g., local institutional initiatives, the actions of individual entrepreneurs, or random events). At the same time, the study's key objective – estimating

stable statistical relationships rather than producing accurate forecasts – is achieved. This is confirmed by the high statistical significance of the non-linear relationships identified.

To examine specific effects, additional specifications were estimated (Tab. 4). Model 5 focuses on the aggregate indicator of employment in science and culture, including the variables *sci_cult* and *sci_cult_{sq}* while controlling for the baseline factors (*students*, *wages*). Model 6 tests the non-linear effect of entrepreneurial activity (*firms*, *firms_{sq}*) with the same controls. Both models use municipality fixed effects to control for time-invariant characteristics but do not include time effects, which makes it possible to focus on cross-sectional differences.

The results of Model 5 show a statistically significant non-linear relationship between the aggregate indicator of employment in science and culture (*sci_cult*) and the growth of creative industries. The positive sign of the linear term and the negative sign of the quadratic term (coefficients 0.0389, $p < 0.1$, and -115085.8, $p < 0.05$, respectively) formally correspond to an inverted U-shaped relationship. It is important to stress that, given the aggregated nature of the *sci_cult* variable,

Table 4. Additional analysis of non-linear effects*

Variable	Model 5	Model 6
<i>sci_cult</i>	0.0389*	
	(0.0223)	
<i>sci_cult_{sq}</i>	-115085.8**	
	(57270.0)	
<i>firms</i>		0.0410
		(0.0321)
<i>firms_{sq}</i>		-1281.7
		(11190.0)
<i>students</i>	0.0133	0.0147
	(0.0142)	(0.0142)
<i>wages</i>	0.0148	0.0128
	(0.0130)	(0.0146)
Fixed effects	Municipality	Municipality
R^2_{within}	0.0041	0.0061

* Dependent variable – *CI_create*. Standard errors clustered at the municipality level are in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Source: own calculation.

which combines different professional groups, interpreting this result as an “optimal level of scientific activity” would be incorrect. The estimate points to the existence of a complex, possibly non-monotonic relationship between the presence of personnel in adjacent sectors at the municipal level and the dynamics of creative industries, the nature of which needs to be clarified in future research using more detailed data.

In Model 6, the quadratic effect of entrepreneurial activity ($firms_{sq}$) is statistically insignificant, which does not allow us to reject the hypothesis of no non-linear relationship between the creation of new enterprises and creative sector growth in this specification. The linear effect of $firms$ also does not reach standard significance levels, which may indicate either the absence of a direct association within the chosen specification or the need to account for additional factors or a different level of data aggregation.

It should be noted that the models presented in this additional analysis are illustrative and exploratory in nature. They are estimated on a limited set of control variables and are intended as a preliminary test of possible non-linear effects. In particular, interpreting the results of Model 5 is complicated by the aggregated nature of the *research* indicator. Therefore, these results should not be regarded as established causal relationships but rather as indications of promising directions for more detailed study in future work. The methodologically grounded conclusions of the study follow from the analysis presented in Table 3.

Discussion

Despite the significant results obtained, the study has a number of methodological limitations that should be taken into account when interpreting the findings and planning further research.

First, the estimation is based on a nine-year window, 2012–2020. This is sufficient for panel models with fixed effects but not enough for analyzing long-term structural shifts. Extending the

unified panel to the years after 2020 is complicated by changes in the administrative-territorial structure of municipalities in a number of FEFD constituent entities during the local government reform (consolidation, transition to municipal okrugs, adjustments to boundaries and names), which disrupts the comparability of observation units over time without a separate method for linking them. Moreover, generalizing the results to the post-COVID period and to conditions after 2022 is limited: those years are associated with different macroeconomic and institutional shocks and require separate analysis.

Second, the dependent variable only shows whether creative business creation occurred in a municipality – that is, whether the number of operating creative industry organizations increased relative to the previous year. It says nothing about the size of companies, their revenue, employment, sustainability, or product quality. The conclusions therefore refer to the factors affecting the probability of creation, not to the scale and efficiency of creative sector development.

Third, the employment indicator in science and culture is aggregated and does not separate the contributions of researchers and cultural workers. Rosstat data on the number of researchers and R&D personnel are not available at the municipal level in the database used. Their inclusion at the regional level is possible in future work. This limits the interpretation of the non-linear relationship identified for this indicator. Models with this variable are illustrative in nature.

Fourth, despite the use of a comprehensive strategy for handling missing values, the possibility of systematic bias related to the non-random nature of missing data cannot be fully excluded.

Fifth, even when controlling for municipality and time fixed effects, the risk of endogeneity associated with reverse causality and omitted variables remains. Specifications with lagged regressors ($t - 1$) yield less precise estimates of the

quadratic effect of students, which is consistent with the limited within-variation in a short panel. The estimated coefficients are therefore interpreted as stable statistical associations while controlling for unobserved heterogeneity.

Finally, the presented models include different sets of explanatory and control variables, reflecting the research logic of testing the robustness of key effects (such as human capital) to alternative specifications. Although this approach is methodologically sound and makes it possible to assess the context dependence of the results, it limits the direct comparability of coefficients across all models.

Conclusions

The results obtained allow several key conclusions to be drawn.

First, a non-linear relationship between a territory's educational potential and the emergence of creative industry organizations is identified (a U-shaped relationship). The threshold effect consists in the fact that near the mean level of the standardized number of students per capita, the marginal contribution of the indicator is minimal, while further growth in the number of students increases the probability of positive dynamics in the number of operating creative industry organizations. In other words, the positive role of human capital materializes after the formation of a local "critical mass" rather than evenly across the entire range of values.

Second, the robustness of the effects depends on the specification and the territorial context. The U-shaped relationship with the number of students holds in the full sample and in the subsample of peripheral municipalities. The non-linear relationship with wages is more pronounced in the full sample; the positive association with entrepreneurial activity emerges in the specification with regional and year effects (Model 3). In the periphery, both of these latter effects lose statistical significance. This points to the context-dependent nature of the mechanisms and prevents wages and

entrepreneurial activity from being interpreted as universal drivers for all types of territories.

Third, the relatively low coefficients of determination for within-group variation mean that the short-term (within-municipality) dynamics of creative industries are only weakly explained by annual changes in the included socio-economic indicators. Unobservable local factors (institutions, networks, initiatives) may play a substantial role; therefore, the estimates are interpreted as stable statistical associations with fixed effects controlled for, rather than as a basis for precise forecasting or strong causal claims.

The theoretical significance of the study lies in shifting the focus from linear notions of human capital to threshold effects and in taking into account the center-periphery hierarchy when analyzing the creation of creative industries at the sub-regional level of a peripheral macroregion. The work also contributes to the methodology of creative industry research by demonstrating the potential of panel models with fixed effects for identifying threshold effects and context dependence at the sub-regional level of a peripheral macroregion.

The practical significance lies in formulating differentiated recommendations for regional policy. For regional centers, measures that strengthen the link between the educational and entrepreneurial environments are more relevant. For the periphery, more relevant are measures supporting basic conditions and educational infrastructure sufficient to approach the threshold level of human capital, as well as local forms of cooperation. Given the low within-group R^2 and endogeneity limitations, these guidelines are indicative in nature and require verification on more detailed data and for the period after 2020. Prospects for further research are associated with identifying spatial growth points for creative industries, deeper analysis of factors at the regional, municipal, and local levels, and a subsequent transition to studying the profiles of individual creative industries.

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The Potential for Improving Energy Efficiency of the Russian Economy: Sectoral Assessment and Macroeconomic Effects



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Abstract. Russia has substantial room for reducing energy consumption by using energy more efficiently, a task made especially pressing by limited investment resources and the need to strengthen the competitiveness of domestic output. This study aims to establish the upper bound of the technically feasible reduction in energy use in Russia through the deployment of advanced energy-efficient technologies and to identify the macroeconomic effects of their implementation. Existing research tends to be confined to individual sectors or regions, or focuses primarily on technical aspects or institutional barriers to energy saving. The study's novelty lies in developing an integrated framework that combines an assessment of the potential across four sectors (energy, housing and utilities, industry, and transport) with a ranking of measures by economic feasibility and the identification of options offering short payback periods. The methodology draws on a combination of sectoral analysis and a scenario approach, using data from Rosstat, projections by research institutes, and expert estimates. The results indicate that the overall energy saving potential could reach as high as 50% of current consumption, generating a direct economic effect of up to 1.3 trillion rubles annually (roughly 0.6% of GDP) and cutting CO₂ emissions by as much as 65% of the country's total emissions. The priority areas identified include optimizing the load of combined heat and power plants, developing distributed generation, introducing heat pumps and smart metering systems, modernizing industry, and promoting electric transport together with public mobility. A limitation of the study is the absence of a detailed assessment of cross-sectoral multiplier effects and the economic efficiency of each technology. This points to future research aimed at building an input-output model that would capture feedback loops between sectors of the economy.

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Key words: energy efficiency, energy saving, potential for energy consumption reduction, technological modernization, fuel and energy balance, macroeconomic effects.

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Introduction

Russia has substantial room for reducing energy consumption by using energy more efficiently. According to CENEF estimates, the possible reduction in electricity consumption is 36%, with the main driver of reduction being savings in industry and buildings¹. According to IEA calculations, the potential for saving energy in buildings through the construction of more efficient buildings and reconstruction of those already existing reaches 50% of annual global energy consumption until 2060 (Dulac, 2017). The use of energy-efficient technologies reduces energy consumption and associated costs, as well as greenhouse gas emissions, which corresponds to the goals of the “Socio-Economic Development Strategy of the Russian Federation with Low Greenhouse Gas Emissions until 2050”², the “Energy Strategy of the Russian Federation until 2050”³ and the state program “Energy Conservation and Energy Efficiency Improvement in the Russian Federation”⁴, which provides for the reduction of GDP energy intensity by 35% by 2035.

Energy efficiency challenges are of special importance for the Russian economy in current conditions due to a number of factors. First, high energy intensity of GDP, despite its downward trend, reduces the price competitiveness of domestic products in foreign markets. Second, limited investment resources and the need to modernize fixed assets make energy efficiency improvement one of the most accessible sources of economic growth that does not require significant capital expenditures compared to the commissioning of new producing capacities. Third, in the context of externally reduced import of technology and capital, energy efficiency becomes a growth resource that does not require foreign exchange costs and external financing: a significant part of the developments included in this study can be implemented on the basis of domestic solutions or with the help of friendly countries. Thus, energy efficiency acts as a key element of systemic energy sector transformation in response to sanctions pressure.

¹ On the state of energy conservation and energy efficiency improvement in the Russian Federation in 2022 (2024). Ministry of Economic Development of the Russian Federation. Moscow. 154 p. Available at: https://economy.gov.ru/material/file/b2ec92f00344707af95c8d44a6abbde8/Energy_efficiency_2023.pdf (accessed: 11.11.2025).

² Strategy for the socio-economic development of the Russian Federation with low greenhouse gas emissions until 2050: RF Government Resolution 3052-r, dated October 29, 2021. Available at: <http://static.government.ru/media/files/ADKkCzp3fWO32e2yA0BhtIpyzWfHaiUa.pdf> (accessed: 10.12.2024).

³ Energy Strategy until 2050: RF Government Resolution 908-r, dated April 12, 2025. Available at: <http://government.ru/news/54754/> (accessed: 18.06.2026).

⁴ Energy conservation and improving energy efficiency in the Russian Federation: RF Government Resolution 1473, dated September 9, 2023. Available at: http://government.ru/dep_news/49471/ (accessed: 18.06.2026).

The scientific problem is the fragmentary estimates of overall energy saving potential, which includes all key economic sectors (energy, housing and utilities – the building sector, industry, transport) and considers their uneven economic feasibility. Existing studies focus either on technical aspects or institutional barriers, without offering an integrated approach to ranking measures by scale of impact and economic efficiency.

The study aims to determine the upper bound of technically feasible reduction in energy use in Russia through the deployment of advanced energy-efficient technologies and to identify the macroeconomic effects of their implementation. To achieve this aim, the following tasks have been set: 1) to summarize the most promising energy efficiency technologies in four key sectors of the economy; 2) to assess the technically feasible potential for reducing energy consumption in each sector and in the economy as a whole; 3) to rank the considered measures by their economic feasibility, highlighting options offering short payback periods; 4) to determine the macroeconomic effects and barriers to the implementation of the identified potential.

The scientific novelty of the study lies in the integrated approach that both assesses technically feasible reduction in energy consumption (including by sectors) and differentiates measures by payback period and economic efficiency. It contributes to the development of the above approach, and the obtained quantitative estimates can be used by the government and local bodies to adjust state energy conservation policy and concentrate resources on the most effective measures.

The study assesses the potential for energy consumption reduction by using such technologies

for 2024 and analyzes the macroeconomic consequences of its implementation. The obtained estimate is not an action plan, but an analytical upper bound that allows showing the possible limits and focusing on the most achievable and economically feasible measures.

Current energy consumption

Energy consumption in Russia in 2022 amounted to 1028 million toe (tons of oil equivalent). Since 2000, energy consumption has increased by 20%, since 2010 – by 11%. Alongside the growing demand for energy sources driven by economic growth and the rising standard of living, energy-saving processes are developing, leading to a reduction in their use. For example, energy intensity of GDP in 2021 was 7.3 toe per million rubles in constant 2021 prices, a decrease of 8% compared to 2015 and 19% compared to 2005⁵. According to other estimates, there was a 2.7-fold decrease in energy intensity of GDP⁶ between 2000 and 2021 (Sokolov, 2023a).

For comparison, European economies have energy intensity 2.5 times lower, the United States – 1.8, Japan – 2.2, China – 1.2 (Sokolov, 2023b). The energy intensity of GDP in these countries is decreasing: in the period 2000–2022, according to the World Bank, it decreased by an average of 32% in European countries, by 38% in the United States, by 42% in China. These states differ from Russia in their level of economic development, energy and power supply management, climatic conditions, principles of energy consumption in households.

The annual per capita consumption of energy resources has increased by 9% since 2015, reaching 1.2 toe in 2022. At the same time, annual per capita heat supply per living area has decreased by 28% since 2010, being 0.11 Gcal/m² in 2022⁷. Per capita

⁵ According to Rosstat. Available at: <https://rosstat.gov.ru/folder/11189>

⁶ Calculated in US dollars (PPP).

⁷ Terentieva A.S. (2024). District heating sector in Russia: Analysis of the condition and forecast of the development in the context of new investment mechanisms. Candidate of Sciences (Economics) dissertation abstract. Moscow. 147 p. Available at: <https://ecfor.ru/wp-content/uploads/2024/10/investitsionnoe-razvitie-sektora-tsentralizovannogo-teplosnabzheniya-v-rossii.pdf>

energy consumption in Russia is similar to that of Finland, Sweden, Belgium, the Netherlands, and South Korea. It is 1.9 times higher than in Europe and 1.3 times higher than in the United States⁸. This means that the identified potential for improving energy efficiency is concentrated not in physical energy consumption (Russia is close here to the group of developed countries with similar climatic conditions), but in the efficiency of its conversion.

For example, trends of GDP energy intensity and per capita heat consumption show that Russia reduces energy use. At the same time, it still has significant room for increasing energy consumption efficiency when compared to developed and developing countries. As a result of implementing energy efficiency and energy conservation programs, an average of 1–2 million toe is saved annually. Such programs receive annual funding of about 170 billion rubles⁹.

Methodology for assessing potential

We use a combination of sectoral analysis and a scenario-based approach to assess possible reduction in energy consumption. The study identified four key economic sectors that contribute to total energy consumption: energy, housing and utilities, industry, and transport.

We selected the most promising energy-saving technologies for each sector based on an analysis of modern Russian and foreign practical technological solutions. The selection criteria were technical efficiency and possibility of within-country distribution with appropriate government support. Each technology potential was calculated by comparing current energy consumption levels and the equipment fleet structure with technology-driven target parameters. The target integration values (hypotheses) were determined based on strategic documents, research institutes forecasts, and expert

assessments regarding the maximum possible level of technology penetration under favorable economic conditions and a consistent incentive policy. The methodological approach for assessing potential is based on balance settlements and combines two direct calculation mechanisms:

- normative effect and scaling method (a “bottom-up” approach), where the result is achieved by increasing energy use efficiency within an existing technology or process (for example, in housing and utilities, industry); it is calculated as the energy saved by technology adoption (for example, a heat pump), multiplied by its total projected technically achievable quantity in Russia.

- structural technological substitution (the “top-down” approach) – the effect is achieved by reformed production or consumption structure, rather than by individual unit efficiency (for example, when coal-based power generation is replaced by renewable energy sources (RES), or when the share of electric vehicles in fleet composition increases); in this case, the effect is calculated as the share of transformed technology or fuel type in the overall structure of the sector (electricity production, fleet composition), given the total volume of sector production or consumption.

Direct calculation based on per unit standards and target structural shares determines physically justified upper limit for primary energy savings in each sector. The choice between two calculation methods depends on a specific technology and its effects. The total sector potential is the sum of factors for all considered solutions and measures. A similar division of effects into “unit efficiency” and “structural shift” is also used in foreign cross-country energy intensity studies (Gonzalez-Torres et al., 2021).

⁸ According to the Statistical review of world energy data – Energy Institute.

⁹ On the state of energy conservation and energy efficiency improvement in the Russian Federation in 2022 (2024). Ministry of Economic Development of the Russian Federation. Moscow. 154 p. Available at: https://economy.gov.ru/material/file/b2ec92f00344707af95c8d44a6abbde8/Energy_efficiency_2023.pdf (accessed: 11.11.2025).

Foreign research on energy efficiency is developing in several directions. N. Apergis and H. Fahmy show that geopolitical risks and energy prices volatility significantly affect energy efficiency at the macro level; however, their analysis is limited to price shocks and does not address structural technological growth points (Apergis, Fahmy, 2024). The foundations of energy-saving policy in buildings, formulated back in the 1980s by A. Rosenfeld and D. Hafemeister, were further developed in the works of J. Dulac and H.-S. Mun and their co-authors, who quantitatively assess the energy-saving potential in buildings and agribusiness – but they consider them in isolation from other economic sectors (Rosenfeld, Hafemeister, 1985; Dulac, 2017; Mun et al., 2025). The industrial segment is examined in the works of D. Ma and colleagues, M. Ali and S. Evans, as well as N. Bolson and co-authors – they provide a detailed analysis of production electrification and decarbonization technologies but remain limited to specific industries or country samples and not compared with other sectors (Ma et al., 2025; Ali, Evans, 2025; Bolson et al., 2026). Other foreign studies examine individual drivers of energy efficiency improvement. For example, M. Sohail and colleagues demonstrate that digital technologies adoption reduces energy consumption without compromising production growth (Sohail et al., 2024). M. Madaleno, M. Robaina, and M. Diaz have proven the effectiveness of subsidies and tax incentives for factories modernization, while L. Zhang and co-authors have assessed energy-saving potential in transport (Madaleno et al., 2024; Zhang et al., 2024).

In Russian science, systematic energy efficiency research is conducted at the Energy Research Institute of RAS, Melentiev Energy Systems Institute of RAS, CENEF-XXI, HSE and other science centers. A methodological contribution

to the analysis of this topic at the macro-level was made by V.S. Arutyunov, A.V. Arutyunov and G.V. Lisichkin, who justified the limited effect of certain clean energy types on economic development, which sets the upper limit for using renewable generation as an energy efficiency tool (Arutyunov et al., 2026). Sectoral assessments of cogeneration technologies in the energy sector are presented in the work by M.D. Dilman and S.P. Filippov (Dilman, Filippov, 2025); low-carbon technologies in buildings are investigated by I. Bashmakov and co-authors (Bashmakov et al., 2023).

To sum up, existing studies (both foreign and Russian) are substantively developed within the boundaries of individual sectors (buildings, industry, agribusiness) or isolated factors (prices, geopolitics), but they do not offer a comparable cross-sectoral assessment. Furthermore, there are no studies among recent works that rank measures according to their economic feasibility and identify options offering short payback periods.

Technologies for energy efficiency improvement

Many energy-efficient technologies develop acceleratively and do not require special measures to be used. This includes the adoption of more energy-efficient materials and technologies in construction, household appliances, lighting methods, vehicles running on more efficient types of fuel, etc. Other solutions are relatively expensive for widespread adoption. However, they have high efficiency and can be actively used with government support (restrictions, quotas, etc.).

Next, we will examine technologies that will not develop by themselves. They are distributed across sectors in order of their energy consumption level and potential to reduce it: the energy sector (electricity and heat production, including operational fuel consumption, transmission and transformation losses) accounts for 28% of energy consumption; housing and utilities (residential

sector, services, etc.) – 26%; industry – 30%; transport – 16%¹⁰.

Energy-efficient technologies in the energy sector

The most environmentally friendly, modern, and efficient energy sector technologies for generating electricity are considered to be renewable power (wind and solar), biofuels, nuclear power plants, and hydroelectric power plants. Renewable sources do not use fossil resources, while thermal power plants do and release into the environment 40–60% of the fuel burned (Ainullov et al., 2022). However, building expenditures for renewable power plant types are higher than for thermal power plants, although the cost of electricity from wind, solar, nuclear, and hydroelectric power plants is lower. Furthermore, all these renewable energy facilities also have a negative impact on the environment in addition to their positive effects. For example, the construction of hydroelectric plants significantly alters the ecosystem and river flow patterns; nuclear stations carry the risk of radiation accidents; solar panels are produced with a large number of toxic and explosive components¹¹. This is only part of the environmental threats associated with the construction and use of renewable energy generation technologies.

Nevertheless, it is necessary to consider the possibilities of using renewable technologies, taking into account the country's resource capabilities, negative environmental consequences, the current power industry structure and its capacity, as well as the existing power and heat markets.

It would also be advisable to consider options for optimizing the capacity utilization in the power industry and heat supply, since underutilization is common now (Semikashov, Terentieva, 2024). In

this case, some boiler houses can be closed, while others can be converted into mini-CHP (combined heat and power plants), which would allow reducing the per unit fuel consumption at heat supply sources by 21 kg of oil equivalent.

Options for using distributed energy technologies can also be considered. Storage systems at consumers' sites and at differentiated generation facilities allow accumulating and releasing electricity, thereby influencing the capacity market and optimizing the processes of energy production and transmission. Smart grids and demand management technologies optimize consumption processes, which can reduce system costs and peak loads, as well as the need for peak capacity. According to experts from Energy Research Institute of RAS, small distributed power generation based on modern gas turbines provides a systematic reduction in the per unit consumption of oil equivalent due to a higher technological efficiency of the equipment compared to the old steam power assets of large plants (Dilman, Filippov, 2025).

Energy-efficient technologies in housing and utilities

Energy-efficient technologies in terms of housing and utilities can include construction technologies (passive and active houses), heating and energy production technologies (heat pumps), as well as energy consumption regulation technologies (smart systems and meters).

Smart energy consumption regulation systems include meters, smart outlets, various sensors, programmable thermostats, etc. They reduce electricity costs for lighting and electrical appliances by 15–20 %. Programmable thermostats, radiator

¹⁰ Hereinafter, if not specified, the shares of sectors in energy resource consumption are calculated based on the Rosstat fuel and energy balance (2022).

¹¹ Degtyarev K.S. (2015). Renewable energy sources and side environmental effects. SOK, 5. Available at: <https://www.c-o-k.ru/articles/vie-i-pobochnye-ekologicheskie-effekty> (in Russian).

and motion sensors, use of different heating modes can reduce energy costs for indoor heating by 25-35%¹². Technological potential estimates of automation and modernization of buildings are consistent with the expert conclusions from CENEF, where key low-carbon solutions for the Russian housing stock are rigorously analyzed (Bashmakov et al., 2023).

Heat pumps provide heating via temperature difference between the building and the ground or outdoor air. The cost savings are up to 80%¹³. According to IEA estimates, heat pumps will account for up to 45% of heating energy demand by 2050¹⁴.

Passive and active house technologies is a comprehensive construction concept (involving design and materials) which supposes that the building does not use additional energy (passive house)¹⁵, or even generates it enough for others purposes (active house). Such a building effectively utilizes solar energy, internal sources, and heat recovery. The house's energy consumption is minimal due to improved thermal insulation, air-proof building envelopes, and energy-efficient engineering equipment.

Energy-efficient technologies in industry

Here technologies provide the most effective and secondary use of resources (circular economy), for example, when producing alumina, cellulose, clinker; transition to the latest technological processes and technologies (cast iron, electric steel, aluminum, fertilizers, synthetic ammonia, synthetic rubber); elimination of some energy-intensive technological processes (replacement of the open-hearth method of steelmaking, efficient

electric motors); automation (iron ore mining); improvement of accounting systems and energy management.

Energy-efficient technologies in transport

Promising transport energy technologies are railroad and electric transportation. We will focus on electric transport developments, since the potential of railroad transport has already been sufficiently realized.

Electric vehicles use modern battery systems and can be considered as a replacement for vehicles with combustion engines. Currently, the technology is being actively implemented in passenger vehicles, but it may be also applied to public, freight, and commercial transportation in the future¹⁶. The use of electric vehicles leads to a reduction in demand for petroleum products and an increase in the need for electricity. Overall, fuel consumption decreases if the country's electric power industry is efficient (with a large share of hydroelectric, nuclear power, high efficiency of thermal power plants with sufficient fuel capacity utilization).

Changes in the structure and concept of road transport can lead to a more efficient distribution of energy resources. For example, transition from personal vehicles to car sharing services, as well as the spread of public transport, can be considered measures to improve energy efficiency.

The list of productive technologies is extensive (those applicable to gas, oil, and coal extraction; agriculture; hydrogen development, etc.), and most of them are not investigated in the article. However, we put our emphasis on the most promising technologies with the greatest potential in the Russian context.

¹² How to save electricity with a smart home system. Inzhenernye seti. Available at: <https://eng-net.ru/blog/kak-economit-s-sistemoi-umnii-dom/> (accessed: 06.12.2024).

¹³ Heat pump for heating a private house. Pros and cons. MAST Dom. Available at: <https://www.mact-dom.ru/advice/poleznaya-informaciya/kupit-teplovoy-nasos-ili-druguyu-sistemu-otopleniya-dlya-doma> (accessed: 06.12.2024).

¹⁴ World Energy Outlook 2025. Paris: IEA, 2025.

¹⁵ A building is considered passive if its thermal load does not exceed 10–15 W/m² of living space.

¹⁶ Rostovski J.-K. (2024). Assessment of the impact of electric vehicle markets on the prospects for Russian industries. Candidate of Sciences (Economics) dissertation abstract. Moscow. 27 p. Available at: <https://ecfor.ru/wp-content/uploads/2024/03/avtoreferat-rostovskij-j.-k.pdf>

Assessment of the potential reduction in energy consumption after technologies adoption

Table 1 shows the estimated potential of the technologies described above and proposes conditions for their adoption.

The growth in the share of renewable sources (including nuclear and hydro power) in electricity generation from 10 to 30% corresponds to the Russian Energy Agency technological development scenario¹⁷. Reduction in the number of fossil fuel power stations while generating the

same amount of electricity and heat saves up to 150 million toe.

Better utilization of existing capacities in the electric power industry and heat supply supposes an increase in the share of CHP from 45 to 80% in heat production and the predominant use of cogeneration at heat supply facilities, which will cause dissolution of some inefficient boiler houses and increase in CHP share of power generation. This will lead to a reduction in fuel consumption by 30–40 million tons.

Table 1. Potential reduction in energy consumption after adoption of energy-efficient technologies by sectors, 2024

Technology	Criterion	Potential reduction of energy consumption, million toe
Energy		
Renewable energy (wind, solar, nuclear, hydro, biofuel)	30% of energy is renewable, reduction in fossil fuel utilization	150
Fossil fueled power plants (improved utilization of capacity, dissolution of some boiler houses)	Increase in the share of CHP to 80% in heat production, predominant use of cogeneration	30–40
Smart grids, distributed energy systems (generation), storage and demand management systems	Optimization of distribution on smart grids and energy storage systems, demand management, distributed generation of about 36–68 GW	30–50
Housing and utilities		
Intelligent systems and meters	All households use meters and intelligent energy consumption regulation systems to varying degrees	50
Heat pumps	18 million heat pumps	44
Passive and active houses	10% of zero-energy buildings in the stock of buildings	24
Industry		
Energy-efficient technologies in metallurgy, cement and chemical industries		52
Transport		
Electric vehicles	19 million or 40% of EV in the stock of vehicles	34
Mass transit and car sharing	2–3% of car sharing in million-plus cities, 50% of mass transit	10
Total		424–454 (44% of current consumption)
Calculated based on: Rosstat fuel and energy balance. Available at: https://rosstat.gov.ru/storage/mediabank/5RIE0jgu/en_balans.htm ; (Milyakin, 2022; Milyakin, Skubachevskaya, 2024); Distributed energy in Russia: Perspectives. Moscow: Energy Center of the Moscow School of Management Skolkovo. 87 p. Available at: https://energy.skolkovo.ru/downloads/documents/SEneC/Research/SKOLKOVO_EneC_DER-3.0_2018.02.01.pdf (accessed: 09.12.2025).		

¹⁷ Scenarios for world energy development until 2050. Moscow: Russian Energy Agency. 130 p. Available at: <https://rosenergo.gov.ru/press-center/news/stsenarii-razvitiya-mirovoy-energetiki-do-2050-goda/> (accessed: 05.12.2025).

Distributed energy technologies, according to Energy Research Institute of RAS estimates, can provide 36–68 GW¹⁸, which will ensure fuel savings after the introduction of highly efficient gas turbines with increased efficiency. This will reduce energy consumption by additional 30–50 million tons. To sum up, energy-efficient technologies adoption in the energy sector can potentially save 260–290 million toe.

Intelligent systems, electricity and heat consumption meters can potentially reduce electricity consumption by 15–20% and heat consumption by 25–35%. This effect is extrapolated to 52 million Russian households according to their structure (different values for individual and multi-apartment buildings). The following hypothesis is being tested: 30% of households reduce consumption by 50%, 70% of households – by 25%. Thus, the use of intelligent systems and meters by households could reduce energy consumption by 50 million toe.

The growth in the number of heat pumps from 16 to 18 million supposes their use in 60% of buildings. This heating method reduces costs by 80%. This effect, multiplied by the target number of heat pumps, will reduce energy consumption by 44 million toe.

Passive and active houses expansion in the stock of buildings from 2 to 9% implies a reduction in energy use by 24 million toe due to ultra-low per unit energy consumption compared to standard objects. To sum up, energy-efficient technologies adoption in the housing and utilities sector can potentially save 120 million toe.

The industry uses CENEF technological estimates for basic energy-intensive branches (metallurgy, chemistry, building materials – specific solutions were described in the previous section) – 52 million tons¹⁹ of potentially saved energy – which is based on the possible adoption of the best available developments and energy management systems.

The expansion of electric vehicles from 0.1% to 40.5% predicted by IEF RAS²⁰ in a positive scenario for electric transportation development causes the replacement of cars with combustion engines, which saves 34 million tons of petroleum products.

The transition to mass transit (increase to 50%) and car sharing (from 1.3% to 2–3% – according to works of colleagues from IEF RAS) in million-plus cities suggests a reduction in per unit energy consumption compared to personal vehicles and saves 10 million tons of petroleum products (Milyakin, 2022; Milyakin, Skubachevskaya, 2024).

In total, the potential reduction of fuel consumption in transport after adoption of technologies described above is 44 million toe.

The overall potential reduction in energy consumption, according to the author's estimates (provided that all the above technologies are adopted) can reach 470–500 million toe, which is up to 50% of current energy consumption. It can also decrease carbon dioxide emissions by 1.1–1.4 billion tons per year which is up to 65% of current Russian total CO₂ emissions.

This value is not a forecast or a target indicator, but a calculated upper bound of technically feasible

¹⁸ On the state of energy conservation and energy efficiency improvement in the Russian Federation in 2022 (2024). Ministry of Economic Development of the Russian Federation. Moscow. 154 p. Available at: https://economy.gov.ru/material/file/b2ec92f00344707af95c8d44a6abbde8/Energy_efficiency_2023.pdf (accessed: 11.11.2025).

¹⁹ Low-carbon technologies and potential for reducing greenhouse gas emissions in the Russian Federation. CENEF. Available at: <https://cenef-xxi.ru/categories/11#> (accessed: 03.12.2024).

²⁰ Rostovski J.-K. (2024). Assessment of the impact of electric vehicle markets on the prospects for Russian industries. Candidate of Sciences (Economics) dissertation abstract. Moscow. 27 p. Available at: <https://ecfor.ru/wp-content/uploads/2024/03/avtoreferat-rostovskij-j.-k.pdf>

reduction in consumption. The economic efficiency of the considered technologies is out the scope of this study. However, we assume that only a small piece of the identified potential is economically feasible in the current market environment. Intersectoral, environmental, social and budgetary effects should be considered when implementing the solutions discussed.

The level of localization of the proposed developments is also important. It is indicative that a large part of distributed energy technologies, renewable energy sources, industry technologies, electric vehicles, heat pumps and passive houses can be implemented using Russian inventions or the help of friendly countries.

Consequences and barriers

The realization of this energy efficiency potential can have a significant effect on key macro-economic and cross-sector parameters.

The defining consequence will be the transformed energy budget with lower demand for fossil fuels and higher electricity consumption. This process creates fundamentally new conditions for power industry development, requiring not only an increase in generating capacity to meet energy needs but also changes in their operation modes, grid infrastructure improvement, the adoption of smart demand management systems.

Fuel industries will face the reduction in domestic demand and the need to focus on export markets, which will be challenging in the context of the global energy transition and sanctions. Lower energy intensity of GDP caused by reaching the potential will contribute to domestic producers' price competitiveness and independence from energy prices fluctuations. More efficient energy consumption in housing and utilities will reduce the burden on household budgets and improve the standard of living.

An important macroeconomic consequence will be the multiplier effect of investments in

energy efficiency, which, unlike investments in the extraction and transportation of energy resources, is characterized by a higher job creation rate per invested ruble and contributes to the localization of equipment in manufacturing industries and construction.

The environmental effect, accompanied by a reduction in greenhouse gas emissions, allows Russia to participate in international climate projects and reduces the risks associated with carbon regulation measures. At the same time, the listed effects are possible only to the extent that the set of constraints hindering energy-efficient technologies adoption is overcome in the current economic and institutional conditions.

Economic constraints are associated with significant initial capital expenditures and relatively long payback periods, despite the high efficiency in the long term. Even projects with a positive return on investment may remain unimplemented due to expensive loan proceeds and limited investment resources. Institutional barriers include the absence of economic incentives to improve energy efficiency, the existing pricing pattern, the ownership structure, and state regulation principles in the power industry and heat supply.

A significant limitation in industry is the production structure inherited from the Soviet period, within which many technological processes were originally designed without considering energy efficiency, and their deep modernization requires not just replacing equipment, but restructuring the entire production chain. Technological limitations include dependence on imported key components of energy-efficient equipment, which may create risks for large-scale programs under conditions of sanction pressure.

The barrier in housing and utilities is the low purchasing power: only subsidies and preferential lending programs allow making even potentially profitable investments.

Table 2 presents the areas that have the greatest potential in terms of the combination of economic effect and feasibility factors. They were selected based on three criteria: contribution to reducing energy consumption; the presence of a clear economic agent that can realize the potential; the possibility of applying support measures in the medium term. An aggregated cost assessment of the potential energy consumption reduction has also been provided, which helps to translate technical indicators into budget planning values and investment decisions. Technologies that require strategic planning and long-term investments, such as large-scale power generation construction, should be considered separately.

The institutional barrier is apparently the most challenging among the listed constraints: even in the context of accessible loan proceeds, the existing

model of tariff regulation and the ownership structure in the power and heat sector do not create a direct economic incentive for most market participants to improve energy efficiency, whereas economic and technological barriers can be largely addressed through targeted support measures.

Conclusion

The calculated potential for the adoption of energy-efficient technologies demonstrates the possibility of significantly reducing energy consumption in Russia – by up to 50% of the current level. This figure represents the estimated upper bound, which shows the actual limits and contributes to a realistic understanding of the scale.

It is crucial to comprehend the heterogeneity of this potential. On the one hand, there are some simple options offering short payback periods: adoption of metering, elimination of losses,

Table 2. Key sectors contributing to energy consumption reduction: expected effects and proposals

Sector	Key technologies	Economic effect*	Agent responsible for realization	Content	Proposals
Energy	CHP optimization, distributed generation, dissolution of inefficient boiler houses	150–250 billion rubles	Generating companies, municipalities, transmission system operator	Reduced per unit fuel consumption, fewer losses in networks and inefficient capacities	Tariff solutions (stimulation of cogeneration); preferential lending for modernization projects; development of technical regulation
Housing and utilities	Heat pumps, smart metering systems	470 billion rubles	Households, management companies, developers	Reduced utility payments, saved budget funds for subsidies	Subsidies for households; mandatory installation of metering systems within major repairs; preferential lending and interest rate subsidies for developers; inclusion of heat pumps in social gasification programs
Industry	Modernization, energy management	260 billion rubles	Large industrial enterprises	Reduced product costs, increased competitiveness in foreign markets	Tax incentives (income tax benefits); preferential loans for modernization; support for energy management
Transport	Electric vehicles, development of mass transit and car sharing	220 billion rubles	Automakers, taxi fleets, population, regional authorities	Reduced petroleum imports, fuel savings	Development of charging infrastructure; subsidies for EV production; support for car sharing and mass transit programs
* The annual economic effect is calculated as the cost of saved fuel at the average price of natural gas converted to industry oil equivalent in 2024 and does not include additional effects (reduction of investments in new generation, environmental effect, etc.). Source: own compilation.					

optimization of operating modes, basic automation systems. These measures can produce a tangible effect without large-scale capital investments – and economic policy should focus on them in the short term. On the other hand, there are technologies that require a profound modernization of facilities and energy supply, which is feasible only in the long term with effective financing mechanisms available.

Even partial realization will lead to significant macroeconomic consequences: a transformation of the energy budget with a reduced demand for fossil fuels and increased electricity consumption, enhanced price competitiveness of producers, a lighter burden on household budgets, a multiplier effect on employment in manufacturing industries and construction, as well as a significant environmental effect.

A set of barriers constrain the realization. First, economic constraints, manifested in significant initial capital expenditures, long payback periods, and the high cost of loan proceeds, which often prevent even profitable projects from being implemented. Second, the institutional barrier, reflected in the existing tariff regulation system and the ownership structure in the power and heat sector, which does not create a direct economic incentive to improve efficiency. This constraint is the most challenging: even financial well-being cannot resolve it. Third, a technological barrier – dependence on the import of key equipment components under conditions of sanctions pressure. Fourth, a barrier in manufacturing, which modernization requires restructuring the entire technological chain, rather than just replacing equipment on an individual basis. Fifth, a barrier in housing and utilities, manifested in the low purchasing power, which makes even profitable measures unaffordable without subsidies.

Economic and technological barriers can be overcome using targeted support measures, whereas the institutional barrier requires reorganization of

the entire electricity and heat markets. When developing support measures, the specific nature of the barriers in different sectors should be considered. In the power industry, the emphasis should be put on the reorganization of its market, as well as on economic incentives for capacity optimization. In the housing and utilities sector, targeted subsidies for low-income households should be accompanied by a system of technical regulation and accessible credit mechanisms for implementing energy-saving elements within major repairs. In industry, the most effective tools seem to be tax incentives and voluntary energy management mechanisms. In the transport sector, the priority is to create charging infrastructure for electric transport and to develop mass transit as the most energy-efficient in large cities.

The key principle of the policy should be the idea that a large part of the technically feasible energy savings will not be implemented for economic reasons, since the cost of the saved energy may exceed the cost of its production. The goal is not to reach the calculated upper bound at any cost, but to create conditions for the implementation of economically efficient measures, including those that influence the development of the Russian economy – both by increasing the output of Russian energy-efficient equipment, by reducing energy costs, and ultimately by enhancing the efficiency and competitiveness of energy-consuming industries.

The direct economic effect of implementing the described measures (the cost of fuel saved annually) could be up to 1.3 trillion rubles, or about 0.6% of GDP. This estimate does not consider complex cross-sector interactions and demonstrates the general value of the direct effect. After taking into account multiplier effects, the total contribution to GDP can be comparable to several percent, but such an assessment requires a separate cross-sector study.

The remaining potential will then remain a budget funds and keep a focus on truly achievable reserve in case of changes in relative prices or results that can ensure a real increase in the the emergence of more efficient technologies. competitiveness of the Russian economy and an This approach will help avoid the inefficient use of improvement in the quality of life.

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



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

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

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

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Introduction

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Literature review

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Methods and data

The study was conducted in several stages.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Research results

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

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

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

Table 2. Quality criteria of two-step clustering

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

Table 3. Fragment of the agglomeration schedule (clusters)

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

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

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

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

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

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

Table 4. Mean values of indicators by cluster

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

Table 5. Distribution of Northwestern Federal District towns by cluster

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Conclusions

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

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

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

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

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

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

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

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

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

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Use of AI Tools

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

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Current Issues in the Development of a Regional Economic Security Monitoring System



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Abstract. The article addresses issues of economic security in Russia's regions. The relevance of the study stems from the need to transform the country's existing economic security framework in light of the considerable disparities among the constituent entities of the Russian Federation. The aim of the work is to develop an approach to monitoring regional economic security based on a vector entropy model. The research identifies three fundamental properties of a socio-economic system – stability, resilience, and progressive development – to be used in the comprehensive monitoring of a territory's economic security. The paper presents a vector entropy model that decomposes the total entropy of the system into components: measures of disorder, self-organization, development, and stability, along with the results of testing the model on Rosstat data for Russia as a whole and for five constituent entities (Moscow, Moscow Region, Sverdlovsk Region, Vladimir Region, and Amur Region) covering the period 1992–2024. The monitoring results reveal regional differentiation in the resilience and adaptability of socio-economic systems. An analysis of the entropy-monitoring findings shows that, in the current period (since the early

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2020s), the economic security of Russia's regions is only partially assured. The mounting number of new challenges and threats exposes the limitations of the existing adaptation mechanisms. The observed rise in the system's disorder, without a commensurate rise in self-organization, indicates that its short-term adaptive capacity is exhausted. The system's dynamism comes at the price of greater vulnerability, as reflected by declining stability amid growing development. The conclusions underscore the need for a differentiated approach to ensuring economic security that takes regional specificities into account. The proposed model can serve as a tool for adjusting strategic directions, prioritizing government support measures, and building adaptive mechanisms to respond to emerging challenges.

Key words: economic security, vector entropy model, stability, resilience, progressive development.

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Introduction

The scientific substantiation and development of mechanisms for ensuring the economic security of Russian regions are becoming particularly relevant amid growing socio-economic challenges and a highly dynamic external environment. The strengthening role of regions in implementing national economic interests necessitates the transformation of the existing system of economic security assurance in the country. The considerable differentiation among the constituent entities of the Russian Federation in terms of the level and pace of infrastructural, industrial, social, and innovative development calls for the formation of differentiated approaches that account for regional specificities and provide adaptive response mechanisms to changes for each region. The central scientific and practical task is to develop a regional system of economic security assurance based on effective support for managerial decision-making and implementation processes. Addressing this task presupposes the preliminary identification of each region's development trajectory, which will create a basis for timely adjustment of strategic directions and the design of effective protective mechanisms.

Research approach

In modern studies of economic security, the indicator method dominates; it involves quantitatively assessing its level by comparing the actual

values of indicators with established threshold values. This approach has received official recognition (the indicator systems of S.Yu. Glazyev and V.K. Senchagov) and was implemented at the state level within the framework of the State Strategy for Economic Security of 1996 (Tseikovets, 2016). However, despite its widespread use in scientific research, the indicator approach faces a number of methodological problems. Researchers at the Financial University rightly point out that one of the most problematic aspects of the methodology is the definition and use of threshold (extremely critical) values of the indicators selected for assessing and analyzing the state of security (Pobyvaev et al., 2018). In many cases, threshold values are determined based on expert assessments, which introduces an element of subjectivity. Furthermore, as G.B. Kleiner notes, the theory of maximum permissible indicators considers each indicator together with its maximum value for the country's security, but does not take into account their interdependencies, substitutability, and complementarity (Kleiner, 2016). However, the economy is a complex dynamic system in which a change in one parameter can have multidirectional effects on other indicators. To overcome the identified limitations and increase the reliability of the assessment, S.Yu. Glazyev and V.V. Lokosov propose expanding the expert testing of the

method of extremely critical indicators through imitation design and modeling of social processes based on the analysis of statistics, empirical data, probabilistic analysis, and the construction of threat graphs. They also suggest taking into account important features of how society functions when building and using the system: the compensatory mechanism of interaction between the structures and elements of the system, the synergistic effect, and the “domino principle” (Glazyev, Lokosov, 2012). However, the increasing complexity of analytical tools is associated with certain difficulties in practical application. The growing complexity of the methods limits their use in the process of making management decisions. Moreover, rapidly changing external and internal conditions require a flexible approach to selecting and adjusting indicators and their thresholds, which is difficult when using cumbersome models. As it is noted in the report by the Institute of Economics of the Russian Academy of Sciences, the system of state management of economic security is severely lacking a modern monitoring component that would reflect the established methodological traditions of modern science, the rapid global and internal changes, as well as the development of strategic planning and management reforms¹. L.A. Belyaevskaya-Plotnik emphasizes that the existing practice of indicative monitoring limits the management potential in the field of economic security, as it is focused on tracking indicators rather than analyzing the effectiveness of government measures and the coherence of strategic documents in this area (Belyaevskaya-Plotnik, 2025). The current situation leads to the fact that the diagnosis of economic security is carried out quite effectively, while the assessment of the effectiveness of the measures taken remains insufficient. Figuratively speaking, we diagnose the “disease” well, but we have a poor understanding of how well the

“prescribed treatment” matches the diagnosis and whether it will lead to recovery.

A number of authors emphasize the importance of the stability of a socio-economic system for ensuring its economic security. O.V. Mikhalev notes that stability, in conjunction with other primary qualities of the system — namely, reliability, manageability, and self-organization — ensures its vitality, i.e. a relatively long period of the system’s existence during which it performs its main inherent functions, striving to achieve its set goals, and also contributes to its efficiency, which ultimately shapes the system’s security (Mikhalev, 2010). S.A. Afontsev characterizes economic security exclusively through the concept of “stability”. According to his interpretation, national economic security is the resilience of the national economic system to endogenous and exogenous shocks of economic or political origin, manifested in its ability to neutralize potential sources of shocks and minimize the damage associated with shocks that have actually occurred (Afontsev, 2002). In his view, stability is a state of the economic system that can be disrupted by endogenous and exogenous shocks, while resilience is the system’s ability to maintain or restore stability in the face of these shocks. T.Yu. Feofilova and E.V. Radygin view economic resilience as the highest form of economic security, when the system remains within the defined parameters. According to their position, even if resilience is disrupted, the system remains in a state defined as “economic security,” since it expends resources to prevent damage to itself. They believe that stability is a dynamic category, so the defined parameters change over time, but at the same time, it is not equivalent to development (Feofilova, Radygin, 2024). For economic development, a temporary loss of economic stability is possible.

To build flexible and reliable systems for assessing economic security, it is necessary to have

¹ Gorodetskii A.E., Belyaevskaya-Plotnik L.A. (Eds). (2025). On the Development of Methodological Approaches to the Definition, Measurement, and Management of Economic Security. Moscow: IE RAS. 68 p.

a clear understanding of the content of the concept itself and its key characteristics, as this allows for an adequate interpretation of the state of the economy. According to L.I. Abalkin's definition, economic security is a set of conditions and factors that ensure the independence of the national economy, its stability and resilience, and its ability to constantly renew and improve (Abalkin, 2002). Developing this approach, scientists from the Ural School of Economic Security Research adapted it to the regional level. In their interpretation, the economic security of a region is understood as a set of conditions and factors characterizing the current state of the economy, the stability, resilience, and steady progress of its development, and the degree of its independence and integration with the economy of the Federation (Tatarkin et al., 1996). This approach to the content of the concept shows that the emphasis on ensuring economic security shifts at different levels of management. At the state level, the key priorities for ensuring economic security are independence, sovereignty, and the ability to self-sustain; at the regional level, they are the preservation of a unified economic space and territorial connectivity. However, regardless of the level of management, the basic characteristics that determine the provision of economic security are stability, resilience, and the progressive development of the socio-economic system.

Thus, to monitor the maintenance of economic security, it is required a combination of these three characteristics of the socio-economic system:

- system stability – a situation in which there are no significant random changes in indicators.
- system resilience – the ability to perceive changing conditions and adapt to them, as well as to withstand failures and recover quickly from them.
- the progressive development of a system – a characteristic of directed change, expressed in the

preservation of the overall development trajectory despite the presence of local fluctuations² (Ayyub, 2014).

Structural shifts in the economy can create imbalances, increase risks, and temporarily destabilize the system; conversely, an excessive focus on stabilizing the economy can hinder development. Therefore, in studies aimed at ensuring economic security, it is advisable to use a systemic approach, within which the territory is viewed as a complex system with many interacting components. The studies of A.I. Tatarkin and D.A. Tatarkin emphasize that the stability of any complex system, when minimizing risks, requires the coordination of all its parts within the integrated whole and is determined by the balance between order and disorder; a disruption of this balance leads to malfunctions in functioning, loss of development guidelines, and the collapse of the system. According to them, the level of stability of an economic system that ensures its self-development consists of two components: the majority of processes within the system that maintain “order” and stability, and a smaller part of the factors that destabilize the system's self-development and undermine its stability – the total value of which equals one (Tatarkin, Tatarkin, 2010a; Tatarkin, Tatarkin, 2010b).

One of the common approaches to analyzing the reliability of complex systems is the use of multivariate copula functions. They allow separating the dependence structure from the marginal distributions, which makes them a flexible tool for constructing multivariate stochastic models (Behrendorf et al., 2019; Li et al., 2021; Dewick, Shuangzhe, 2022). However, finding an appropriate copula structure is not a trivial task; it suffers significantly from the “curse of dimensionality” and requires large data samples, which is unfeasible in macro-economics (Li et al., 2021).

² According to: Economic stability. The Great Russian Encyclopedia. Available at: <https://bigenc.ru/c/ekonomicheskaja-stabil-nost-8890fd> (accessed: 08.04.2026).

Furthermore, specific types of distributions do not in themselves affect the risk, so refining them seems unnecessary in risk analysis tasks.

A fundamental characteristic of any systems exhibiting ambiguous or probabilistic behavior is entropy (Klimontovich, 2002; Haken, 2006; Prigogine, 1967).

The concept of entropy is often used in modern science to describe behavior, structural organization, and disorganization, as well as the degree of disruption of connections between elements of various systems (Purvis et al., 2019; Jakimowicz, 2020; Ishii et al., 2022). However, as a rule, Shannon's information entropy is used, which does not allow for an explicit consideration of the behavior and interrelationships between elements and subsystems (Shannon, 1948).

A universal characteristic is known – it is a functional of the probability density $p_Y(x)$ of the m -dimensional continuous random variable Y :

$$H(Y) = - \int_{-\infty}^{+\infty} \dots \int_{-\infty}^{+\infty} p_Y(x) \ln p_Y(x) dx, \quad (1)$$

in particular, for a one-dimensional random variable: $H(Y) = - \int_{-\infty}^{+\infty} p_Y(x) \ln p_Y(x) dx$.

Formula (1) was proposed by Claude Shannon as a formal analogue of information entropy for continuous messages (Shannon, 1948). Later, I.M. Gelfand, A.N. Kolmogorov, and A.M. Yaglom studied this quantity and called it differential entropy (Gelfand et al., 1958).

Within the framework of this study, it is proposed to use a vector entropy model to monitor the basic characteristics of ensuring the economic security of a region. This model is based on decomposing $H(Y)$ into two components – the “measure of chaos” and the “measure of self-organization” (Dewick, Shuangzhe, 2022). This approach makes it possible to obtain a more accurate picture of the system's state, to assess its stability, resilience, and forward momentum in development, which directly

characterizes the provision of economic security in the region (Ayyub, 2014).

Vector entropy model

We will use a systems approach since systems can be different and have different efficiency criteria. Ensuring the economic security of a region can be quantitatively assessed and qualitatively interpreted within the framework of a vector entropy model. Let us consider the change in entropy over time using the example of a Gaussian data representation: 1) the use of the normal distribution law is based on the central limit theorem; 2) the analyzed samples are small, which does not allow identifying the distribution law of the random vector.

In the vector entropy model, a system of continuous random variables is understood as a set of analyzed socio-economic indicators $Y = (Y_1, \dots, Y_m)$ (Musso, 2019; Vizjak, Pavic, 2025). According to the vector entropy model, differential entropy (hereinafter referred to as entropy) is expressed through entropy measures of chaos $H_V(Y)$ and self-organization (dependence) $G_R(Y)$ as:

$$H(Y) = H_V(Y) - G_R(Y), \quad (2)$$

where $H_V(Y) = \sum_{j=1}^m \ln \sigma_{Y_j} + m \ln \sqrt{2\pi e}$,
 $G_R(Y) = -0.5 \ln |R_Y|$,

$|R_Y|$ – determinant of the correlation matrix R_Y (Tyrsin, 2022).

When analyzing indicators over time, each component Y_j represents a time series consisting of the sum of the trend $\tilde{Y}_j$ and a random component (noise) ξ_j :

$$Y_j = \tilde{Y}_j + \xi_j.$$

Since the trend and the random component are mutually independent, the variance of the Y_j component can be represented as the sum of the variances of the trend and the noise:

$$\sigma_{Y_j}^2 = \sigma_{\tilde{Y}_j}^2 + \sigma_{\xi_j}^2.$$

We decompose it into two terms: $\ln \sigma_{Y_j} = \ln \sigma_{\tilde{Y}_j} + \ln \frac{\sigma_{Y_j}}{\sigma_{\tilde{Y}_j}}$. Then we transform formula (2) into the following form:

$$H(Y) = H_D(Y) + H_S(Y) - G_R(Y), \quad (3)$$

where $H_D(Y) = \sum_{j=1}^m \ln \sigma_{\tilde{Y}_j} + m \ln \sqrt{2\pi e}$ – entropic measure of development,

$H_S(Y) = \sum_{j=1}^m \ln \frac{\sigma_{Y_j}}{\sigma_{\tilde{Y}_j}}$ – entropic measure of stability,

$G_R(Y) = -0,5 \ln |R_Y|$ – entropic measure of self-organization.

It is worth noting that the minimum $H_S(Y)$ is bounded by zero, and in this case, all $\sigma_{Y_j} = \sigma_{\tilde{Y}_j}$, or $\sigma_{\xi_j} = 0$. In practice, situations involving insignificant negative values of $H_S(Y)$ can sometimes arise due to a small sample size and the simultaneous occurrence of sharp changes in several indicators. In this case, to identify trends $\tilde{Y}_j$, it is necessary to use robust smoothing methods (Golovanov, Tyrsin, 2025; Clarke, 2018). We should note that the trend can be either deterministic (due to changes in the average level of the $\tilde{Y}_j$ component) (Zhechev, 2024) or stochastic (due to unaccounted factors, for example, random walk) (Ji et al., 2023).

Formula (3) represents the entropic measure of chaos as the sum of the entropic measures of development and stability, $H_V(Y) = H_D(Y) + H_S(Y)$. This makes it possible to distinguish fundamentally different sources of chaos in the entropic measure of chaos, caused by the dynamics of the system's state indicators ($H_D(Y)$) and the influence of random and unaccounted-for factors on the system ($H_S(Y)$). This clarification expands the possibilities of vector entropic modeling for the analysis of complex systems.

Within the framework of the vector entropy model (3), we will express all three characteristics of the socio-economic system.

The progressiveness of system development will be characterized by the trend of joint changes in the entropic measures of chaos and self-organization.

These measures characterize different aspects of the system's functioning (integrity and additivity) and must be taken into account jointly when assessing the system's development. The progressiveness of system development can be described as the behavior of the vector $(H_V(Y), G_R(Y))$. This value makes it possible to take into account both the overall development trajectory and local fluctuations (the influence of the random component is present in both $H_V(Y)$, and $G_R(Y)$).

The stability of a system can be interpreted as the dynamics of relative fluctuations in the entropy measure of development. It can be quantitatively assessed in the form of a vector $(H_D(Y), H_S(Y))$. At each point, the value $H_S(Y)$ will quantitatively characterize the relative deviation (fluctuations) of the indicators from the current level of development.

Random changes in the indicators are numerically equal to the difference between the actual values Y_j and their conditional mathematical expectation, which is estimated using smoothed data $\tilde{Y}_j$; therefore, we describe the stability of the system as an entropy-based measure of stability $H_S(Y)$. The distinctive feature of this measure is that it numerically characterizes the relative random deviations of the indicators Y_j , i.e., $H_S(Y)$ is dimensionless quantity, and this makes it possible to standardize the assessment of behavioral stability across different systems.

We transform the entropy-based measure of stability:

$$\begin{aligned} H_S(Y) &= \sum_{j=1}^m \ln \frac{\sigma_{Y_j}}{\sigma_{\tilde{Y}_j}} = -\frac{1}{2} \sum_{j=1}^m \ln \frac{\sigma_{Y_j}^2}{\sigma_{\tilde{Y}_j}^2} = \\ &= -\frac{1}{2} \ln \prod_{j=1}^m \frac{\sigma_{Y_j}^2}{\sigma_{\tilde{Y}_j}^2} = -\frac{m}{2} \ln \bar{R}_Y^2, \end{aligned}$$

where $\bar{R}_Y^2 = \sqrt[m]{\prod_{j=1}^m \frac{\sigma_{Y_j}^2}{\sigma_{\tilde{Y}_j}^2}} = \sqrt[m]{\prod_{j=1}^m R_{Y_j}^2} \in [0; 1]$ –

average coefficient of determination for all indicators $Y = (Y_1, \dots, Y_m)$, equal to the geometric mean of the determination coefficients $R_{Y_j}^2$ for all indicators Y_j .

From here, we get the following after simple transformations:

$$\bar{R}_Y^2 = \exp(-2H_S(Y)/m).$$

Let us introduce a relative quantity – the proportion of noise variance relative to the total data variance $w_Y = 1 - \bar{R}_Y^2$. For it, it is the following $w_Y = 1 - \exp(-2H_S(Y)/m)$.

The simplicity, dimensionless nature, and interpretability of $\bar{R}_Y^2$ and w_Y make it possible to introduce a threshold level for the entropy-based measure of stability relative to specific values of these indicators:

$$H_{S,thres} = -\frac{m}{2} \ln \bar{R}_Y^2 = -\frac{m}{2} \ln(1 - w_Y).$$

It is worth noting that the threshold level should be formed based on prior information and knowledge about the system being analyzed. As an illustration, *Table 1* shows some values of threshold levels for 9 indicators ($m = 9$).

The logarithmic scale of entropy measures makes it possible to unify the analysis of its dynamics. Indeed, the difference between any of the measures in the current and previous periods is a dimensionless quantity.

Each region, as a multidimensional stochastic system, is represented in the form of a random vector of indicators described in *Table 2*. Within the framework of the Strategy for the Economic Security of the Russian Federation³, monitoring

Table 1. Examples of threshold levels of $H_{S,thres}$ the entropy measure of stability, depending on the values of $\bar{R}_Y^2$ and w_Y for $m = 9$

$\bar{R}_Y^2$	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95	1.00
w_Y	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.05	0.00
$H_{S,thres}$	10.36	7.24	5.42	4.12	3.12	2.30	1.61	1.00	0.47	0.23	0.00

Source: own compilation.

Table 2. Indicators used to construct vector entropy model

Population	
Y_1	Overall rate of natural increase, per mille
Y_2	Share of population engaged in the economy, % of the total population*
Y_3	Incidence rate of the population, registered diseases per 1,000 people**
Economy	
Y_4	Volume of construction work per capita, in 2024 prices, million rubles***
Y_5	Retail trade turnover per capita, in 2024 prices, thousand rubles
Y_6	Investment in fixed capital per capita, in 2024 prices, thousand rubles.
Standard of living	
Y_7	Per capita average monthly income of the population, in 2024 prices, in thousands of rubles
Y_8	Consolidated budget per capita, in 2024 prices, thousand rubles
Y_9	Housing availability per capita, m ² per person****
Note: since the official statistical methodology changed during the period under consideration, alternative indicators were used to compile the study data for the earlier period:	
* number of employed persons aged 15 and over (prior to 2017 – aged 15–72);	
** number of diseases registered in patients with a diagnosis established for the first time in their lives before 2000;	
*** volume of work carried out under the economic activity category “Construction”; prior to 2000, this referred to the volume of work carried out under construction contract agreements;	
**** total area of residential premises per capita, on average, before 2000 – the area of dwellings per capita, on average.	
Source: own compilation.	

³ On the Strategy for the Economic Security of the Russian Federation for the Period up to 2030: Presidential Decree 208, dated May 13, 2017.

is envisaged for an extensive list comprising about 40 indicators. At the same time, this approach is subject to significant criticism in academic circles. For example, researchers point to the dominance of macroeconomic and externally oriented indicators in the list, the shortage of key metrics reflecting social well-being and spatial development, as well as the existence of gaps between the identified threats, the set tasks, and the established target parameters (Serebrennikov et al., 2018).

For the purposes of this study, we compiled a shortened but representative list of 9 indicators, distributed across three groups: “population”, “economy”, and “standard of living”. The rationale for selecting these indicators is based on their high informational value, which has been confirmed by their practical applicability in Russian studies on economic security, in particular in the works of V. K. Senchagov and A. I. Tatarkin (Senchagov, 2008; Tatarkin, Kuklin, 2012). The indicators in the “population” group reflect trends in the reproduction of the labor force, the efficiency of labor use, and the burden on social infrastructure; those in the “economy” group reflect business and consumer activity, the modernization of the economy, and growth potential; and those in the “standard of living” group reflect the well-being of the population and the risks of social tension. Thus, the proposed system of nine indicators provides a balanced reflection of the most important aspects of economic security. It combines scientific validity, practical applicability, and continuity with the methodological approaches established in the Russian scientific tradition.

The information base for the research was the statistical collections of Rosstat “Regions of Russia. Socio-economic indicators”. We used data from 1992–2024 when constructing the vector entropy model to monitor the economic security of the region.

We carry out monitoring using samples spanning 12 years: 2000–2012, 2001–2013, ..., 2012–2024. This period turned out to be optimal in terms of statistical smoothing (the sample size should be greater than the number of indicators being

analyzed), on the one hand, and in terms of taking into account the dynamics of entropy changes (the larger the volume of the non-stationary sample being analyzed, the less sensitive the monitoring is to changes in the system being analyzed), on the other. Data smoothing was performed using a sliding window of seven neighboring observations. Second-order polynomials were used as a filter.

Monitoring of entropic indicators for ensuring the economic security of Russia and several of its regions

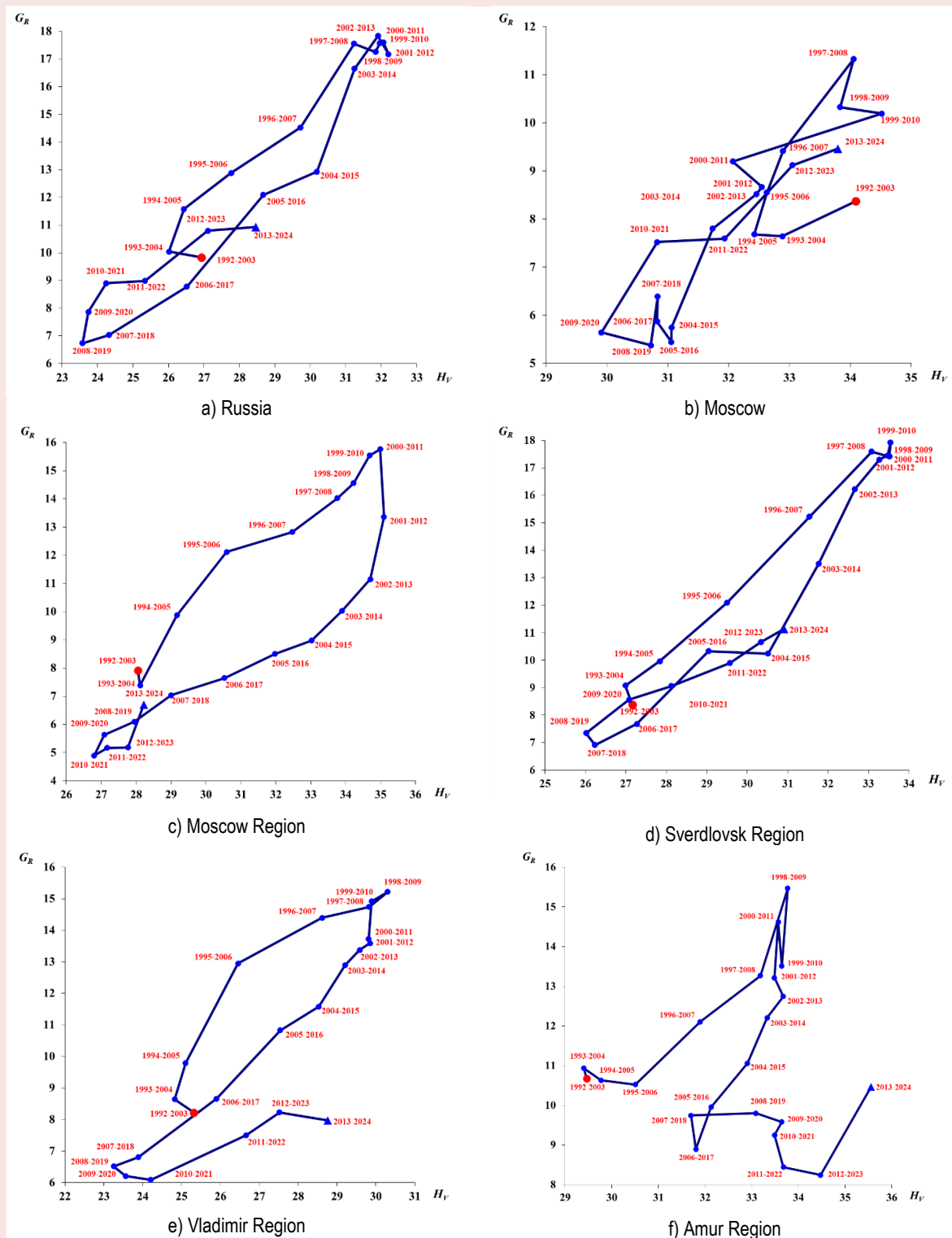
The proposed vector entropy model was tested using data for Russia as a whole and for five constituent entities of the Russian Federation, selected in such a way as to represent various types of regions identified in accordance with the synthetic classification (Grigoryev et al., 2011):

- highly developed regions: Moscow and the Moscow Region;
- developed regions: the Sverdlovsk Region;
- medium-developed regions: the Vladimir Region;
- less developed regions: the Amur Region.

Figure 1 shows the dynamics of entropic measures of chaos (H_V) and self-organization (G_R) for indicator values across the constituent entities of the Russian Federation and for Russia as a whole for the period 1992–2024, presented in the form of vector entropy hodographs. The results demonstrate a clear cyclical pattern in the dynamics of entropic measures. The progressive development of the socio-economic system is adaptive in nature. An increase in the system’s chaos provokes the activation of self-organization mechanisms, which serves as a driver of adaptation and directed change in the system.

We identified five distinct periods based on the results of monitoring entropy indicators for data on Russia. The first period (until the mid-1990s) was characterized by a decrease in the entropy measure of chaos and a simultaneous slight increase in the entropy measure of self-organization. It corresponded to the initial stage of market reforms after the collapse of the USSR. Against the backdrop of a large-scale

Figure 1. Hodographs of the entropic measures of chaos (H_V) and self-organization (G_R) for the indicator values across the constituent entities of the RF and Russia as a whole for the period 1992–2024



Note: the starting point of the period under consideration is marked with a red circle, and the ending point is marked with a blue triangle.

Source: own compilation.

crisis that included decline in production volumes, surge in inflation, and significant population decline (Smirnov, 2016), new economic relations were spontaneously emerging, economic ties were being streamlined on new principles, and primary market institutions and mechanisms (barter, mutual settlements) were taking shape.

The second period (until the mid-2000s) presented an increase in the entropic measure of chaos and the entropic measure of self-organization, which was a consequence of the post-crisis development of market relations after the transformational shock of the 1990s (Tatarkin, Bersenev, 2016). The chaos of the socio-economic system manifested itself in institutional instability, price and exchange rate volatility, uncertainty regarding property rights, and significant share of the informal economy. At the same time, processes of self-organization of the socio-economic system intensified, business associations were formed, trade and logistics networks developed, and financial markets and business groups were created as mechanisms for coordinating economic actors (Manturov, 2016).

The third period (until the mid-2010s) was characterized by a reduction in the entropic measure of chaos and the entropic measure of self-organization, which was due to macro-economic stabilization. This included reducing inflation to 6–7 % by 2013 (from double-digit values), accumulating reserves (creation of the Stabilization Fund in 2004 and the Reserve Fund in 2008), and strengthening state regulation and banking supervision. The reduction of chaos in the socio-economic system was ensured by the formalization of rules and the standardization of business processes. At the same time, the decline in self-organization of the socio-economic system was linked to the centralization of management, bureaucratization, and a reduction in competition in a number of economic sectors (Leksin, 2013).

The fourth period (until the end of the 2010s) is associated with a new increase in the entropic

measure of chaos and the entropic measure of self-organization. The dynamics was a response to a set of external shocks. The increase in the system's chaos was due to factors such as sanctions pressure on the Russian economy, volatility of oil prices, geopolitical tensions, and the COVID-19 pandemic. In response, the mechanisms of self-organization of the socio-economic system became more active; in particular, parallel imports developed, digitalization processes accelerated, and cooperatives were formed to achieve import substitution.

In the fifth period (from the early 2020s), further increase in the entropic measure of chaos is observed, while the entropic measure of self-organization remains unchanged. The intensification of chaos in the socio-economic system is linked to the persistence of geopolitical tensions, the tightening of sanctions pressure, and the need for a structural restructuring of the economy under new restrictions. As a result of reaching a certain limit of the adaptive potential, the growth of self-organization of the system has practically stopped. This is due to the exhaustion of short-term reserves for digitalization and restructuring of logistics chains, limited access to technology and capital, increase in bureaucracy as part of the crisis response, and decline in entrepreneurial initiative amid high uncertainty.

Regional dynamics differ and reflect the varying levels of development of the constituent entities of the Russian Federation and their ability to adapt to changes. The specific features of the dynamics of entropy measures in the Moscow and Sverdlovsk regions, compared to the nationwide trend, are evident in the first and last periods. In the first period, the significant potential of the Moscow Region (highly developed region) helped to mitigate the most acute manifestations of the crisis, and the higher adaptability of local institutions to changes prevented a surge in uncertainty. As a result, the system's chaotic nature did not change. Although the mechanisms of its self-organization developed moderately, they did not collapse under the influence of the crisis, but neither did they receive

a powerful impetus for growth due to the overall instability in the country. A distinctive feature of the fourth period in the Moscow Region is its later start compared to the nationwide trend, which was accompanied solely by an increase in the entropic measure of chaos, without any significant changes in the entropic measure of self-organization. In the fifth period, the growth of the entropic measure of chaos continued, and an increase in the measure of self-organization was recorded. This is due to a number of competitive advantages of the Moscow Region, which ensure increased resilience and mitigate external shocks: a highly diversified economy, proximity to federal resources, a well-developed infrastructure, a significant volume of investment, and human potential.

In the Sverdlovsk Region (developed region), a slight increase in the entropic measure of self-organization was observed in the first period, while the value of the entropic measure of chaos remained virtually unchanged. In the early years of market reforms, attempts were made to build new economic ties around local industrial giants to replace the destroyed planned-economic chains. The fifth period is not distinguished in the region; the dynamics of the fourth period are maintained.

The trajectories of the dynamics of entropy measures in the Vladimir Region (moderately developed region) and Moscow virtually follow the overall Russian trend. However, in the latest period, in the Vladimir Region, the entropy measure of chaos is growing at a faster rate than the entropy measure of self-organization. The dynamics may be linked to the structural dependence on certain sectors of the region, limited access to investments, and the outflow of skilled labor to the capital region. Although the dynamics of entropy measures in Moscow generally align with the overall Russian trend, they are characterized by more pronounced fluctuations. During crisis periods, the growth of chaos is promptly compensated for by the accelerated self-organization of the socio-economic

system. Thanks to the high concentration of financial and managerial resources, as well as the dominance of the service sector and digital technologies, Moscow demonstrates a rapid response to changes.

The dynamics of entropy measures for the Amur Region (less developed region) demonstrate significant differences in the previous two periods. In the fourth period (2010s), there is an increase in the entropy measure of chaos, while the value of the entropy measure of self-organization remains unchanged or even decreases. This means that the region's socio-economic system is becoming less ordered, imbalances in the development of sectors are intensifying, and uncertainty in ongoing processes is growing. At the same time, the mechanisms of self-organization (adaptation of institutions, redistribution of resources, development of infrastructure), which could compensate for the chaos, do not become active in response to crisis phenomena or operate less effectively. This situation may be due to the weakness of local institutions, high dependence on external decisions (federal programs and investments), and the inertia of the economy, with traditional sectors predominating. This situation is reflected in the region's financial and economic indicators. In 2015, the Amur Region was included in the list of constituent entities of the Russian Federation where the volume of public debt exceeded their own revenues. The region has joined a group of 12 federal subjects with the highest debt burden, which serves as an indicator of increased financial risks and limitations in implementing independent regional policy (Ivanov et al., 2018).

In the fifth period (starting from the early 2020s), a sharp increase in the entropic measure of self-organization is observed, despite the persistence and even intensification of its chaotic nature, which is explained by the implementation of major projects (the Amur Gas Processing Plant, the Vostochny Cosmodrome)⁴. The Amur

⁴ Amur Region. Ministry of Economic Development of the RF. Available at: <https://invest.economy.gov.ru/regional-investments/amurskaya-oblast> (accessed: 08.04.2026).

Region's GRP has been growing annually over the analyzed period from 2017 to 2023, and in 2023 the figure increased 2.6-fold compared to 2017 due to the completion of major investment projects in the region (Zakharova et al., 2025). An additional factor driving development is the inflow of foreign capital. As of early 2022, the accumulated volume of Chinese investments in the region had reached 280 million dollars (Gao, 2025). Such projects serve as “growth points” around which resources and management decisions are concentrated; however, in peripheral sectors (for example, in agriculture or small businesses), imbalances may grow, which is reflected in the increasing chaos within the socio-economic system.

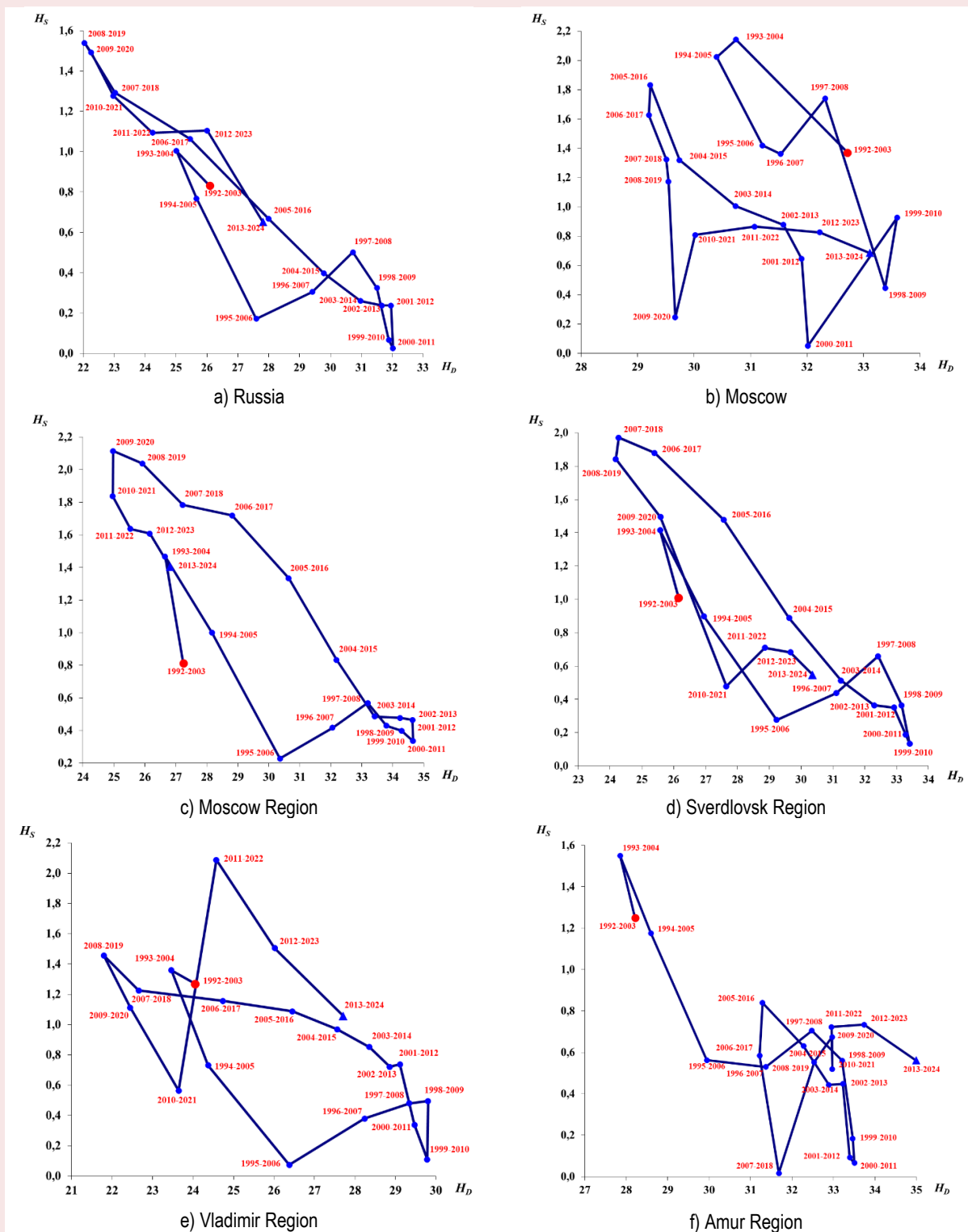
Figure 2 shows the dynamics of entropy-based measures of development (H_D) and stability (H_S) of indicator values for the constituent entities of the Russian Federation and for Russia as a whole for the period 1992–2024, presented in the form of vector entropy hodographs. The dynamics of entropy-based measures have a certain cyclical character. The results show that the stability of the socio-economic system is dynamic and consists of cycles of stabilization and development. In the stabilization phase, the system consolidates resources, strengthens institutional mechanisms, minimizes vulnerabilities, and reduces risks, which creates a solid foundation for further development. Then comes the development stage, when the system adapts to new external and internal challenges, transforms its structure, introduces innovations, and seeks promising growth areas. Alternating these phases makes it possible to maintain a balance between preserving the achieved results and the need for change, which ensures the long-term viability of the socio-economic system in conditions of uncertainty. The decline in the stability of the socio-economic system in recent years reflects the natural process of the system adapting to new realities, which in the long term may increase its resilience.

The results of the calculations for Russia make it possible to identify four qualitatively distinct periods in the dynamics of the processes under consideration. The first period (until the end of the 1990s) is characterized by an increase in the entropic measure of stability, which may indicate the formation of basic institutions and mechanisms that ensure the relative stability of the socio-economic system under the conditions of the transformational crisis of the 1990s, and a simultaneous decrease in the entropic measure of development, reflecting the slowdown of positive structural changes, a decline in adaptive potential, and limited opportunities for innovative growth during the formation of the new economic model.

The opposite pattern is observed in the second period (until the mid-2000s). The decline in the entropic measure of stability, likely related to the intensification of structural changes, the growth of economic dynamics, and the increase in uncertainty under conditions of rapid growth and integration into the global economy, is combined with an increase in the entropic measure of development, which indicates the strengthening of development processes, the diversification of economic activity, an increase in the system's adaptability, and implementation of growth potential against the backdrop of favorable external conditions, including high energy prices. It is noteworthy that in the early 2000s, there was a short-term increase in stability, possibly due to the consolidation of power.

The third period (until the mid-2010s) was accompanied by a decline in the entropic measure of development and increase in the entropic measure of stability. The dynamics may reflect the growing systemic constraints on growth (institutional, technological), a decline in the system's adaptive capacity, the influence of global factors (global financial crisis of 2008–2009, subsequent sanctions, and the volatility of commodity markets), as well as the emergence of a “middle-income trap” and the exhaustion of the growth model based on commodity exports (Lyakin, 2013).

Figure 2. Holograms of entropy-based development measures (H_D) and stability (H_S) for the indicators' values across the constituent entities of the RF and for Russia as a whole for the period 1992–2024



Note: the starting point of the period under consideration is marked with a red circle, the ending point is marked with a blue triangle.

Source: own compilation.

The fourth period (from the mid-2010s) is characterized by opposite trends: there is an increase in the entropy-based measure of development against the backdrop of a decline in the entropy-based measure of stability. The dynamics is driven by a complex of external and internal factors, among which the key role is played by global digital transformation, sanctions pressure, the need for accelerated import substitution, changes in the geopolitical situation, and the need to ensure technological sovereignty. As a result, the socio-economic system demonstrates increased flexibility and adaptability. This period has a pronounced transformational character. The growth of entropic measures of development indicates an increase in the dynamism of the system, the activation of mechanisms for qualitative changes, and the search for new growth points (development of digital technologies and transformation of economic relations). At the same time, decrease in the entropic measure of stability reflects the natural process of adaptation of the socio-economic system to new realities (transformation of financial flows, changes in logistics chains, etc.).

The results of entropy modeling in the fourth period demonstrate noticeable differences in the dynamics of entropy measures across Russian regions, reflecting their structural characteristics, resource potential, and adaptive capabilities. In Moscow, the fourth period began in the early 2010s, and from the middle of the decade, a sharper increase in the entropy measure of development is observed, which indicates the activation of innovation processes, the development of high-tech industries, the strengthening of financial and business activity, and the expansion of digital services and services. At the same time, gradual decline in the entropic measure of stability is observed, which is associated with the restructuring of the socio-economic system under the influence of new conditions.

The Sverdlovsk Region generally follows the overall dynamics observed in Russia; in the fourth

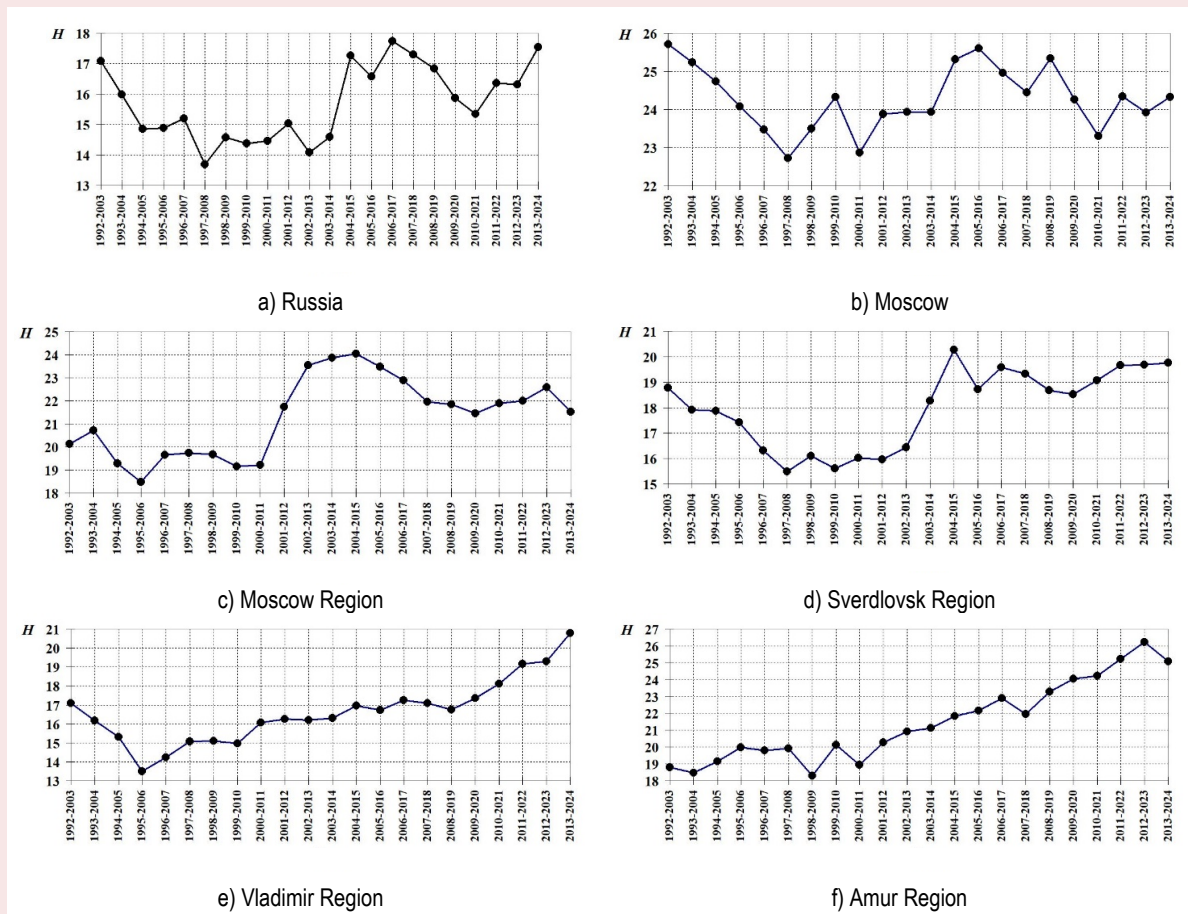
period, it also shows an increase in the entropy-based measure of development against the backdrop of a decline in the entropy-based measure of stability. However, since the late 2010s, the entropy-based measure of stability has practically stopped changing and has stabilized at a single level. This may indicate the achievement of a new equilibrium in the socio-economic system and the formation of a sustainable development model based on industrial potential and infrastructure projects.

In the Vladimir Region, the trends largely mirror the nationwide picture, but with a characteristic feature in the latest period. In 2022, the region recorded a sharp increase in the entropic measure of stability, followed by restoration of the previous trend. This is likely due to the implementation of anti-crisis measures to support the regional economy, the intensification of import substitution processes in key sectors, an increase in budgetary capacity, and launch of infrastructure projects.

The Amur Region also demonstrates the overall national trend, but with a noticeable deviation in 2017–2018, when a sharp decline in the entropy-based measure of stability was observed; after that, the indicator's value recovered and stabilized at a single level against the backdrop of a slow growth in the entropy-based measure of development. Such dynamics may have been influenced by the implementation of major infrastructure projects (construction of bridges and development of transport corridors), a shift toward Asian markets and associated changes in the structure of exports and logistics, and fluctuations in investment activity due to the launch of mega-projects.

The dynamics of entropy H in the values of the indicators demonstrate significant differences at the level of particular constituent entities of the Russian Federation and on a national scale (*Fig. 3*). Overall, a decrease in entropy was observed in Russia in the 1990s, which reflected the processes of stabilizing the economic system after a period of turbulence,

Figure 3. Dynamics of entropy H values for indicators across the constituent entities of the RF and for Russia as a whole for the period 1992–2024

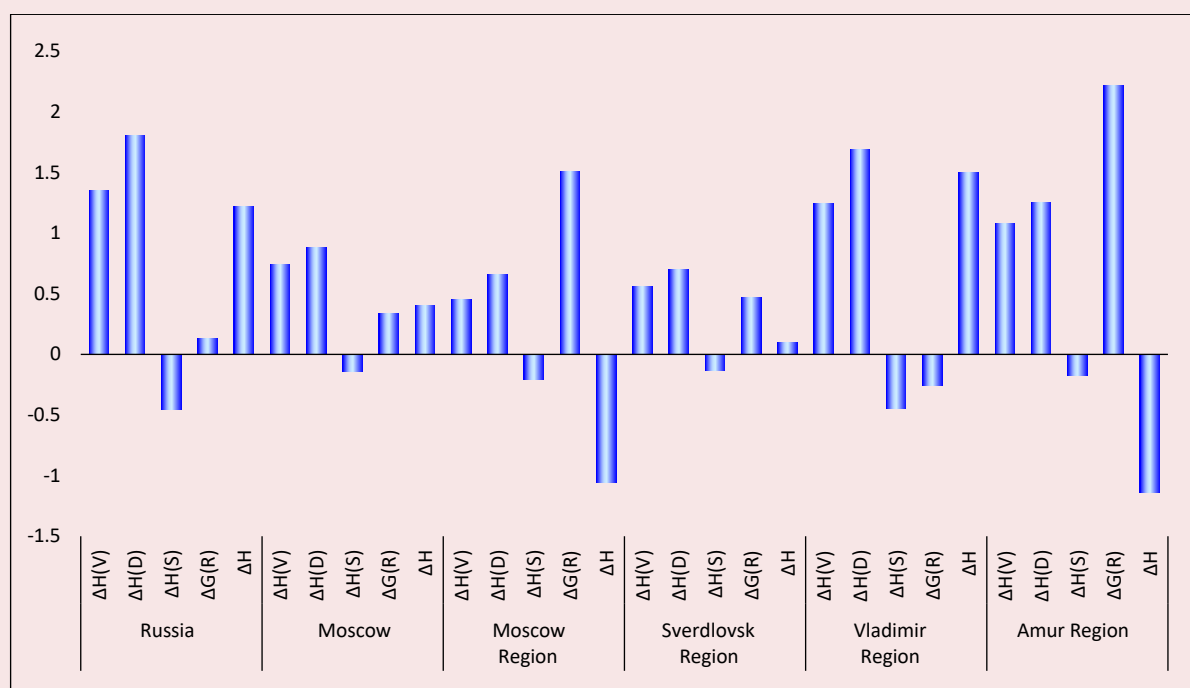


Source: own compilation.

accompanied by the formation of large economic structures, including monopolies. In the 2000s, entropy remained at the same level, which indicated a stable equilibrium in the socio-economic system. During this period, a stable structure of economic relations was formed, and there were no drastic structural changes. The period up to the mid-2010s was characterized by an increase in entropy, which indicates the activation of innovation processes and the diversification of economic activity. From the mid-2010s to the end of the 2010s, a decrease in entropy was observed, обусловленное by the strengthening of regulatory measures, market consolidation, and the optimization of business

processes. The state and large corporations increased their control, which contributed to the streamlining of economic relations and a reduction in the variety of development scenarios for individual segments of the economy. Since the early 2020s, an increase in entropy has been recorded, indicating growing uncertainty in the socio-economic system. This stage is associated with the emergence of new economic challenges, the transformation of traditional business models, and an increase in the diversity of economic scenarios. Against the backdrop of global crises, technological changes, and geopolitical factors, the system has become less predictable.

Figure 4. Increase in entropy-based measures of indicators for Russia and its regions over the period from 2012 to 2024



Source: own compilation.

The results of monitoring the entropy dynamics show that in Russia's regions, the trajectories of changes in this indicator are to varying degrees consistent with the nationwide trend. This indicates the presence of common macro-economic factors influencing the level of uncertainty and diversity of economic indicators across the country. However, the Amur Region demonstrates a significant deviation from the general pattern: during the period under consideration, a steady increase in entropy was recorded there, which may indicate an increase in the heterogeneity of intra-regional development processes.

Figure 4 shows the increase in the entropy indicators for Russia and its individual regions from 2012 to 2024. The results of monitoring the entropy dynamics measures in the context of ensuring the country's economic security over a thirty-year period demonstrate a number of significant trends. An analysis of changes in entropy indicators revealed

an increase in entropy alongside an increase in entropy measures of chaos, development, and self-organization, while entropy measures of stability decreased. This combination of dynamics in entropic measures reflects a non-equilibrium but productive state of the socio-economic system and indicates its active transformation. On the one hand, the system gains greater flexibility, which is reflected in an increase in entropy and a decrease in the entropic measure of stability. On the other hand, the growth of entropic measures of development and self-organization compensates for the potential decline in stability, and the growth of the entropic measure of chaos is combined with the strengthening of adaptation mechanisms. This combination indicates that the socio-economic system has developed the ability to function effectively under conditions of increased variability, when uncertainty ceases to be a barrier and becomes a resource for finding new solutions.

From the perspective of ensuring economic security, this combination of dynamics in entropy measures reflects not a crisis, but a purposeful transformation of the socio-economic system into a more stable and adaptive model. The growth of the entropy measure of chaos, coupled with the simultaneous strengthening of adaptation mechanisms, indicates an increase in adaptive potential. The system learns to function under conditions of uncertainty, which reduces its vulnerability to unexpected external shocks (sanctions, price fluctuations in commodity markets, global crises), builds “immunity” to typical threats through the diversification of response strategies, and ensures the ability to quickly adapt to new conditions without losing key functions. An increase in entropy and a decrease in the entropy-based measure of stability indicate a departure from the “frozen stability” model in favor of dynamic equilibrium. This is positive for ensuring economic security in the long term, since rigid stabilization often masks structural problems, whereas flexible resilience allows them to be identified and addressed. The increase in entropic measures of development and self-organization reflects the formation of internal mechanisms for ensuring economic security. The identified dynamics also show that the system is not merely reacting to threats but is learning to benefit from variability. In the context of ensuring economic security, this manifests itself in the transition from reactive risk management to the proactive use of opportunities.

The trajectory of changes in the entropic measures of socio-economic indicators across Russian regions reflects the overall national dynamics, but the amplitude of the changes (the difference in the values of the entropic measure between the final and initial points of the period under consideration) varies significantly. Moscow and the Sverdlovsk Region demonstrate dynamics similar to the national average, but with a more moderate amplitude of changes. Identical trends in the changes of entropic measures are observed in the Moscow and Amur regions, where the socio-economic system is becoming less predictable,

yet at the same time increasing its capacity for self-regulation and adaptation. This may be a sign of movement toward a more complex and stable state, albeit one that is associated with short-term risks of instability. The similarity of trends in two regions with different geography and economies may indicate the influence of common factors, in particular, the strengthening of centralized management. The Vladimir Region is characterized by a noticeable increase in entropy and entropic measures of chaos and development, while there is a slight reduction in entropic measures of stability and self-organization. This may indicate a high sensitivity of these regions to external shocks, underdeveloped adaptive institutions, and the inertia of the economy, where development is primarily driven by extensive factors rather than by internal restructuring of the system.

Conclusion

The study conducted is devoted to the development of an approach to monitoring the economic security of Russian regions, based on a vector entropy model. The approach makes it possible to assess the stability, resilience, and progressive development of the socio-economic system under consideration, which directly characterizes the provision of economic security in the region. The application of the proposed model makes it possible to decompose the overall entropy of the socio-economic system into components (entropy measures of chaos, self-organization, development, and stability), the combination of which describes three key characteristics of the socio-economic system. The use of a logarithmic scale of entropy measures ensures the unification of the assessment of system dynamics. Each region, as a multidimensional stochastic system, is represented as a random vector of nine indicators.

The approach was tested using data for Russia as a whole and for five constituent entities of the Russian Federation (Moscow, Moscow Region, Sverdlovsk Region, Vladimir Region, and Amur Region) for the period 1992–2024. The monitoring results revealed a cyclical nature of the dynamics of entropy indicators, with periods of stabilization

being followed by stages of increased diversity and volatility. At the same time, there is a significant differentiation of regions in terms of the level of stability and adaptability of socio-economic systems, as well as the influence of macroeconomic factors on the nationwide dynamics, with possible deviations of the trajectories of individual regions from the general trend. An analysis of regional specifics has shown that Moscow and the Moscow Region demonstrate high resilience and adaptability due to the diversification of their economies, proximity to federal resources, and well-developed human resource base. The Sverdlovsk Region follows the nationwide dynamics with a moderate amplitude of changes, relying on its industrial potential and infrastructure projects. The Vladimir Region is characterized by high sensitivity to external shocks, economic inertia, and limited capacity for endogenous transformation. The Amur Region is experiencing a steady increase in entropy, which indicates growing heterogeneity in development and dependence on external decisions (federal programs and investments). The study's findings allow concluding that an increase in entropy is not always negative; it can indicate development potential and the emergence of new opportunities, whereas an excessive decrease in entropy threatens stagnation, and a sharp increase in it leads to instability and risks.

The analysis of the results of entropic monitoring demonstrates that the economic security of Russian regions is partially ensured in the current period (since the beginning of the 2020s), but it is under pressure from external and internal destabilizing factors. Despite the preservation of the adaptive potential of the socio-economic system, there is a clear trend toward a decline in its stability. The growing number of new challenges and threats reveals the limitations of the existing adaptation mechanisms. The observed increase in the system's chaos, in the absence of a proportional increase in self-organization, indicates the exhaustion of its short-term adaptive potential. The dynamism of the system is achieved at the expense of increasing its vulnerability, which is indicated by a decline in

stability as development progresses.

The developed approach to monitoring the economic security of Russia's regions, based on a vector entropy model, makes it possible to identify structural shifts, assess risks, and adjust policies. Differences in the dynamics of entropy measures of socio-economic indicators underscore the need for a differentiated approach to ensuring economic security, taking into account regional specifics — in particular, assessing the region's resource potential, analyzing the maturity of the institutional environment, considering the quality of management impact, and identifying key factors of the system's stability and adaptability. The obtained results can serve as a basis for adjusting the strategic directions for ensuring economic security, determining priority measures of state support, and developing adaptive mechanisms for responding to external and internal challenges. Depending on the combination of values and vectors of characteristics that determine the provision of economic security (entropic measures of chaos, self-organization, development, and stability), management decisions should be developed in a differentiated manner. Thus, if the entropic measure of stability exceeds the threshold value ($H_S > H_{S,thres}$), stabilization measures (formation of reserves, provision of subsidies, and systematic risk monitoring) become a priority. In the event of an increase in the entropic measure of development (H_D), it is advisable to support transformation processes by stimulating innovation, diversifying the economy, and launching new projects, while simultaneously implementing risk control mechanisms to minimize negative consequences. If the level of self-organization (G_R) is low or declining, it is necessary to strengthen interdepartmental coordination, develop the institutional environment, scale up digital platforms, and support industry associations. Analysis of the vector (H_V, G_R) allows for differentiation of management responses: if both H_V and G_R are growing simultaneously, indicating "adaptive growth," measures should be aimed at supporting and scaling up the existing positive trends; if H_V is growing while G_R is stagnating, which corresponds

to a “destabilization” scenario, the key priorities become strengthening institutions and improving coordination of actions; in a situation of low and declining values of H_V and G_R , reflecting a state of “stagnation,” it is necessary to stimulate the diversification of economic activity and the development of competitive environment.

The developed approach to monitoring economic security based on a vector entropy model is a significant analytical tool that naturally complements the approach based on indicator analysis. These approaches do not contradict each other but form a mutually reinforcing assessment system. Their combined use makes it possible to form a more complete and balanced picture of the state of economic security in the region. The indicative method is focused on operational diagnostics; it records deviations of actual indicator values from established threshold levels and thereby provides a clear picture of the current state of the system “then and there”, but it does not take into account the interdependence of indicators and their dynamics. The vector entropy model, by contrast, reflects structural shifts,

adaptive potential, and accumulated uncertainty, and therefore can signal risks earlier than the indicative index goes beyond critical threshold values. A clear example of the complementarity of approaches is the comparison of the results of calculations using the methodology of the Institute of Economics of the Ural Branch of RAS (Tatarkin et al., 2003) for the Moscow Region. In some years, the indicative index remained within the “normal zone,” without recording critical deviations. At the same time, the vector entropy model demonstrated an increase in the entropy measure of chaos (H_V) while maintaining the level of the self-organization measure (G_R). The dynamics is interpreted as “adaptive growth,” i.e., a state that is not critical, as it remains within the threshold values, but requires close attention to maintaining a balance between transformational processes and the stability of the socio-economic system. Thus, the vector entropy model is a promising tool for monitoring the economic security of regions, enabling a shift from reactive risk management to proactive use of opportunities in conditions of increased uncertainty.

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Intergovernmental Equalization in Russia: Assessing Efficiency and the Issues of Reducing Interregional Disparities



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Abstract. Growing interregional disparities and the increasing dependence of many Russian regions on federal financial assistance underscore the need to assess the efficiency of the current system of intergovernmental equalization. The aim of the study is to reveal the impact of intergovernmental transfers on regional fiscal capacity and the degree of interregional asymmetry. Drawing on Federal Treasury data on the execution of consolidated regional budgets, we conduct a comprehensive assessment of the effectiveness of the transfer mechanism for 2012–2024. By distinguishing three qualitatively different stages – pre-crisis, pandemic, and post-pandemic – we trace the evolution of the equalizing effect under changing macroeconomic conditions. The methods include statistical grouping, coefficients of variation and asymmetry, Spearman’s rank correlation, and regression analysis. The findings show that intergovernmental transfers smooth interregional disparities in budget revenues (the coefficient of variation falls by a factor of 1.5–1.7), but do not lead to a lasting reduction in the gap between the most and least fiscally secure regions (the decile ratio for total revenues remains between 2.4 and 3.0). The results also reveal a temporary weakening in 2020 of the relationship between regions’ own revenues and federal financial assistance (Spearman’s coefficient dropped to 0.58) due to the expansion of anti-crisis support during the pandemic. Moreover, the interregional hierarchy of fiscal capacity remains highly stable after transfer redistribution (Spearman’s coefficient > 0.7 in most years), pointing to the persistence of existing disparities. Overall, the current model of intergovernmental regulation is highly sensitive to external shocks while offering only a limited long-term equalizing effect: it is effective tactically in

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smoothing the consequences of crises but remains only partially effective strategically in ensuring long-term regional convergence. The study's practical significance lies in the possibility of using its findings to refine intergovernmental fiscal mechanisms and design policies for narrowing regional disparities.

Key words: intergovernmental transfers, fiscal capacity, regional budgets, interregional disparities, intergovernmental regulation efficiency, Spearman's coefficient, COVID-19 pandemic.

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Introduction

Pronounced interregional socio-economic differentiation remains a defining feature of Russia's spatial development. Russia's constituent entities differ markedly in economic activity, natural resource endowments, investment potential, and demographic profiles. These differences produce a pronounced asymmetry in regional tax bases and fiscal capacity. As A.G. Aganbegyan and E.V. Baklaeva point out, the spatial heterogeneity of the Russian economy manifests itself not only in divergent economic indicators but also in unequal access to public goods and infrastructure (Aganbegyan, 2019; Baklaeva, 2017). In this context, the system of intergovernmental fiscal relations becomes strategically important as a mechanism for preserving the financial stability of Russia's regions and smoothing territorial disparities.

A fundamentally important distinction in assessing the effectiveness of intergovernmental fiscal regulation is that between the "equalization" and the "smoothing" of regional differences. In Russian legislation, as in many other countries, intergovernmental transfers are intended not to fully

eliminate differences among regions – objectively impossible given such pronounced spatial heterogeneity – but to reduce excessive disparities in fiscal capacity. Equalization grants to the RF constituent entities, despite their name, in fact perform the function of smoothing interregional disproportions rather than eliminating them altogether. In this study, the effectiveness of intergovernmental equalization is understood as the ability of the transfer system to ensure a sustainable reduction in regional fiscal disparities while preserving incentives for regions to develop their own revenue bases.

The issue of intergovernmental equalization is among the most debated in the modern theory of fiscal federalism. Most countries face the challenge of balancing fairness in the distribution of budgetary resources against the preservation of incentives for territories to develop their own revenue bases (Levaggi, 2002; Dougherty, Mota, 2024). The theoretical foundations of such approaches go back to the concepts of fiscal competition and the financial autonomy of subnational entities developed by Charles Tiebout (Tiebout, 1956) and further elaborated in the public finance research¹

¹ Nemec J., Wright G. (Eds). (1997). *Public Finance: Theory and Practice in Central European Transition*. NKPAcee. Bratislava. 458 p. Available at: <https://www.nispa.org/files/publications/ebooks/Public-Finance-Theory-and-Practice.pdf>; Wallack J.S., Spinivasan T.N. (Eds). (2006). *Federalism and Economic Reform: International Perspectives*. Cambridge University Press. 528 p. Available at: http://www.untag-smd.ac.id/files/Perpustakaan_Digital_1/FEDERALISM%20Federalism%20and%20Economic%20Reform,%20International%20Perspectives.pdf

(Kollman et al., 1997; Hueglin, Fenna, 2006). Within these frameworks, a region's ability to generate its own revenues is regarded as the most important condition for sustainable territorial development. E. Zhuravskaya's work shows that the institutional design of intergovernmental fiscal relations influences the behavior of regional authorities, including their interest in expanding their own tax bases (Zhuravskaya, 2010).

International practice reveals a variety of approaches to intergovernmental fiscal regulation. In Germany, the fiscal equalization system is aimed primarily at reducing differences among the Länder in the level of public service provision. After the 2020 reform, the federal center's role in resource redistribution increased, while requirements for spending efficiency and regional fiscal responsibility were maintained² (Leonardy, 1999).

The American model is characterized by greater state autonomy in the tax sphere. Equalization is achieved mainly through targeted federal support programs, which fosters regional competition but simultaneously widens differences in the fiscal capacity of territories. The pandemic experience exposed the vulnerability of less well-off states, which required additional federal budget assistance (Gamkhar, 2002; Frieden, 2024; Dougherty et al., 2024).

The Canadian system combines a high degree of provincial autonomy with a well-developed mechanism of equalization transfers based on assessments of tax capacity. At the same time, this approach is criticized for potentially weakening incentives for territories to develop their own revenue bases (Béland et al., 2017).

India's experience demonstrates the need to take into account not only financial but also demographic and infrastructural differences among regions. Transfers are distributed through

the Finance Commission, using both equalization instruments and support mechanisms for regions aimed at improving governance performance (Chakraborty, 2026; Malik et al., 2025).

A comparison of the experience of various federal states shows that the effectiveness of intergovernmental fiscal regulation is determined not only by the volume of redistributed resources but also by the extent to which the system creates incentives for territorial development. The practices of Germany, the United States, Canada, and India illustrate different ways of combining these objectives: equalization mechanisms help reduce differences in regional fiscal capacity, but their long-term effect depends on accounting for the factors that expand territories' own revenue bases. At the same time, international experience shows that in times of crisis most federal states strengthen the center's role in redistributing financial resources, after which regulatory mechanisms are adapted to the new conditions. An important element of modern systems is also the consideration of regional authorities' performance when providing certain types of support, which makes it possible to combine the compensatory and incentive functions of transfers. For Russian practice, it is particularly important to strike a balance between the objectives of budgetary equalization and the creation of conditions for regional economic development. The experience of foreign countries shows that the sustainability of an intergovernmental fiscal system requires regular adjustment of its parameters in response to structural changes in the economy and differences in territorial potential.

In the Russian scholarly literature, the issues of intergovernmental fiscal relations are examined mainly through the lens of the financial autonomy of the federation's constituent entities, the consequences of fiscal centralization, and the effective-

² Financial relations between the Federation and Länder on the basis of constitutional financial provisions. Federal Ministry of Finance. 2025. Available at: https://www.bundesfinanzministerium.de/Content/EN/Standardartikel/Press_Room/Publications/Brochures/financial-relations-federation-2025.pdf?__blob=publicationFile&v=2

ness of intergovernmental transfer mechanisms (Akindinova et al., 2018; Balaev, 2018; Pechenskaya-Polishchuk, 2023). A.G. Bukhvald emphasizes that the current model of Russian fiscal federalism is characterized by a high degree of centralization of financial resources and by the growing dependence of a significant number of regions on federal assistance (Bukhvald, 2022). Similar conclusions are presented in the study by N.V. Golovanova and E.A. Dombrovsky (Golovanova, Dombrovsky, 2016). A number of researchers highlight the ambiguous impact of intergovernmental transfers on economic growth and on the structure of regional economies (Mikhaylova et al., 2018; Chernyshova, 2016).

A separate line of research concerns fiscal disparities among Russian regions. M.Yu. Malkina examines the convergence and divergence of the RF constituent entities in terms of fiscal capacity using a decomposition of the Theil – Bernoulli indices and concludes that stable interregional heterogeneity persists (Malkina, 2016). Many researchers stress that fiscal disparities among Russian regions remain considerable even amid active intergovernmental redistribution (Bogacheva, Smorodinov, 2019; Zubarevich, Safronov, 2023). A.M. Kalinin pays particular attention to the structure of regional budget revenues and to the problem of incentives for expanding own revenue bases (Kalinin, 2021).

In recent years, the analysis of crisis shocks and their impact on the transformation of intergovernmental fiscal policy has become increasingly prominent. The COVID-19 pandemic required a large-scale expansion of federal support to the constituent entities of the Federation and brought about substantial changes in the parameters of intergovernmental fiscal regulation. As I.V. Karavaeva and co-authors note, the strengthened role of the federal budget during the crisis became one of the key factors in maintaining the country's economic stability (Karavaeva et al., 2021). At the same time, the increase in federal support did not in itself ensure a sustainable

reduction in regional disparities (Bashenkov et al., 2022). Research on the post-pandemic period shows that transfers perform a dual function: they help reduce fiscal risks and maintain regional stability, but they simultaneously increase the dependence of individual territories on federal decisions (Bukina, 2022; Timushev, Mikhaylova, 2023; Mokhnatkina, 2023). In this regard, the debate continues as to how well the current model of intergovernmental fiscal regulation contributes not only to equalizing fiscal capacity but also to developing the own revenue bases of the RF constituent entities.

Of considerable interest are studies devoted to improving the federal policy for equalizing regional budget revenues. V.N. Timushev analyzes the main directions for improving the mechanisms of fiscal capacity equalization in the RF constituent entities, arguing for the need to enhance the effectiveness of intergovernmental fiscal regulation while taking into account the specific features of regional socio-economic development. The author emphasizes the problem of preserving incentives for regions to expand their own revenue bases under the redistribution of financial resources through the system of intergovernmental transfers (Timushev, 2025). The role of equalization grants in changing regional budget inequality is analyzed by D.Yu. Zemlyansky and co-authors, who note the stability of the composition of the regions receiving the largest volumes of grants (Zemlyansky et al., 2024). Current approaches to intergovernmental fiscal regulation and the provision of financial support to the RF constituent entities in the planning period are examined in the work of S.I. Shabelnikova, making it possible to assess modern trends in transfer policy (Shabelnikova, 2024; Shabelnikova, 2025). The assessment of interregional disproportions in the context of the policy of equalizing spatial development is presented by I.A. Antipin and co-authors, who confirm the persistence of significant differences among the RF constituent entities (Antipin et al., 2025).

Despite the large number of studies on intergovernmental fiscal relations, a number of issues remain debatable. In particular, the long-term effectiveness of the Russian equalization system and its impact on the persistence of regional disparities remain underexplored. Most works focus on individual instruments of transfer policy or on particular periods, which limits the ability to assess its long-term consequences. Moreover, additional analysis is needed not only of changes in regional fiscal capacity but also of the persistence of differences in their financial positions after resource redistribution. The question of how well the current system of intergovernmental fiscal regulation ensures the long-term convergence of the RF constituent entities, rather than merely temporary smoothing of the consequences of external shocks, remains insufficiently studied.

Accordingly, the aim of this work is to assess the effectiveness of intergovernmental transfers as an instrument for reducing interregional disparities in the fiscal capacity of the RF constituent entities in 2012–2024. To achieve this aim, the following objectives are addressed:

- 1) the dynamics and structure of budget revenues of Russian regions over the period under study are analyzed, distinguishing three stages: pre-crisis (2012–2019), pandemic (2020–2021), and post-pandemic (2022–2024);
- 2) the degree of interregional differentiation of tax and non-tax revenues, as well as total revenues including transfers, is quantitatively assessed using coefficients of variation, skewness, and the decile ratio;
- 3) the stability of the interregional hierarchy of fiscal capacity is assessed using Spearman's rank correlation coefficient;
- 4) the orientation of federal transfer policy is identified through regression analysis;
- 5) recommendations are formulated for improving the mechanisms of intergovernmental fiscal regulation.

The scientific novelty of the study lies in identifying the specific features of changes in the equalizing role of intergovernmental transfers in Russia during 2012–2024, a period that includes pre-crisis, pandemic, and post-pandemic stages. Unlike approaches focused mainly on assessing the scale of resource redistribution, this work examines how transfers affect the persistence of the interregional hierarchy of fiscal capacity. Drawing on an analysis of regional revenue dynamics and the use of variation measures, the decile ratio, and Spearman's rank correlation, it is shown that federal financial support reduces differences among territories but does not lead to a substantial change in the relative positions of regions within the system of fiscal capacity. This provides a basis for arguing that equalization mechanisms should be combined with instruments aimed at developing the own revenue bases of the RF constituent entities.

Description of the research methodology and its rationale

The information base of the study includes data from the official website of the Federal Treasury of the Russian Federation on the execution of the consolidated budgets of the RF constituent entities for 2012–2024. Three types of budget revenues per capita are analyzed: tax and non-tax revenues, non-repayable receipts from the federal budget, and total regional budget revenues. To ensure comparability, all monetary indicators are converted to constant 2012 prices and adjusted by the budget expenditure index. The research methodology comprises four consecutive stages.

At the first stage, the dynamics and structure of regional budget revenues are analyzed using statistical grouping into interval categories of per capita revenues (with a step of 20,000 rubles). This makes it possible to identify structural shifts in the distribution of regions under the influence of macroeconomic shocks and the transformation of intergovernmental fiscal policy.

At the second stage, interregional heterogeneity is quantified. Means, asymmetry ranges, coefficients of variation, and decile ratios are calculated. The analysis is conducted for both tax and non-tax revenues and total revenues, which makes it possible to assess the smoothing effect of transfers.

At the third stage, the stability of the inter-regional hierarchy of fiscal capacity is assessed using Spearman's rank correlation coefficient:

$$\rho = 1 - \frac{6 \cdot \sum d^2}{n \cdot (n^2 - 1)},$$

where d is the difference in a region's ranks for own and total revenues,

and n is the number of RF constituent entities.

The choice of a non-parametric method is due to the skewed distribution of regional revenues and the need to assess changes not in absolute values but in the relative positions of regions. Coefficient values close to 1 indicate the preservation of the hierarchy after the distribution of transfers.

At the fourth stage, the orientation of federal transfer policy is assessed using a regression model of the relationship between the logarithm of per capita non-repayable receipts ($\ln T$) and the logarithm of per capita tax and non-tax revenues ($\ln R$):

$$\ln T_i = \alpha + \beta \cdot \ln R_i + \varepsilon_i.$$

The use of logarithms makes it possible to interpret the coefficient β as an elasticity indicator, i.e., as a measure of the response of intergovernmental transfer volumes to changes in the own revenues of the RF constituent entities. If the coefficient takes a negative value, this indicates an equalizing orientation of fiscal policy: more assistance is directed to regions with lower tax and non-tax revenues. A positive value of β , by contrast, indicates that resources are concentrated in better-off regions. The model was estimated separately for each year using the least squares

method, which made it possible to track changes in intergovernmental fiscal relations over time.

Thus, the sequential application of grouping methods, variation measures, rank correlation, and regression analysis makes it possible to examine various aspects of the functioning of the fiscal equalization system: changes in the revenue structure, the degree of interregional heterogeneity, the stability of the fiscal hierarchy, and the orientation of redistributive processes. When interpreting the results, the study's limitations should be taken into account. The methods used allow statistical relationships to be identified but do not establish causal links. In addition, the analysis is conducted without disaggregating transfers by type, although grants, subsidies, and subventions have different purposes. Grants are aimed at equalizing current fiscal capacity, subsidies at co-financing expenditures, and subventions at financing delegated powers. Each of these instruments affects the financial positions of regions differently, and their aggregated analysis may obscure the specific nature of their impact. In particular, subventions, which are strictly tied to delegated powers, depend less on a region's level of own revenues, which may distort the overall picture of the equalizing effect.

Research results and discussion

Dynamics of budget revenues of Russian regions:

Analysis of trends

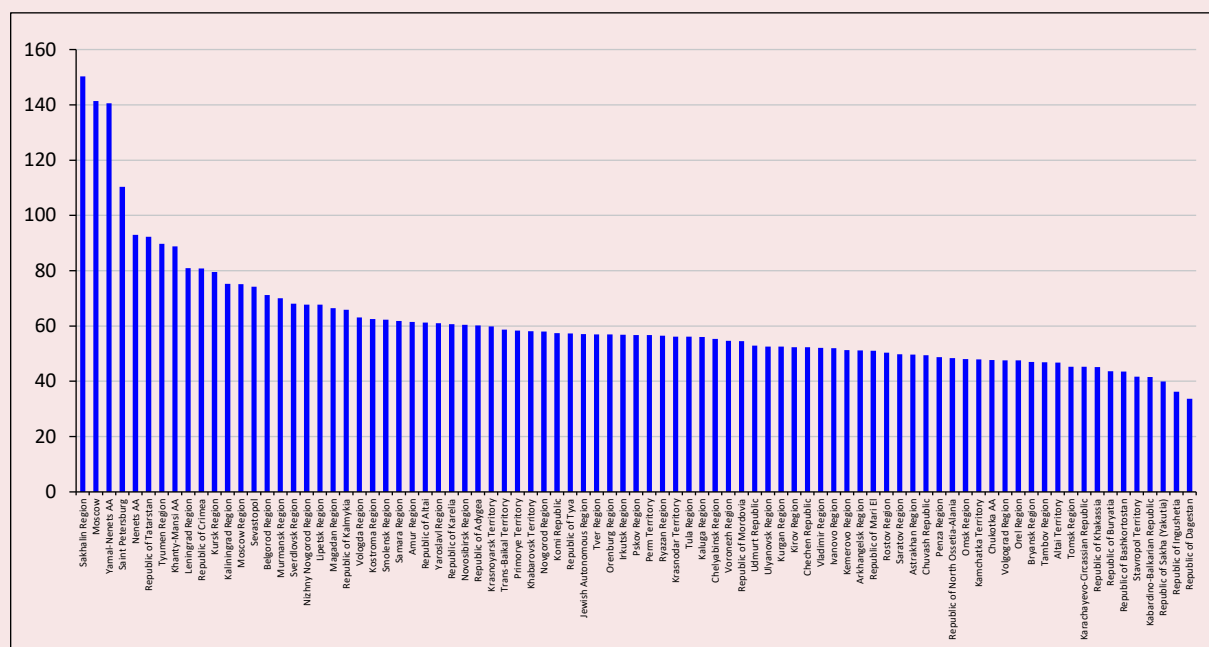
The distribution of regional budgets by the level of total per capita budget revenues is presented in *Table 1*. A graphical interpretation of the distribution of the RF constituent entities by total per capita budget revenues as of 2024 is shown in *Figure 1* (for clarity, the regions are arranged in descending order of revenues).

The analysis revealed a number of stable trends in the dynamics of fiscal capacity of the RF constituent entities. In the pre-crisis period (2012–2019), there was a gradual decline in the number of regions in the group with per capita total revenues of 50–70 thousand rubles: from 12 in 2012 to 8

Table 1. Grouping of the RF constituent entities by the volume of total budget revenues per capita, number of regions

Revenue, thousand rubles	Period under consideration												
	Pre-crisis								Pandemic		Post-pandemic		
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
from 10 to 30	1	0	2	6	6	4	0	0	0	0	0	0	0
from 30 to 50	61	63	64	67	65	66	67	60	39	24	27	24	23
from 50 to 70	12	14	10	5	8	8	8	15	36	47	45	47	46
from 70 to 90	5	2	5	5	4	5	5	4	5	8	8	7	10
from 90 to 110	2	3	2	1	1	1	4	3	3	3	1	4	2
from 110 to 130	0	1	2	0	1	1	0	1	1	2	1	0	1
above 130	2	0	0	1	0	0	1	2	1	1	3	3	3
Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: https://roskazna.gov.ru													

Figure 1. Distribution of regions by total budget revenues in 2024



Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: <https://roskazna.gov.ru>

in 2016–2018, followed by an increase to 15 in 2019. The group with revenues of 30–50 thousand rubles contained the absolute majority of the RF constituent entities during this period (from 60 to 67). Thus, the pre-crisis period was characterized by the concentration of the bulk of regions in the lowest income group.

In the pandemic period (2020–2021), the most noticeable structural shifts occurred. The number of regions in the group with revenues of 50–70 thousand rubles increased sharply, from 15 in 2019 to 36 in 2020 and 47 in 2021. At the same time, the number of regions with per capita revenues of 30–50 thousand rubles decreased significantly, from 60

in 2019 to 39 in 2020 and 24 in 2021. These changes coincide with a sharp increase in federal financial assistance in the respective years (see Tab. 5), which makes it possible to link the structural shifts to the expansion of anti-crisis support for the regions.

In the post-pandemic period (2022–2024), the established structure was generally preserved: the number of regions in the group with per capita revenues of 50–70 thousand rubles stabilized at 45–47, while the group with 30–50 thousand rubles remained at 23–27 regions. By 2024, the number of regions in the 50–70 thousand rubles group had reached 46, more than three times the 2019 level (15 regions). This indicates a shift of the bulk of the RF constituent entities into groups with higher fiscal capacity, but this shift occurred mainly during the pandemic period and did not intensify further.

The minimum values of per capita revenues of consolidated budgets during most of the study period were typical primarily of constituent entities with a limited own revenue base, high dependence on federal financial assistance, and a relatively low level of economic activity. This group included several republics of the North Caucasian Federal District, some agriculture-oriented regions, and territories with limited industrial and investment potential.

At the same time, the number of regions with the highest level of total revenues (above 70 thousand rubles per capita) remained comparatively limited throughout the period under review, despite a gradual increase in their number by the end of the study period. This group consisted mainly of financially stable constituent entities with a high concentration of the resource sector, a developed industrial base, and significant tax potential.

Unlike total revenues, which include inter-governmental transfers, tax and non-tax revenues reflect the ability of regions to generate financial resources independently. This indicator is therefore more closely related to the specific features of a territory's economy, its sectoral structure, and the scale of its tax base.

The distribution of regions by the level of own revenues gradually shifted toward higher values (Tab. 2). Whereas in 2012–2017 most RF constituent entities were in the 10–30 thousand rubles per capita range, in subsequent years the main range moved to the 30–50 thousand rubles group. In 2022–2024, this trend continued: the number of regions with per capita revenues of 30–50 thousand rubles rose from 38 to 43, while the number in the 50–70 thousand rubles range increased from 11 to 20.

Table 2. Grouping of the RF constituent entities by the volume of tax and non-tax budget revenues per capita, number of regions

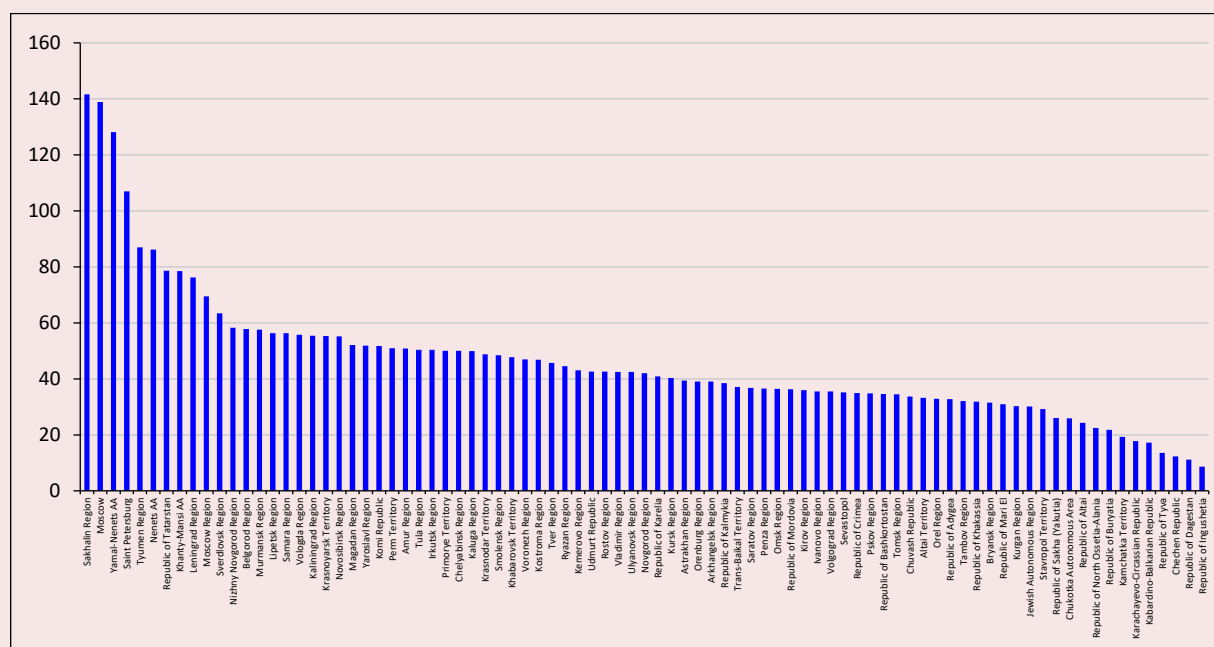
Revenue, thousand rubles	Period under consideration												
	Pre-crisis								Pandemic		Post-pandemic		
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
below 10	3	3	5	5	5	5	3	3	3	2	1	1	1
from 10 to 30	37	36	42	50	46	41	35	36	37	30	29	15	12
from 30 to 50	33	35	29	21	26	29	37	36	35	35	38	45	43
from 50 to 70	5	4	3	3	4	5	3	3	6	12	11	16	20
from 70 to 90	3	4	3	4	2	4	4	3	1	1	2	3	5
from 90 to 110	0	0	2	1	1	0	2	2	2	3	0	2	1
from 110 to 130	2	1	1	0	1	1	1	1	0	1	2	1	1
above 130		0	0	1	0	0	0	1	1	1	2	2	2
Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: https://roskazna.gov.ru													

Despite the overall growth of the indicator, differences among the RF constituent entities remained considerable. A high level of own revenues was maintained mainly in regions with developed industrial production, a strong extractive sector, and a high concentration of economic activity. At the same time, the composition of regions with the lowest indicator values changed only slightly, which points to the persistence of differences in the tax potential of territories.

The continued heterogeneity of own revenues determines the need to use intergovernmental transfers as an instrument for compensating differences in the financial capacity of regions (*Fig. 2*).

Changes in the volume of non-repayable receipts (*Tab. 3*) reflect the impact of crisis periods on the scale of resource redistribution. Before 2019, transfers of less than 10,000 rubles per capita were typical of most RF constituent entities. In 2020, the situation changed markedly: the number of regions

Figure 2. Distribution of regions by tax and non-tax budget revenues in 2024



Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: <https://roskazna.gov.ru> (accessed: April 2026).

Table 3. Grouping of the RF constituent entities by the volume of non-repayable receipts per capita, number of regions

Revenue, thousand rubles	Period under consideration												
	Pre-crisis								Pandemic		Post-pandemic		
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
below 10	30	41	46	52	55	51	42	30	7	11	11	19	27
from 10 to 30	49	37	34	29	26	29	38	47	63	64	62	58	52
from 30 to 50	2	5	3	4	4	4	2	6	11	8	10	6	6
from 50 to 70	2	0	2	0	0	1	3	2	4	2	2	2	0

Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: <https://roskazna.gov.ru>

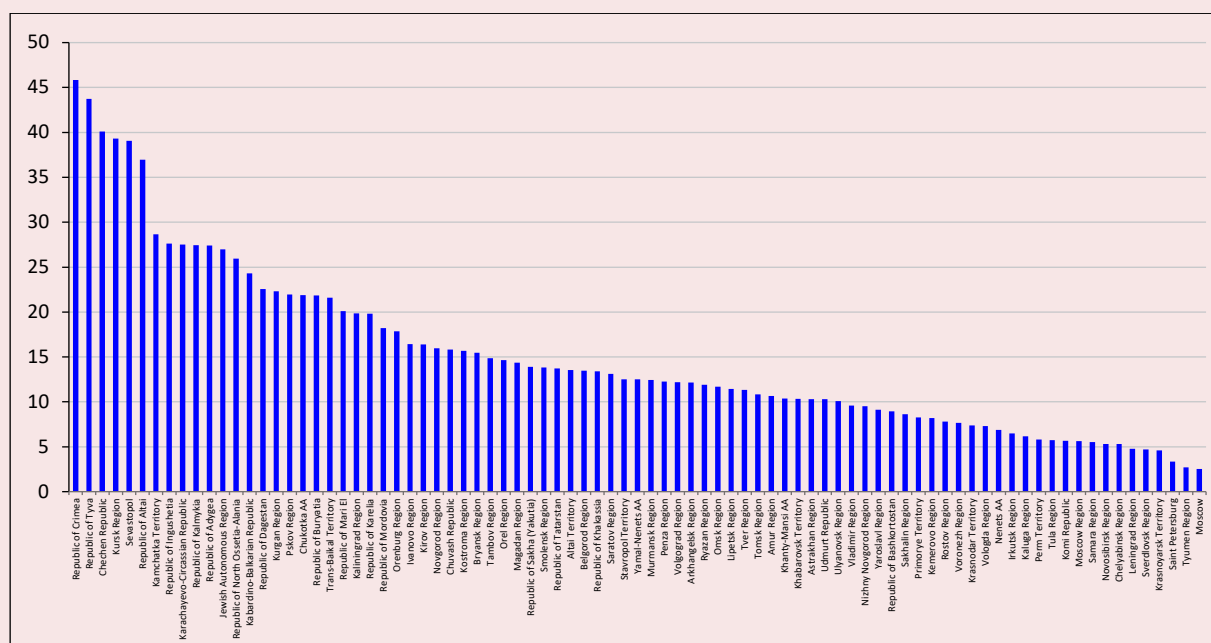
receiving less than 10,000 rubles fell from 30 to 7, while the number of regions with transfers above 30,000 rubles increased from 8 to 15. In subsequent years, support volumes gradually declined, and by 2024 the number of regions receiving less than 10,000 rubles per capita reached 27.

The largest volumes of federal assistance went to regions with limited capacity to generate own revenues, a high social burden, and substantial expenditure obligations. This group consisted mainly of several republics of the North Caucasus, national republics, and territories with difficult natural and climatic conditions. At the same time, the composition of the main recipient regions remained largely unchanged throughout the period. The smallest volumes of support were typical of regions with a more developed economic base and high tax potential (*Fig. 3*).

The results show that the system of inter-governmental redistribution is oriented to a considerable extent toward supporting regions with limited tax potential and a high need for fiscal equalization. At the same time, the persistent large differences in federal financial assistance and the stability of the group of regions receiving the largest transfers indicate a high degree of heterogeneity in the socio-economic development of the RF constituent entities and the entrenchment of existing disproportions.

When analyzing intergovernmental fiscal regulation, it must be borne in mind that the equalization of the fiscal capacity of the RF constituent entities is achieved not only through direct intergovernmental transfers but also through the redistribution of certain federal tax revenues. Thus, part of the receipts from excise taxes on

Figure 3. Distribution of regions by non-repayable receipts in 2024



Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: <https://roskazna.gov.ru>

alcoholic beverages and petroleum products is distributed among regions according to established norms and in practice performs the functions of intergovernmental transfers.

An additional influence on interregional redistribution came from changes in the proportions of corporate profit tax distribution starting in 2017, accompanied by a one-percentage-point reduction in the regional component of the tax rate and the subsequent allocation of the corresponding funds to equalizing the fiscal capacity of the RF constituent entities. This measure helped reduce interregional differences in budget revenues but at the same time increased the dependence of some regions on federal redistribution and reduced the own revenue sources of individual constituent entities.

Thus, the transformation of the mechanisms for distributing revenue sources among levels of the budget system points to the strengthening role of the

federal center in regulating interregional financial flows and shaping the fiscal capacity of the RF constituent entities. At the same time, as the data show, changes in the regulatory framework did not lead to a substantial transformation of the interregional structure of fiscal capacity: the composition of regions with the lowest and highest revenues remained stable throughout the period under review.

Intergovernmental transfers as a tool for reducing asymmetry in the fiscal capacity of Russian regions

To assess the effectiveness of intergovernmental equalization, it is necessary to compare the degree of interregional differentiation of budget revenues before and after the distribution of intergovernmental transfers. To this end, *Table 4* presents statistical indicators of tax and non-tax revenues, as well as total revenues of the budgets of the RF constituent entities in per capita terms.

Table 4. Changes in selected quantitative indicators of budget revenues per capita across the budgets of the RF constituent entities, thousand rubles

Indicator	Period under consideration												
	Pre-crisis								Pandemic		Post-pandemic		
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Tax and non-tax revenues													
Mean	34.8	33.8	32.8	30.9	31.1	32.4	35.5	36.9	34.7	40.8	41.3	44.7	46.2
Maximum	125.0	118.6	120.4	158.7	110.5	124.8	129.4	139.1	130.8	148.3	146.7	143.9	141.6
Minimum	7.4	7.7	6.9	6.6	6.9	7.3	8.0	7.2	8.2	8.2	8.8	7.8	8.7
Asymmetry range, times	17.0	15.5	17.4	23.9	15.9	17.0	16.1	19.4	16.0	18.0	16.6	18.4	16.4
Coefficient of variation, %	58.8	54.0	62.6	70.1	57.2	57.8	59.6	62.3	57.4	56.5	61.8	55.6	52.9
Decile ratio, times	7.99	7.14	7.91	7.92	6.59	7.20	7.52	7.66	6.40	6.62	7.20	6.78	6.40
Total revenues													
Mean	49.3	47.2	46.1	41.8	41.5	43.5	48.5	52.0	56.0	60.5	60.5	61.9	61.4
Maximum	137.0	122.3	127.3	162.5	115.3	127.7	133.6	143.0	145.4	154.7	152.8	155.0	150.3
Minimum	29.6	31.8	26.1	26.6	27.7	28.4	31.1	33.7	38.5	39.8	39.4	35.2	33.6
Asymmetry range, times	4.6	3.8	4.9	6.1	4.2	4.5	4.3	4.2	3.8	3.9	3.9	4.4	4.5
Coefficient of variation, %	38.5	33.2	40.4	45.7	37.4	38.9	39.8	39.1	31.1	31.2	36.2	33.9	33.9
Decile ratio, times	2.84	2.58	2.96	2.97	2.68	2.84	2.85	2.79	2.35	2.41	2.65	2.58	2.66
Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: https://roskazna.gov.ru													

Table 5. Dynamics of selected statistical indicators of non-repayable receipts, thousand rubles

Indicator	Period under consideration												
	Pre-crisis								Pandemic		Post-pandemic		
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Mean	14.5	13.4	13.2	10.8	10.4	11.0	13.0	15.1	21.3	19.7	19.3	17.2	15.2
Maximum	63.6	46.6	59.1	41.7	43.9	53.5	56.9	54.8	62.3	56.4	60.1	63.7	45.8
Minimum	4.0	2.7	2.5	2.1	1.6	1.8	3.8	3.9	7.1	5.0	3.8	2.4	2.5
Asymmetry range, times	16.1	17.6	24.1	19.9	28.3	30.0	15.1	14.0	8.8	11.4	15.8	26.4	18.2
Coefficient of variation, %	64.6	63.3	77.3	68.8	77.6	84.8	78.0	67.9	54.5	55.3	57.1	64.9	64.4
Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: https://roskazna.gov.ru													

The data in Table 4 show that interregional differentiation of budget revenues persisted throughout the observation period, but its scale differs considerably for the indicators before and after transfers are allocated.

In the pre-crisis period (2012–2019), the coefficient of variation for tax and non-tax revenues ranged from 54.0 to 70.1%, reaching a maximum in 2015 (70.1%). For total revenues, this indicator was markedly lower, in the range of 33.2–45.7%. The asymmetry range for own revenues reached 23.9 times (in 2015), while for total revenues it did not exceed 6.1 times. The decile ratio for own revenues during this period varied from 7.14 to 7.99 times, and for total revenues from 2.58 to 2.97 times. Thus, already in the pre-crisis period, intergovernmental transfers ensured a more than twofold reduction in the gap between the polar groups of regions.

In the pandemic period (2020–2021), differentiation indicators reached their lowest values for the entire interval under consideration. The coefficient of variation for total revenues fell to 31.1–31.2%, the asymmetry range to 3.8–3.9 times, and the decile ratio to 2.35–2.41 times. The increase in federal support in 2020–2021 was accompanied by a reduction in regional differences in total revenues (*Tab. 5*). In subsequent years, differentiation indicators increased somewhat: the coefficient of variation for total revenues was 33.9–36.2%, and the decile ratio rose to 2.58–2.66 times.

This points to the persistence of stable differences in fiscal capacity even after a period of large-scale resource redistribution.

Over 2012–2024, per capita tax and non-tax revenues of the regions increased from 34.8 to 46.2 thousand rubles. However, the growth of own revenues was not accompanied by a reduction in interregional differences: the coefficients of variation and asymmetry indicators remained high. Thus, regions' capacities to form their own revenue bases continued to differ significantly.

Unlike own revenues, total regional budget revenues were characterized by a lower degree of heterogeneity. During the period of the largest increase in transfers, primarily in 2020–2021, regional differences narrowed considerably: the asymmetry range for total revenues did not exceed 6.1 times, and the coefficient of variation remained within 31.1–45.7%. This confirms that intergovernmental transfers perform the function of smoothing differences in the fiscal capacity of territories.

A comparison of the decile ratios also reveals the difference between the level of the own revenue base and the final fiscal capacity of regions. In 2024, the gap between the top and bottom deciles of regions was 6.4 times for tax and non-tax revenues and 2.66 times for total revenues. Over the entire study period, the decile ratio for own revenues ranged from 6.40 to 7.99 times, whereas for total revenues

it ranged from 2.35 to 2.97 times. Consequently, redistribution through the transfer system substantially reduces regional differences but does not fundamentally change regions' relative positions in the interregional income structure.

The dynamics of non-repayable receipts also reflect the changing role of federal support. After a decline in per capita transfers from 14.5 thousand rubles in 2012 to 10.4 thousand rubles in 2016, their volume began to grow and reached a maximum in 2020 – 21.3 thousand rubles per person.

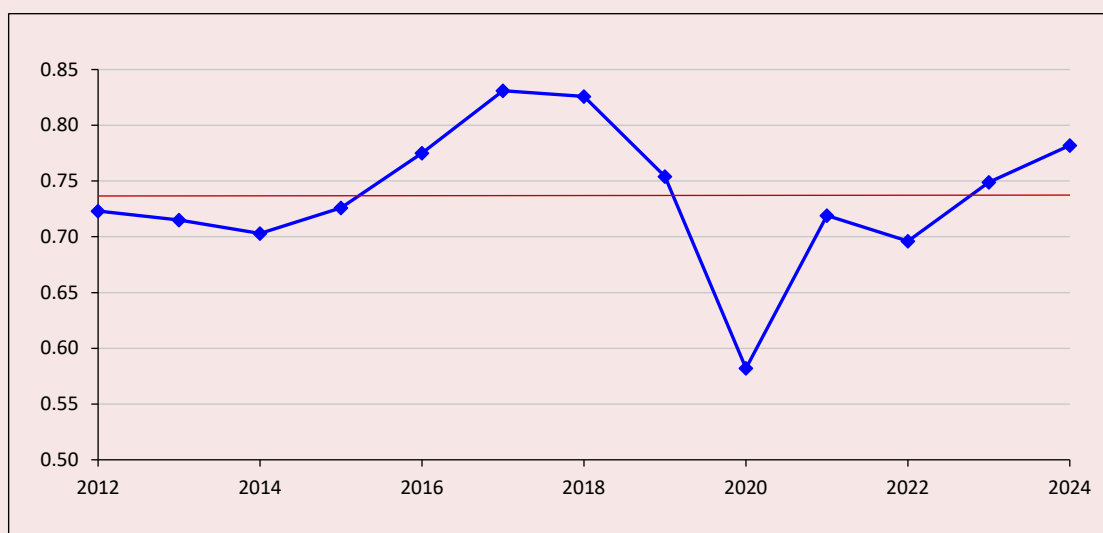
The increase in federal financial assistance in 2020 was associated with the implementation of anti-crisis measures during the pandemic. In subsequent years, transfer volumes gradually declined, indicating a return to more standard parameters of intergovernmental fiscal regulation. This suggests that the system of intergovernmental transfers is highly adaptive to external shocks but does not ensure a sustainable reduction in interregional differences in the long term.

One of the key objectives of intergovernmental fiscal regulation is to reduce interregional diffe-

rences in fiscal capacity while preserving the incentives of the RF constituent entities to develop their own revenue bases (Malkina, 2016; Timushev, Mikhaylova, 2023). To assess the effectiveness of the current system of intergovernmental transfers, we compared the ranks of the RF constituent entities by tax and non-tax revenues and by total regional budget revenues, followed by the calculation of Spearman's rank correlation coefficient (*Fig. 4*).

For most of the period under review, Spearman's rank correlation coefficient remained at the level of a strong positive relationship, exceeding 0.7 and reaching 0.83 in some years. The obtained values of Spearman's coefficient indicate the high stability of the interregional structure of fiscal capacity. In other words, the distribution of the RF constituent entities by total revenues after accounting for intergovernmental transfers largely preserved the order formed on the basis of tax and non-tax revenues. Consequently, the current system of intergovernmental fiscal regulation has a limited impact on changes in the relative positions of regions.

Figure 4. Values of Spearman's rank correlation coefficient



Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: <https://roskazna.gov.ru>

The most noticeable deviation from this pattern was observed in 2020, when the coefficient fell to 0.58 – the lowest level for the entire study period. This points to a change in the nature of intergovernmental redistribution during the pandemic crisis: the volumes of federal support depended less on the initial level of fiscal capacity of the RF constituent entities and were determined to a greater extent by the need to implement anti-crisis measures. Already in 2021, the coefficient rose again to values corresponding to a strong positive relationship (0.70–0.78), indicating a return to the established principles of intergovernmental transfer distribution.

Thus, intergovernmental transfers help reduce interregional differentiation in fiscal capacity, but they do not substantially transform the existing hierarchy of the RF constituent entities by income level. Despite the smoothing effect of federal redistribution, regional differences remain quite high. The stability of the interregional hierarchy (Spearman's coefficient > 0.7 in many years of the study period) means that the system in fact conserves the existing structure of interregional differences without creating conditions for changes in the relative positions of regions. This points to the limited ability of the current system of intergovernmental fiscal regulation to ensure the long-term convergence of regions.

Identifying the orientation of federal policy in the provision of intergovernmental financial assistance

The nature of intergovernmental redistribution was assessed on the basis of the regression relation-

ship between the logarithm of per capita non-repayable receipts ($\ln T$) and the logarithm of per capita tax and non-tax revenues of the regions ($\ln R$). The estimation results are presented in *Table 6*. A graphical interpretation of the identified relationship for individual years of the study period is shown in *Figure 5*: the actual distribution of regions is shown in blue, and the fitted regression line characterizing the orientation of federal transfer policy is shown in red.

The values of the coefficient of determination R^2 ranged from 0.39 to 0.68, reaching a maximum in 2015. This means that differences in regional own revenues explained between 39 and 68% of the variation in intergovernmental transfer volumes. Consequently, a stable statistical relationship persisted between the fiscal capacity of the RF constituent entities and the scale of federal financial assistance.

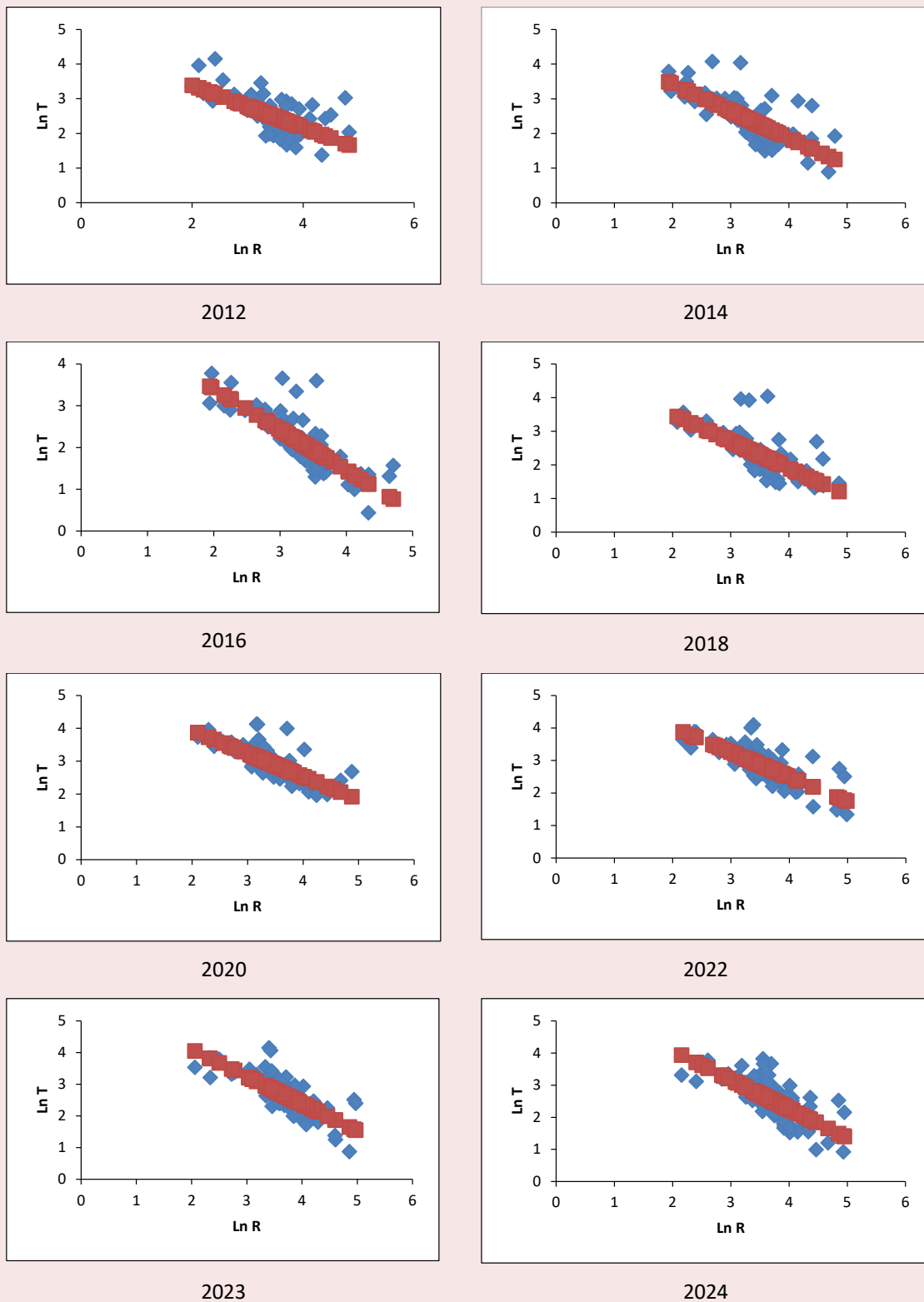
A fundamentally important result is the consistently negative value of the coefficient β over the entire period under consideration. Its magnitude ranged from -0.61 to -0.98, indicating an inverse relationship between the level of regional own revenues and the volume of transfers provided: less well-off RF constituent entities systematically received larger volumes of federal financial assistance. The statistical significance of the coefficient in all models confirms the reliability of this pattern.

An analysis of the dynamics of the coefficient β across the three periods makes it possible to trace the evolution of federal transfer policy.

Table 6. Estimation results for the equation $\ln T_i = \alpha + \beta \cdot \ln R_i + \varepsilon_i$

Indicator	Period under consideration												
	Pre-crisis								Pandemic		Post-pandemic		
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
R^2	0.39	0.49	0.52	0.68	0.62	0.59	0.50	0.55	0.53	0.62	0.56	0.57	0.50
α	4.60	5.09	5.00	5.03	5.37	5.40	5.12	5.32	5.34	5.62	5.53	5.82	5.89
β	-0.61	-0.78	-0.78	-0.86	-0.98	-0.97	-0.80	-0.81	-0.70	-0.78	-0.76	-0.86	-0.91
Significance of β	+	+	+	+	+	+	+	+	+	+	+	+	+
Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: https://roskazna.gov.ru													

Figure 5. Relationship between the logarithms of per capita tax and non-tax revenues of regions and the intergovernmental transfers they receive



Calculated from: materials from the official website of the Federal Treasury of the Russian Federation. Available at: <https://roskazna.gov.ru>

In the pre-crisis period (2012–2019), the coefficient β ranged from -0.61 to -0.98, reaching its highest absolute values in 2016–2017 (-0.98 and -0.97, respectively). This indicates that in those years federal policy was oriented to the greatest extent toward supporting regions with low levels of own revenues. In 2015, the model had its highest explanatory power ($R^2 = 0.68$), pointing to the closest relationship between regional own revenues and transfer volumes.

In the pandemic period (2020–2021), the identified relationship noticeably weakened: the coefficient β declined from -0.81 in 2019 to -0.70 in 2020, and R^2 decreased from 0.55 to 0.53. In 2021, the value of β rose to -0.78 and R^2 to 0.62, indicating a partial restoration of the relationship between regional own revenues and transfer volumes, though a full return to pre-crisis parameters had not yet occurred. The decline in the absolute value of β in 2020 reflects the changing nature of federal support during the crisis: the distribution of transfers was determined less by differences in regional tax potential and more by the need to implement anti-crisis measures. This is consistent with the dynamics of Spearman's coefficient (see Tab. 6), which also reached its minimum in 2020 (0.58), indicating a temporary weakening of the established interregional fiscal hierarchy.

In the post-pandemic period (2022–2024), the values of β again approached pre-crisis levels: -0.76 in 2022, -0.86 in 2023, and -0.91 in 2024. This indicates a return to the established principles of intergovernmental transfer distribution, under which the volume of financial assistance is determined to a greater extent by the level of regional own revenues. At the same time, the R^2 values in this period (0.50–0.57) remained below the 2015 maximum (0.68), which may point to a certain increase in the complexity of the factors determining federal support volumes, including the growing importance of targeted transfers and program-based instruments.

Thus, the regression analysis confirms that federal transfer policy was equalizing in nature throughout the entire study period: funds were directed predominantly to regions with lower levels of own revenues. However, the degree of this equalizing orientation was not constant: it temporarily weakened during the pandemic period, giving way to anti-crisis priorities, and then recovered in subsequent years. At the same time, the identified pattern does not contradict the conclusion about the limited long-term smoothing effect, since even with the preservation of the equalizing orientation of policy, the interregional hierarchy of fiscal capacity remains stable.

Conclusion

The study has shown that the current system of intergovernmental fiscal regulation in the Russian Federation generally performs an equalizing function but does not eliminate the persistent interregional differentiation of fiscal capacity. The main conclusions can be formulated as follows.

1. Intergovernmental transfers reduce the gap between the most and least well-off regions but do not fully eliminate interregional differences. Throughout the study period, the coefficient of variation for total revenues was 1.5–1.7 times lower than that for own revenues, yet it remained at 31–46%, indicating substantial heterogeneity in fiscal capacity. The decile ratio shows a similar pattern: for total revenues its values remained within 2.35–2.97 times, whereas for own revenues they were 6.40–7.99 times. This points to a significant narrowing of the gap between the most and least well-off regions as a result of intergovernmental redistribution, but it does not allow us to speak of overcoming interregional differentiation.

2. Despite the large-scale redistribution of financial resources through the system of intergovernmental transfers, the interregional hierarchy of fiscal capacity remains stable. Spearman's rank correlation coefficient exceeded 0.7 for most of the study period, indicating that the relative positions

of regions are preserved after they receive transfers. This means that the system of intergovernmental fiscal regulation “adds” resources to existing revenues without fundamentally changing the established structure of interregional differences, thereby effectively conserving the existing asymmetry.

3. The coronavirus pandemic in 2020 led to a temporary transformation of intergovernmental fiscal regulation mechanisms: the volumes of federal support were determined to a lesser extent by the initial level of regional fiscal capacity. This manifested itself in a decline in Spearman’s coefficient and a weakening of the negative elasticity of transfers with respect to own revenues. However, already in 2021–2022 the parameters of intergovernmental fiscal regulation returned to pre-crisis values, indicating the adaptability but not the sustainability of the smoothing effect.

4. The results indicate that the current mechanism of intergovernmental fiscal regulation largely fulfills the task of smoothing differences in regional fiscal capacity, but it does not bring about substantial changes in the existing differences in the level of the own revenue base. The stability of the composition of the groups of regions with high and low income levels points to the need to improve mechanisms capable not only of compensating for resource shortages but also of creating conditions for expanding the tax potential of territories.

One direction for the development of intergovernmental fiscal regulation could be the broader use of incentive elements in the distribution of financial support. When assessing regions’ need for transfers, it is advisable to take into account not only the current level of fiscal capacity but also changes in indicators characterizing the development of their own revenue bases.

Another important direction is to differentiate the tasks of various types of transfers. Equalization

mechanisms should reduce objective differences in regional fiscal capacity, while incentive-based support instruments could be oriented toward improving the efficiency with which existing economic potential is used.

Given the dynamic nature of interregional differences, the parameters of transfer policy require periodic adjustment. This should take into account changes in regional economic structures, demographic processes, and the transformation of the expenditure obligations of the RF constituent entities.

The indicators obtained in the study – the coefficient of variation and Spearman’s rank correlation coefficient – can be used as additional tools for analyzing the results of intergovernmental fiscal regulation. They make it possible to assess not only the degree of differences among regions but also changes in their relative positions after the redistribution of budgetary resources.

Improving intergovernmental fiscal relations involves not only increasing the precision of fiscal capacity equalization but also finding a balance between the compensatory and incentive functions of transfers. Such an approach could contribute to gradually reducing regions’ dependence on federal support and strengthening their own financial bases.

The question of the effectiveness of the current system of intergovernmental equalization can be answered in two ways. On the one hand, the system performs the function of smoothing interregional differences: the coefficients of variation and decile ratios for total revenues are substantially lower than those for own revenues. On the other hand, in the long term the system does not ensure regional convergence or change their relative positions, which makes it possible to describe its effectiveness as limited – effective in the tactical dimension (smoothing shocks) but not in the strategic dimension (sustainably reducing differentiation).

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Analysis of the Systems for Monitoring the Scientific and Technological Development of the BRICS Countries: Problems and Possible Solutions



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Abstract. In the context of intensifying global technological competition, science and technology development has become one of the key factors of national competitiveness, resilience, and strategic autonomy. For the BRICS countries, this sphere is especially important because it combines the tasks of economic modernization, strengthening domestic scientific capacity, and developing national mechanisms of technological advancement. The purpose of the article is to identify common trends and national specificities in the monitoring systems of science and technology development in the BRICS countries through a comparative analysis of roadmaps and indicator architecture. The empirical basis includes official strategic and program documents of Brazil, Russia, India, China, and South Africa. The methodological framework combines comparative analysis, qualitative content analysis of documents, a systems approach. An approach distinguishing resource, output, applied-effect, and strategic-impact

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indicators was used for cross-country comparison. The study shows that the BRICS countries differ in the function of monitoring within the system of public governance of science and technology development. Russia and China demonstrate predominantly centralized models in which monitoring is embedded in the strategic planning framework. India is characterized by a mission-oriented evaluative model that combines program flexibility, digital monitoring contours, and pronounced feedback mechanisms. Brazil and South Africa are closer to coordination-transformational models focused on linking strategic and program levels. The scientific novelty of the article lies in comparing the BRICS countries not by aggregate statistical indicators, but by the architecture of monitoring as a specific element of public science and technology policy. The practical significance of the study lies in the possibility of using its conclusions to improve national monitoring systems, develop interim assessment procedures and adjust government policy in the scientific and technological field, as well as identify the need for a strategic system of scientific and technological cooperation within the entire BRICS association.

Key words: BRICS, science and technology development, science and technology policy, monitoring system, roadmaps, indicators, public governance, comparative analysis, performance evaluation.

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Introduction

Technologies are becoming one of the most important resources for the socio-economic development of society in today’s geo-economic conditions. Research in this area is of critical importance for the development and implementation of state strategies for science and technology development. Geopolitical instability and fragmentation have led to technologies becoming the basis for interstate competition (Kireeva, Pozdnyaev, 2026). A number of countries are following the path of increasing their technological leadership. China (Cha, 2023), the states of the European Union (Roch, Oleart, 2024), the United States (Reynolds, 2024); others are on the path to achieving technological sovereignty (Russia, India, Brazil) and bridging the gap in technological innovation (Dezhina, Ponomarev, 2022).

A large body of research has been accumulated in the scientific literature devoted to these issues. The works of N.V. Smorodinskaya and D.D. Katukov examine the issues of technological self-sufficiency,

primarily in Russia (Katukov, Smorodinskaya, 2025; Smorodinskaya, Katukov, 2024). M.A. Gershman and co-authors analyze the science and technology policies of various countries, focusing on strategies for achieving technological leadership (Gershman et al., 2025).

However, issues related to the effectiveness of national systems for assessing and monitoring the science and technology development of the BRICS countries are addressed relatively rarely. Within the framework of existing studies, for example, those conducted by the Russian Institute of Economics, Politics and Law in the scientific and technical sphere (Ilyina et al., 2023), the problem of the effectiveness of scientific and technological development is considered more from the perspective of the need to develop a universal tool for the subsequent harmonization of monitoring systems within the association. The works of foreign authors are more focused on the effectiveness of national innovation systems and their role in ensuring the

sustainability of economic growth (Alnafrah, 2021). The indices and aggregated indicators collected by the OECD and UNESCO are convenient metrics for comparative studies in an international context, but they often conceal imbalances¹, whereas sets of indicators, although more transparent, are fragmented. In this regard, the questions of how exactly the performance indicator systems are structured methodologically, what levels of effectiveness dominate in them, and how they reflect the priorities of science and technology policy often remain unexplored. The methodologies developed within the framework of the OECD² and UNESCO³ Statistical Institute only partially address this research question. For example, the Frascati Manual proposes an institutional-sectoral approach⁴. However, the authors of the manual warn that they do not provide official recommendations, as the statistical infrastructure varies from country to country: different data sets are collected and different methodologies are used.

Within the BRICS framework, there is heterogeneity both at the level of the goals of national strategies in the scientific and technological sphere and at the level of the effectiveness of the implemented scientific and technological policy. In comparative studies of the BRICS countries, the main focus is often placed on strategic goals, institutional architecture, publication and patent activity, or overall indicators of innovative development. As a result, the questions of how exactly these countries form their own indicator

systems, which performance levels dominate in them, and how the actual priorities of science and technology policy are expressed through these systems are practically unexplored (Bshivanna et al., 2026).

Currently, the BRICS is governed by a number of documents signed by the Russian Federation at the international level and approved under national legislation, which highlight the need to establish a strategic system for cooperation in the fields of science, technology, and innovation among the BRICS member states, as well as the importance of monitoring the effectiveness of its operation⁵. First and foremost, this is the RF Government Order 434-r, dated February 14, 2015 “On signing of memorandum on cooperation in the field of science, technology and innovation between the Government of the Federative Republic of Brazil, the Government of the Russian Federation, the Government of the Republic of India, the Government of the People’s Republic of China and the Government of the Republic of South Africa,”⁶ which notes the commitment of the BRICS member states to strengthen cooperation in the field of science, technology and innovation for accelerated and sustainable socio-economic development. The strategic document “Concept of International Scientific and Technical Cooperation of the Russian Federation,” which was approved by the RF Government decision TG-P8-952, dated February 8, 2019⁷, identifies priority cooperation with countries participating in international

¹ Belousov D.R., Frolov I.E. (Eds). (2022). On the Long-Term Scientific and Technological Development of Russia: Monograph. Moscow: Dinamik Print. 168 p.

² Available at: www.oecd.org (accessed: 05.08.2026).

³ Available at: uis.unesco.org (accessed: 05.08.2026).

⁴ OECD (2018), Eurostat. Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation. 4th ed. Paris: OECD Publishing. DOI: 10.1787/9789264304604-en. Available from: https://www.oecd.org/en/publications/oslo-manual-2018_9789264304604-en.html

⁵ The joint website of the foreign ministries of the BRICS member states. Available at: <https://infobrics.org/en/documents/2016/> (accessed: 05.08.2026).

⁶ Current legislation of the Russian Federation. Available at: <https://rulings.ru/government/Rasporyazhenie-Pravitelstva-RF-ot-14.03.2015-N-434-r> (accessed: 05.08.2026).

⁷ The concept of international scientific and technical cooperation. Available at: https://www.minobrnauki.gov.ru/upload/2021/07/kontsepsiya_MNTS_Rossiyskoy_Federatsii.pdf (accessed: 05.08.2026).

associations, including the BRICS, as one of the main areas of international scientific and technical cooperation.

The scientific problem of the study is that differences in national systems for monitoring science and technology development hinder the possibility of forming a strategic system of scientific and technological cooperation within the entire BRICS alliance. The models for implementing state science and technology policy, the varying sets of indicators in terms of structure, and the differences in the logic for assessing results and effects create a research gap that this work addresses.

The aim of the work is to identify the common and specific characteristics of the assessment and monitoring systems of the countries that are part of the BRICS core. The subject of the study is the architecture of the assessment and monitoring systems for science and technology policies. The research hypothesis is that the differences between the BRICS countries manifest themselves not only and not so much in the composition of the indicators used, but rather in the logic of assessing the results of the science and technology policy being implemented.

The article addresses the following tasks to achieve the set goal: systematizes theoretical approaches to the analysis of science and technology policy and monitoring systems; develops an analytical framework for comparing policy documents and the architecture of indicator systems; conducts a comparative analysis of the

monitoring systems of five BRICS countries; identifies common trends, national characteristics, and limitations of the comparability of the analyzed systems. The scientific novelty lies in the development of an analytical approach to comparing policy documents and the architecture of indicator systems for monitoring the science and technology development of the BRICS countries. The practical significance lies in the possibility of using the obtained results when forming a strategic cooperation system within the framework of the BRICS alliance, improving national monitoring systems, and enhancing the quality of assessment of science and technology policy.

Current state of science complexes in the core BRICS countries

The BRICS countries have science complexes that differ in scale, structure, and effectiveness. To form a strategic system of science and technology cooperation, it is necessary to analyze their current state. *Table 1* presents the key parameters of the main BRICS members (R&D expenditures, human resources, patent activity, etc.).

The analysis of R&D expenditures shows that the BRICS countries are highly heterogeneous. While the average share of expenditures in China is 2.23%, in India and South Africa it is 0.67% each. In terms of the number of researchers per million people over the period under analysis, Russia is among the top three. However, if we compare these figures with the number of patent applications filed, China is the leader, followed by Russia and India.

Table 1. The main characteristics of science complexes of the key BRICS countries, average values for 2014–2024

Country	R&D spending, % of GDP	Number of researchers per 1 million people	Number of patent applications filed by residents of the country, pieces	Number of publications, pieces	Share of high-tech exports in GDP, %	Share of added value of high-tech products, % of GDP
Brazil	1.22	903.2	5046.25	62401	12.4	33
Russia	1.05	2832.4	24313	74996	12.3	31.6
India	0.67	241.2	17241.25	13421	10	42
China	2.23	1405.1	1203615	576093	30	41
RSA	0.67	475.8	836.6	13756	6	24

According to: data.worldbank.org.

China is also the leader in terms of the number of publications, followed by Russia and Brazil. In terms of the share of high-tech exports – China, Brazil, Russia, and India. The data presented on the science complexes of the BRICS countries allow drawing the following conclusions: heterogeneity is observed both between the countries and when comparing the ratios of the indicators. For instance, in China, the number of researchers per 1 million people is 1,405.1, and the share of high-tech exports is 30%; in India, it is 241.2 researchers and 10% of high-tech exports, respectively. This imbalance indicates that the BRICS countries are on different trajectories of technological development. And while China is capable of competing with the United States, the task for the other BRICS states is to build up their technological sovereignty.

The discrepancy between the number of scientists and the share of high-tech exports in Russia indicates that the commercialization of technologies is a pressing problem. Patent activity in the country is 50 times lower than in China, which also confirms the thesis about the gap between theoretical developments and their practical application. It is worth noting that high spending on R&D does not guarantee results: with 0.67%, India has a higher share of high-tech products (42%) than Brazil. Therefore, the key factor is the institutional infrastructure of the science sector.

It is this indicator that serves as the basis for calculating the readiness index for advanced technologies, which is calculated based on the presence of institutional conditions for the development of artificial intelligence (AI) and

innovation. Currently, in the ranking by the readiness index for advanced technologies, the BRICS countries occupy positions from 21 to 52 (Tab. 2).

The brief analysis of the current state of science complexes in the BRICS countries has proved that their science and technology development is heterogeneous, and their science complexes operate with varying degrees of efficiency.

Literature review

The following areas of research are relevant to this research: the study of national innovation systems, works on combining instruments of state policy in the science and technology sphere, studies on measuring science and technology development, and comparative research on the BRICS countries (Niembro, Levin, 2026).

The first block consists of works on national innovation systems, which represent the result of interaction between the state, the research sector, business, the education system, and infrastructure institutions (Alnafrah, Bogdanova, 2018). These studies show that the effectiveness of science and technology policy is determined not only by the volume of resources but also by the quality of the institutional environment, the density of cooperative ties, the capacity for knowledge transfer, and the stability of coordination mechanisms (Isaksen et al., 2022; Belussi et al., 2024).

The second block is related to research on the tools of state policy. These works focus on the fact that the effectiveness of state policy depends not only on the quality of individual measures but also on the logic of combining them. For the BRICS

Table 2. Index of readiness for advanced technologies in the BRICS countries

Country	Place	ICT	Professional qualifications	R&D	Industrial potential	Funding opportunity
China	21	101	64	1	6	3
Russia	33	41	29	17	72	63
India	36	9	113	3	10	70
Brazil	38	38	59	18	50	41
RSA	52	76	71	41	55	27

According to: UNCTAD Technology and Innovation Report 2025 (UNCTAD, 2025).

countries, this approach is important, since their science and technology policy is typically based on a combination of strategies (Howoldt, 2024; Lenihan et al., 2025).

The third block consists of studies that examine the problems of measurability of the results of science and technology development. In modern literature, science and technology development is increasingly viewed less as a linear accumulation of resources, publications, and patents. On the contrary, the focus of research is shifting toward analyzing the conversion of accumulated knowledge into specific products and services with export potential (Zhang et al., 2025).

Overall, two main vectors can be identified in the literature on measuring the results of science and technology development. The first relies on the aggregation of traditional statistical indicators that characterize research and development expenditures, the number of research personnel, publication activity, patenting, and innovative products. This approach is implemented in supranational institutions⁸. However, standard sets of indicators, developed for economically homogeneous countries, do not always adequately reflect the specifics of states with varying levels of institutional maturity, territorial asymmetry, different sectoral structures, and different combinations of growth, modernization, and social transformation challenges (Kruss et al., 2025; Olariaga-Santa-Cruz et al., 2024).

The second vector is focused on building more complex evaluative and analytical tools that distinguish between levels of performance, use hierarchies of indicators, and take into account the relationship between invested resources, immediate results, practical application, and long-term effects. It is this vector that is particularly important for

comparative analysis, as it allows going beyond simply recording the scale of scientific activity and raising the question of which results the state considers most significant for evaluation and monitoring (Corrente et al., 2023; Zhang et al., 2025).

The next block consists of studies directly focused on the BRICS countries. One part of them is concerned with comparing macro-level indicators of science and innovation development (Santana et al., 2024), while the other examines national models of science and technology policy, institutional conditions, and strategic priorities of individual states. Russian researchers focus on the institutional logic of the innovation system, the impact of external constraints, and the issues related to technological sovereignty (Volchik, Fursa, 2015; Lenchuk, 2022; Lenchuk, 2024; Smorodinskaya, Katukov, 2024). Chinese scholars concentrate on the state coordination of technological development, the combination of support tools, environmentally oriented innovations, and the regional complexity of innovation policy (Liang, 2024; Liefner, 2025).

Researchers from India emphasize the evolution of the national science and technology policy, its connection with development goals, and the importance of digital infrastructure as a practical tool for implementing science and technology policy (Krishna, 2022; Mammen, Nirupama, 2024; Desai, Manoharan, 2024). The Brazilian case is examined through the lens of innovation barriers, regional and technological disparities, as well as the sectoral and institutional foundations of modernization (Silva, 2025; Araújo et al., 2026; Nehring, 2021). For the Republic of South Africa, studies on the coherence of science and technology policy and the link between innovation and economic growth are significant (Kahn, 2023; Kasongo, Makamu, 2024).

⁸ OECD (2018), Eurostat. Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation. 4th ed. Paris: OECD Publishing. DOI: 10.1787/9789264304604-en. Available at: https://www.oecd.org/en/publications/oslo-manual-2018_9789264304604-en.html

With regard to the BRICS countries, the identified gap manifests itself in the fact that comparative studies either compare aggregated indicators or analyze individual aspects of science and technology policy. It is much less common to analyze how the implementation of national strategies is assessed, how program documents and the architecture of indicators are related, and which monitoring functions dominate in various models of managing science and technology development.

Thus, the existing body of scientific literature provides the necessary theoretical foundation but does not offer a methodological basis for the joint analysis of policy documents, the architecture of indicators, interim assessment mechanisms, and feedback procedures aimed at adjusting science and technology policy in the BRICS countries. It is precisely this gap that this study addresses.

Materials and methods

The object of the study is the systems for assessing and monitoring science and technology development in five BRICS countries: Brazil, Russia, India, China, and the Republic of South Africa. The main documents used were both the national strategies of the BRICS countries and the official documents of the science and technology assessment centers.

For example, for Brazil, the main document regulating science and technology activity is the National Strategy for Science, Technology and Innovation (ENSTI)⁹. In 2020, a new strategy for

2020–2030 was adopted, which revised the science and technology policy and identified systemic problems that had prevented the achievement of the results set out in the 2016–2022 policy¹⁰. The document regulating the assessment of science and technology policy is the Innovation Law (Law 10.973/2004)¹¹. The National Council for Scientific and Technological Cooperation (CNPq)¹² regularly publishes criteria for evaluating the effectiveness of scientific activity (scientific productivity, training of scientific personnel, contribution to innovation). Also in 2021, a national innovation strategy¹³ was published, aimed at expanding the capabilities of the innovation ecosystem in Brazil. To assess the effectiveness of science and technology development in the country, the following indicators are used: spending on R&D, the number of scientific publications, patent activity, the share of high-tech exports, the level of business digitalization, and the number of researchers per 1 million inhabitants¹⁴.

In China, where the main goals of science and technology development are set out in five-year plans, the assessment of science and technology activities is carried out in accordance with the standards developed by the National Center for Science and Technology Evaluation (NCSTE)¹⁵. The standards set out the principles of assessment (objectivity, ethics) and define the methodology and rules for the work of experts. The key objective of the standards is to shift the focus from purely quantitative indicators to a more comprehensive

⁹ Available at: <https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/noticias/2021/07/publicada-a-estrategia-nacional-de-inovacao> (accessed: 05.08.2026).

¹⁰ RIAC: Model of scientific diplomacy in Brazil and the prospects for the development of Bilateral scientific cooperation between Russia and Brazil. Available at: <https://russiancouncil.ru/analytics-and-comments/analytics/model-nauchnoy-diplomatii-v-brazilii-i-perspektivy-razvitiya-dvustoronnego-nauchnogo-sotrudnichestva/?ysclid=mt76s18481672590473> (accessed: 05.08.2026).

¹¹ Available at: <https://www.wipo.int/wipolex/en/legislation/details/19033> (accessed: 05.08.2026).

¹² CNPq – Conselho Nacional de Desenvolvimento Científico e Tecnológico. Available at: <https://www.gov.br/cnpq/pt-br> (accessed: 05.08.2026).

¹³ Available at: <https://leemanncenter.stanford.edu/media/fostering-a-new-brazilian-national-innovation-policy> (accessed: 05.08.2026).

¹⁴ Available at: https://www.theglobaleconomy.com/Brazil/GII_Index/ (accessed: 05.08.2026).

¹⁵ NCSTI – International Center for Science & Technology Innovation. Available at: <https://en.ncsti.gov.cn/> (accessed: 05.08.2026).

assessment of innovative potential. The National Bureau of Statistics of China¹⁶ is responsible for collecting indicators reflecting the effectiveness of science and technology development. In addition to traditional indicators, China collects information on the average cost of contracts in the technology market (indicator of the commercialization of developments), the share of graduates in natural sciences and engineering, and the innovation potential index¹⁷.

The system for monitoring the effectiveness of India's science and technology development is based on a technology maturity assessment scale¹⁸, which makes it possible to move from subjective assessments to measurable indicators¹⁹. India also tracks R&D spending, the number of scientific publications (especially in engineering and natural sciences), the number of patents and trademarks, the development of innovation clusters, and the effectiveness of startup support programs²⁰.

In Russia, all target indicators are set out in the Strategy for Scientific and Technological Development until 2035²¹. The list of indicators reflecting the effectiveness of science and technology development is regulated by Order 880-r, dated 08.04.2025 and includes domestic spending on R&D, the share of extra-budgetary spending on R&D, Russia's position in the world

in terms of the volume of scientific research, the share of young scientists, etc. In South Africa, the main strategic document defining the country's science and technology policy is the White Paper on Science, Technology and Innovation²². The Monitoring and Evaluation Framework for the South African Science, Technology and Innovation System²³, developed by the National Advisory Council on Innovation (NACI)²⁴, is used to evaluate its results. The South African approach is the closest to the approach proposed in the Frascati Manual. To assess effectiveness, it is collected data on R&D expenditures, the number of researchers; and the impact of scientific and technological development on the economy and society is assessed²⁵.

The methodological basis of this study consisted of comparative analysis, qualitative content analysis of documents, a systems approach, as well as the classification and typologization of indicators.

The research procedure consists of five main stages. In the first stage, regulatory documents for the BRICS countries were systematized. In the second stage, the selected documents were analyzed to identify strategic priorities, indicators, and feedback mechanisms. In the third stage, the indicators were distributed across analytical levels of performance. In the fourth stage, cross-country comparison was carried out. In the fifth stage, based

¹⁶ China's Innovation Index in 2024. Available at: https://www.stats.gov.cn/english/PressRelease/202510/t20251030_1961735.html (accessed: 05.08.2026).

¹⁷ Available at: <https://issek.hse.ru/news/688845347.html?ysclid=msixbtdslq372001684> (accessed: 05.08.2026).

¹⁸ Available at: <https://psa.gov.in/national-technology-readiness> (accessed: 05.08.2026).

¹⁹ OPSA: Driving Science, Technology, and Innovation for India's Growth. Available at: <https://psa.gov.in/about-us> (accessed: 05.08.2026).

²⁰ Available at: <https://dst.gov.in/dsts-key-achievements-during-2024-year-end-review-2024>; <https://clarivate.com/academia-government/blog/insights-from-the-g20-scorecard-indias-research-performance-in-focus/>; <https://dst.dashboard.nic.in/DashboardF.aspx> (accessed: 05.08.2026).

²¹ Presidential Decree 145, dated February 28, 2024. Available at: <http://www.kremlin.ru/acts/bank/50358/page/1> (accessed: 05.08.2026).

²² Available at: https://www.saasta.ac.za/wp-content/uploads/2019/03/FINAL-White-Paper-to-Cabinet_11-March-2019.pdf (accessed: 05.08.2026).

²³ Available at: <https://www.saasta.ac.za/wp-content/uploads/2025/01/framework-for-the-promotion-of-excellence-in-a-national-network-of-science.pdf> (accessed: 05.08.2026).

²⁴ NACI – Innovation for a better future. Available at: <https://www.naci.org.za> (accessed: 05.08.2026).

²⁵ Available at: <https://hsr.ac.za/about-cestii/measuring-rd-activity-in-south-africa/>; https://hsr.ac.za/wp-content/uploads/2025/10/RD_StatisticalReport2023-24_FINAL.pdf (accessed: 05.08.2026)

on the information obtained, a typology of national models for assessing and monitoring science and technology development was proposed.

It is worth noting that it was the function of the indicator in the assessment and monitoring model that was analyzed. The same indicator could belong to different analytical levels, depending on whether it was used as an indicator of resource provision, direct result, applied effect, or long-term strategic impact. This approach made it possible to avoid the mechanical comparison of seemingly similar indicators, which would obscure the differences in logic and the institutional role of monitoring.

Resource indicators included metrics that characterized the financial, human resources, infrastructure, and organizational aspects of science and technology activity; performance indicators included publications, patents, developments, and other formalized results of scientific and innovative activity. Indicators of applied impact recorded the implementation of results, commercialization, cooperation between science and production, the dissemination of technologies, and the use of scientific solutions in the economy, public administration, or the social sphere²⁶. Indicators of strategic impact reflected longer-term changes related to competitiveness, technological self-sufficiency, structural modernization, sustainability, and progress toward national development priorities²⁷.

The following systematization criteria were used for cross-country comparison: the strategic goal of the policy, the type of roadmap (as a tool for implementing science and technology policy), the coordinating framework, the predominant category of indicators, the presence of interim assessments, adjustment mechanisms, and the final type of assessment and monitoring model.

The limitations of the study are related to the varying degrees of openness of official data and the differing levels of documentation of assessment and monitoring procedures. For this reason, the article focuses on identifying differences in the monitoring architecture and in the functions of indicators as elements of state science and technology policy.

Results of the study

The comparative analysis conducted has shown that the differences between the BRICS countries manifest themselves not only in the declared priorities for science and technology development, but also in the way these priorities are institutionalized, in the configuration of roadmaps, and in the logic underlying the design of assessment and monitoring systems.

A comparison of strategic documents that define the architecture of indicators shows that in the BRICS countries, the monitoring system performs different functions. In some cases, it primarily serves as a tool for mobilizing resources and focusing efforts on priority areas; in others, it acts as a mechanism for tracking the applied effect and social return; and in yet others, it serves as a means of aligning long-term strategy, program implementation, and subsequent policy adjustments.

The parameters presented in *Table 3* allow drawing two preliminary conclusions. First, the differences between countries are not so much about the formal presence of strategies and programs as about the degree to which they are operationalized through measurable indicators and feedback procedures. Second, the architecture of assessment and monitoring is closely linked to the function that the state assigns to science and technology policy, which is why the typology in this study is based on a combination of four criteria: the strategic goal of the policy,

²⁶ OECD (2015). Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development. Paris: OECD Publishing. DOI: 10.1787/9789264239012-en

²⁷ OECD (2018), Eurostat. Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation. 4th ed. Paris: OECD Publishing. DOI: 10.1787/9789264304604-en. Available at: https://www.oecd.org/en/publications/oslo-manual-2018_9789264304604-en.html

the type of roadmap, the predominant category of indicators, and the degree of institutionalization of the assessment.

Russia and China demonstrate the most pronounced examples of centralized architecture. In Russia's case, the foundation is the Strategy for Scientific and Technological Development until

2035, followed by detailed elaboration through state programs and support for priority areas. In China's case, the same function is performed by five-year plans and related program documents, within which scientific and technological goals are integrated into a unified system of socio-economic planning. In this regard, despite the outward similarity of centralized

Table 3. Comparative parameters of monitoring systems for science and technology development of the BRICS countries

Country	Strategic objective of the policy	Type of roadmap	Coordinating contour	Prevailing level of indicators	Interim assessment and adjustment	Type of monitoring model
Russia	Technological sovereignty, reduction of technological dependence, ensuring competitiveness and security	Strategically centralized, with subsequent detailed elaboration through government programs and priority areas	Strong state coordination, integration into the strategic planning system	Resource, performance, and strategic impact indicators	Adjustment is integrated into the overall framework of strategic management, but the procedures for multi-level assessment of effects are limited	Strategic and mobilization
China	Innovative development, industrial modernization, strengthening internal potential, long-term technological leadership	Centralized planned system integrated into the nationwide socio-economic planning	Unified coordination center within the framework of five-year planning and long-term benchmarks	Performance indicators and measures of strategic impact, while maintaining strong resource base	Adjustment is carried out through a planned system and a hierarchy of target indicators	Centrally targeted
India	Self-sufficiency in critical areas, mission-driven development, and solving social problems through science and technology	Mission-oriented and programmatic, with a strong focus on specialized initiatives and digital monitoring frameworks	The combination of state goal-setting and distributed institutional implementation	Effective indicators of applied impact and, to some extent, strategic influence	Clearly defined monitoring procedures, databases, key performance indicators, and expert feedback mechanisms.	Mission-assessment
Brazil	Reindustrialization, sustainable development, bioeconomy, digital and social transformation	Two-level: framework strategy and its subsequent operationalization through an action plan	Interdepartmental coordination with a transition from the strategic level to programmatic detail	Mixed structure: resource-based, outcome-based, and indicators of applied effect	A significant portion of the assessment mechanisms is shifted to the level of strategy operationalization.	Coordination and transformation
Republic of South Africa	Inclusive development, addressing social and structural issues, and enhancing the social impact of science and technology	Problem-oriented and transformational, with clear focus on the policy monitoring, evaluation, and learning loop	Coordination through a long-term white paper and a ten-year implementation plan	Indicators of applied effect and strategic impact while maintaining resource and performance levels	The most pronounced institutionalization of monitoring, evaluation, reflection, and policy adjustment	Socio-transformational
Source: own compilation.						

coordination, the Russian model tends to gravitate more toward strategic mobilization in priority areas, whereas the Chinese model focuses on integrating science and technology into the overall framework of socio-economic development.

Brazil and the Republic of South Africa represent a different type of architecture, in which the role of inter-level coordination is particularly noticeable. In the Brazilian case, the strategy sets long-term guidelines but assumes subsequent specification through an action plan. In the Republic of South Africa, the basic long-term documents and the implementation plan directly link strategic priorities with the assessment and monitoring framework. This allows speaking not just about a difference in the form of the document, but about the degree of institutionalization of the assessment mechanism.

India occupies an intermediate position, combining targeted state task setting with a more distributed implementation system. Empirically, this is manifested in the fact that framework documents of science and technology policy are combined with mission-oriented programs and digital monitoring circuits, and the implementation itself is accompanied by key performance indicators and expert feedback.

The comparison showed that national assessment and monitoring systems differ not just in the set of indicators they use, but in which performance levels are dominant in them.

Russia is characterized by combination of strong resource base and pronounced focus on performance indicators and indicators of strategic impact. At the documentary level, this is manifested in priority attention to indicators of resource provision, human resources, research infrastructure, and the direct results of science activity, as well as to benchmarks related to technological self-sufficiency, reducing critical dependencies, and strengthening competitive positions.

The Chinese model demonstrates a list of indicators that is similar in structure but differs in logic. In the five-year planning documents, the resource block is combined with performance indicators and strategic targets related to innovative development, industrial modernization, digitalization, and strengthening domestic innovative potential. Thus, the indicators here function not only as assessment tools but also as elements of coordination within a unified system.

In Indian practice, the focus is shifting more toward performance determinants, indicators of applied effect, and, to some extent, indicators of strategic impact. The basis for this conclusion is the presence in the documents not only of target benchmarks but also of key performance indicators and mechanisms for monitoring how the results of scientific and technological activities are applied within the framework of mission programs²⁸.

For the Republic of South Africa, it is fundamentally important not only to achieve formal results but also to measure their social, institutional, and structural effects. This follows from the fact that in the documents under analysis, monitoring and evaluation are linked from the outset to the public benefits of science and technology and to the resolution of social problems; therefore, the South African model turns out to be the most sensitive to indicators of applied effect and strategic impact.

The Brazilian system occupies an intermediate position and is characterized by a mixed list of indicators. It retains the significance of resource-based and performance-based parameters. The strategy and the subsequent action plan are focused on a broader range of transformations — from technological modernization and the bioeconomy to the territorial, social, and environmental dimensions of development.

The results obtained make it possible to identify generalized types of assessment and monitoring models in the BRICS countries.

²⁸ Available at: <https://indiaai.gov.in/missions/atal-innovation-mission> (accessed: 05.08.2026).

The first type – strategically mobilization-oriented – is focused on concentrating resources, supporting priority areas, and achieving the goals of sovereignty, security, and competitiveness. Russia and, with certain reservations, China, belong to this type to the greatest extent. At the same time, their similarity is determined not only by the content of strategic goals but also by the general logic of how monitoring is integrated into the implementation of the state's science and technology policy.

The second type – mission-based assessment – is most clearly manifested in India. It is distinguished by a combination of a programmatic mission roadmap, distributed institutional implementation, and the predominance of performance and applied indicators.

The third type – coordination-transformational type – unites Brazil and the Republic of South Africa, albeit in different variants. The basis for distinguishing it is the combination of interlevel coordination, mixed structure of indicators, and

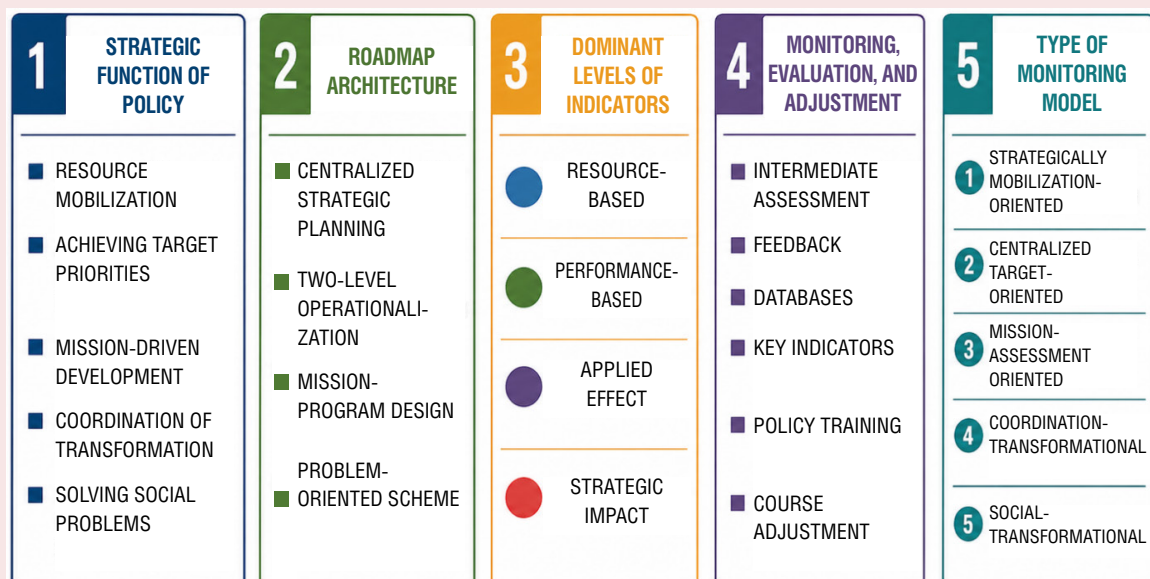
more pronounced focus on the projected effect of science and technology policy. In both countries, assessment and monitoring are largely linked to the alignment of long-term priorities and program implementation, as well as to broader structural and social effects.

The main result of the comparative analysis is that the BRICS countries differ not only in terms of the set of indicators but also in terms of the monitoring function itself within the system of public governance for scientific and technological development. The typologization shows that this function is empirically expressed through combination of policy goals, the configuration of roadmaps, the structure of indicators, and the ways of institutionalizing feedback.

The *Figure* presents the logic for generalizing the identified differences and forming a typology of monitoring models.

The presented diagram shows that the differences between the BRICS countries should be interpreted not as variability in indicator systems,

Logic behind the development of monitoring models for science and technology development in the BRICS countries



Source: own compilation.

but as differences in the logic of organizing assessment and monitoring within the system of public governance for science and technology development.

Discussion

The analysis showed that assessment and monitoring cannot be interpreted solely as a tool for implementing the strategy of science and technology development. It is an integral element of the public administration model and, through the structure of indicators and the presence of adjustment procedures, it identifies which results the state considers significant and subject to continuous monitoring.

This means that the differences between the BRICS countries should be interpreted not as a linear scale of “more developed” and “less developed” systems, but as differences in types of managerial rationality (Kalyanova, 2014). In strategically centralized models, primarily in Russia and China, monitoring is subordinated to the tasks of concentrating resources, maintaining priorities, and achieving long-term state goals. In systems with a more pronounced programmatic and evaluative component, such as in India, it is largely linked to intermediate stages of science and technology policy. In the transformational models represented by Brazil and, especially, the Republic of South Africa, monitoring is more closely linked to the goals of social, structural, and institutional impact.

From theoretical perspective, the analysis conducted makes it possible to refine the conclusions of works on the combination of policy instruments and the assessment of effectiveness. The system for monitoring science and technology development turns out to be the point of intersection of these aspects. It simultaneously reflects the institutional configuration of the innovation system, the logic of selecting and coordinating state policy instruments, and the understanding of acceptable success criteria.

This is also related to the issue of cross-country comparability. Formally similar indicators may perform various functions in different management systems. The same indicator may serve as a tool for the resource block in one case, as a means of assessing the applied effect in another, and as a strategic parameter in yet another. A more appropriate approach is the functional one, which compares the indicator's place in the management architecture and its predominant role.

From a practical point of view, the results obtained indicate that improving monitoring systems in the BRICS countries is unlikely to be based on a model of mechanically borrowing individual indicators. A more productive approach is to transfer the principles of monitoring organization: delineating levels of performance, linking strategic goals to measurable parameters, institutionalizing intermediate assessment, incorporating feedback mechanisms, and taking into account the resulting effects.

Conclusion

The study showed that the systems for assessing and monitoring science and technology policy in the BRICS countries differ not only in the composition of the indicators used but also in the monitoring function they perform. The comparison of roadmaps, the structure of indicators, and feedback mechanisms revealed that in some countries, monitoring primarily serves a mobilization function, in others – a mission-assessment function, and in still others – coordination-transformation function.

The proposed approach, based on the distinction between resource, performance, applied, and strategic indicators, makes it possible to identify differences in the logic of managing scientific and technological policy. Thus, the article contributes to the development of comparative studies of science and technology policy, focusing on analyzing not only the goals and tools but also the management mechanisms.

The practical significance of the work lies in systems and to analyze multilateral science the possibility of using the findings both to and technology cooperation within the BRICS improve national assessment and monitoring framework.

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The Significance of Financial Incentives in the Motivation for Having a Large Family: A Qualitative Study



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Abstract. This study aims to identify the role of financial motives among the motivational and value orientations that shape people's decisions to have a large family. It draws on focus group discussions with parents of large families in Yekaterinburg, divided into two groups: Generation 1 (those who became parents of large families before the introduction of maternity capital in 2007; N = 14; 8 women and 6 men) and Generation 2 (those who became parents of large families after 2007; N = 15; 8 women and 7 men). The interview guide covered motivation, drivers behind the decision to have a large family, and the influence of financial factors on reproductive choice. The working hypothesis was that the introduction of maternity capital had reshaped the hierarchy of motives: Generation 1 was expected to be driven primarily by sociocultural values, while for Generation 2 financial factors were expected to gain importance without displacing value-normative attitudes. The results show that the motivation for having a large family is driven primarily by value-normative attitudes and social-relational drivers rather than by an orientation toward financial benefits from state support. Both generations exhibited a similar set of key motives: an intentional orientation toward having a large family; the influence of positive examples of large families in older generations; the desire to create a family; and the expectation that siblings will support one another. Intergenerational differences in the structure of motivation proved insignificant. At the same time, gender-specific features were recorded: men less often report planning for a large family, which reflects different perceptions of planning and a reliance on the woman's reproductive readiness; they also more often emphasize the effect of "renewal of parental energy" at the birth of a child. Women, in turn, stress entering a new marriage, the fulfillment of parental love, and the enrichment of the motherhood experience. Future research could assess the institutional effect of maternity capital by comparing one-child and two-child families before and after 2007, shedding light on how motivational structures evolve and how support measures shape reproductive decisions.

Key words: large family, maternity capital, value-motivational structure, focus group method.

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Introduction

Against the backdrop of a continuing demographic decline, a falling total fertility rate, and population shrinkage, support for the family, motherhood, and childhood has acquired particular importance within the state's social and demographic policy. Despite a range of measures aimed at stimulating fertility – including material support programs for families with children – the demographic situation in Russia continues to be marked by declining reproductive activity, especially with regard to second and subsequent births.

The phenomenon of the large family has taken on particular importance in current conditions as

a socio-demographic resource for population reproduction. At the same time, having many children is not only a demographic but also a sociocultural phenomenon, bound up with value orientations, family attitudes, life strategies, and the personal motives of parents. The decision to have a third or subsequent child is shaped by a combination of factors.

Given the persistent demographic challenges, support for large families is regarded as a priority area of state social and demographic policy. An important step in institutionalizing support measures for large families was the adoption of Presidential

Decree 63 of January 23, 2024, “On Measures of Social Support for Large Families”, which for the first time established a normative definition of a large family at the federal level. The adoption of this document resulted from interaction between public authorities and civil society organizations representing the interests of large families. Of particular importance is the establishment of the indefinite status of a large family regardless of the children’s age, which helps to strengthen the social standing of large families and expand the system of social guarantees (Rostovskaya et al., 2024).

The importance of the large family as a key resource for the country’s demographic development was also highlighted in the Address of the President of the Russian Federation to the Federal Assembly on February 29, 2024, which emphasized the need to foster a positive public perception of large families and to improve the quality of life of families with children¹.

To overcome the negative demographic trends in the Russian Federation, the federal law “On Additional Measures of State Support for Families with Children” came into force on January 1, 2007, providing financial assistance to families considering the birth of a second or third child. The set of state support measures for families with children, including the right to receive maternity capital, was one of the significant factors that influenced fertility dynamics and contributed to its rise. Thus, in 2007 the number of births increased by almost 123,000 compared with the previous year. While in 2006 the number of births per 1,000 population was 10.4, in 2009 it rose to 12.4 and reached 13.3 in 2014. Among all births in 2007, the share of second and third children increased from 33 to 44%. Between 2006 and 2011, the total fertility rate rose from 1.3 to 1.6 births per woman, and from 2007 to 2014 the crude birth rate increased by 2.24 per mille (Svetlichnaya, Menshikova, 2017).

Despite the expansion of state support measures for large families, scholarly debate continues regarding the factors that shape families’ readiness to have a third or subsequent child. Researchers note that economic incentives alone do not serve as the decisive condition for having many children. Family values, attitudes toward parenthood, the specifics of family socialization, intergenerational support, and the subjective perception of parenthood all play a substantial role (Borisova, Pavlyutkin, 2019; Gudkova, 2019).

At the same time, the personal motives behind the decision to transition to having a large family remain underexplored in the Russian literature, especially in the context of changing value orientations of the modern family and the transformation of reproductive behavior. Analyzing the subjective foundations of having many children is particularly important given the need to develop effective demographic policy measures aimed not only at material incentives for fertility but also at fostering a positive image of the large family. Studying the motives underlying reproductive decisions helps to better understand the declining fertility trends and the postponement of decisions about subsequent children in contemporary society.

Given the strategic importance of increasing the number of large families, it is essential to understand the extent to which the existing, predominantly financial support for families with children contributes to the spread of large families. Accordingly, the aim of this study is to identify the degree of significance of financial motives in the decision to create a large family.

In line with the stated aim, the following research objectives are defined:

- to conduct focus group discussions to identify existing similarities and differences in the structure of motivational and value orientations that determine the decision to create a large family

¹ Address of the President of the Russian Federation to the Federal Assembly. February 29, 2024. Available at: <http://kremlin.ru/events/president/news/73585> (accessed: 10.03.2026).

among representatives of two generations of large families: Generation 1 – families that became large before the introduction of maternity capital (from January 1, 2007, for the second and subsequent child), and Generation 2 – families that became large after the introduction of maternity capital;

– to assess the relative importance of the financial component in the motivation for having many children, to carry out a comparative analysis of its role among representatives of the two generations of large families under study, and to identify the gender specificity of motivational attitudes.

Theoretical and methodological framework of the study

In contemporary social and demographic research, reproductive behavior is viewed as the product of a complex interaction of economic, institutional, cultural, and personal factors. In Russian fertility sociology, one of the foundational approaches is that of V.A. Borisov, according to whom reproductive behavior is a system of actions, relations, and psychological states of the individual connected with the birth or non-birth of children of any order. In the structure of reproductive behavior, the author distinguishes interrelated components: reproductive needs, attitudes, motives, interests, plans, decisions, and actions (Borisov, 1970, p. 8). Within this framework, reproductive attitudes serve as one of the internal regulators of reproductive behavior. From the perspective of family crisis theory, they represent a personal predisposition that determines the consistency of actions driven by a positive or negative attitude toward the birth of a certain number of children (Sivoplyasova, 2022).

Unlike reproductive attitudes, which reflect an individual's attitude toward childbearing, the concept of demographic attitudes is broader and captures the individual's readiness for certain life-course outcomes. Accordingly, reproductive attitudes can be regarded as a specific type of

demographic attitude directly related to the attitude toward childbearing, the desired number of children, and the readiness to pursue a corresponding reproductive strategy. Reproductive motives, in turn, are the impulses underlying the decision to have a child (Kornienko et al., 2017).

Amid declining fertility, it is particularly important to study not only actual reproductive behavior but also reproductive intentions, which largely predetermine the subsequent realization of births (Dommermuth et al., 2025). At the same time, the current research agenda is shifting from a predominantly economic explanation of reproductive behavior to a comprehensive analysis of value orientations, life strategies, family relations, and the subjective motivation for parenthood.

There is currently a shortage of empirical and theoretical work that reveals the mechanisms through which large-family reproductive strategies are formed (Šmeriangaiová, 2025). The scholarly literature identifies several main groups of factors that shape the choice in favor of having many children: economic and housing conditions, the characteristics of partner relations, value orientations, the experience of the parental family, the specifics of employment and gender roles, and the institutional and sociocultural context. The importance of the material component in the formation and realization of reproductive intentions is confirmed by contemporary research: financial situation and the stability of living conditions are significant determinants of reproductive behavior (Jurczak et al., 2026; Bakytzhanova et al., 2026). At the same time, the realization of reproductive intentions is determined not only by economic parameters but also by a set of socio-demographic characteristics of the family. In particular, as women age, reproductive constraints accumulate, driven by both biological factors and the specific features of partner status (Makarentseva, Biryukova, 2023, p. 44).

The significance of institutional conditions is confirmed by research on the reproductive attitudes of young families. Drawing on in-depth interviews, A.V. Korolenko and O.N. Kalachikova identify a range of positions among young families regarding state support, from denying its influence on reproductive decisions to expecting state assistance and recognizing its importance for realizing births. The most widespread position was one in which families do not view state support as a decisive factor in having children (Korolenko, Kalachikova, 2022). Thus, the influence of external incentives on reproductive behavior is not unambiguous and is mediated by a family's subjective perception of its own resources and the support measures available to it.

The stability of partner relations and the presence of emotional support act as “organizing” factors (Rahnu, Jalovaara, 2023, pp. 11–12) that determine both the readiness to have a child and the timing of reproductive decisions.

Socio-economic analysis makes it possible to identify a number of factors that shape reproductive intentions and set the further trajectory of reproductive behavior. These include the age of the youngest child (3–6 years), positive expectations about improving housing conditions, and the husband's desire to have more children within an agreed reproductive plan for the couple. Of particular research interest are women who express a desire to have more children but have no concrete plans to realize it, which may manifest itself in either postponement or complete abandonment of the intention. For this group, economic factors are significant: the availability of one's own housing, stable employment, and the absence of debt (Makarentseva et al., 2025). A separate important subgroup consists of women over 35 (Smulyanskaya,

2017), owing to the growing share of this category in the female population in recent years.

Among the postulated motives for childbearing, researchers highlight the value of parenthood as a source of life satisfaction, the possibility of fulfilling the parental role, and the satisfaction derived from raising a child (Brini et al., 2026). At the same time, most women of reproductive age express a desire to have two or three children, with the desired number exceeding the expected number in all age groups². This confirms the “ideal” of the small family (two children) described in Russian and international publications (Kovalchuk et al., 2018) and indicates that a significant proportion of women who already have one child retain the intention to have a second and, in some cases, a third³.

The economic component occupies a special place among the factors shaping reproductive decisions. Russian and international research has extensively examined the influence of financial incentives on fertility, including the short-term effects of financial support and the impact of social and economic reforms on reproductive behavior (Rasmussen, 2010; Brewer et al., 2012; Carneiro et al., 2015; Tudor, 2020). The effectiveness of family policy measures, however, depends on a combination of factors: the institutional context, the socio-economic characteristics of families, and the specific features of the national social policy model (Gonzalez, 2013; Gurko, 2023; Ezdi et al., 2024). Studies show that in low-fertility countries, economic support is more effective when combined with institutional conditions that allow work and family life to be reconciled (Gauthier, Gietel-Basten, 2025).

The maternity capital program, introduced in 2007, is a central element of contemporary Russian demographic policy and offers a valuable empirical

² Sample Survey of Reproductive Plans of the Population in 2022. Federal State Statistics Service. Available at: https://rosstat.gov.ru/free_doc/new_site/RPN22/reports.html

³ Reproductive plans of Russians: two in the hand, three in the mind? VCIOM. Available at: <https://wciom.ru/analytical-reviews/analiticheskii-obzor/reproduktivnye-plany-rossijan-dva-pishem-tri-v-ume>

case for analyzing how direct financial incentives affect reproductive behavior. Methodologically, its launch can be treated as a “natural experiment” that makes it possible to assess the extent to which institutionalized economic measures can modify the reproductive strategies of the population.

Empirical evidence indicates that the program made only a limited contribution to final fertility. Much of the rise in fertility observed after its introduction was driven not by an increase in the planned number of children but by the redistribution of births over time – so-called “timing” shifts (Arkhangelsky et al., 2024b). This suggests that maternity capital functioned less as a factor that creates a new orientation toward large families and more as a mechanism for realizing existing reproductive intentions by lowering economic barriers and changing the timing of decisions about having a child.

Thus, despite its relatively modest direct demographic effect, the program retains significant research value: it helps clarify the place of financial incentives in the motivation for having many children and sheds light on how these incentives interact with the value-based and cultural determinants of reproductive choice. This makes the analysis of how large families perceive support measures a relevant direction for sociological and demographic research.

The literature review therefore suggests that the motivation for having a large family is shaped by a set of interrelated factors. Economic security and housing conditions define a family’s resource capacity but do not by themselves explain the decision to have a third or subsequent child. Also important are the stability of partner relations and emotional support (Rostovskaya et al., 2021), the value of parenthood and family, and institutional conditions that facilitate combining professional and family life (Markova, 2024).

Gender, regional, and intergenerational specificities also play no less important a role in

reproductive behavior (Rostovskaya et al., 2023; Vakulenko et al., 2024).

Gender specificity manifests itself in the differing balance of economic, social, and psychological grounds for deciding to have children. For both genders, constructive psychological motives related to the value of family and parenthood, as well as love for children, are of fundamental importance, while the set and weight of additional motives differ. According to several studies, men are oriented to a greater extent toward the economic aspects of having a child, whereas women more often take into account social expectations from the family and society (Sinelnikov et al., 2023; Trusova, Tkach, 2022).

For women, the decision to have subsequent children is connected not only with material conditions but also with the potential consequences for professional employment and the possibilities of combining the parental role with work. In particular, studies of middle-income large families show that the choice in favor of having many children is often associated with the restriction of the mother’s professional and social opportunities, which may influence subsequent reproductive decisions (Bannykh et al., 2019, p. 125). In a broader context, changes in gender roles, career orientations, and the distribution of family responsibilities are also regarded as factors that determine the timing and realization of reproductive intentions (Gorlatykh, Abramov, 2025, p. 250; Abdulaeva, 2024).

The sociocultural specificities of regions also determine differences in the structure of motivation for having many children. In Moscow, the choice of a large-family strategy is more often linked to value orientations and the availability of state support, while the material component also retains its significance. Large families in Moscow are described as a relatively more deliberate and rare choice (Rusanova, Zhuravleva, 2019). In the Ural region, the importance of a combination of material and non-material factors has been recorded, with

value-biographical determinants, including the experience of the parental family, playing a special role (Bannykh et al., 2019). By contrast, in the North Caucasus, reproductive behavior is largely determined by traditions, ideas about family and marriage, religiosity, and sociocultural norms. Among the regionally specific factors are an orientation toward large families, gender attitudes (including a preference for sons), expectations regarding the early marriage of daughters, and restrictions on women's life trajectories, such as educational opportunities (Sirazhutdinova, 2024, p. 269).

Alongside current socio-economic conditions and the sociocultural specificities of regions, the family experience of the previous generation is a significant determinant of reproductive behavior. Data from the Sample Survey of Reproductive Plans of the Population point to a positive relationship between the number of children born to the respondent's mother and the respondent's average desired and expected number of children⁴. This relationship is consistent with research findings that record the influence of the parental family's reproductive experience on the probability of choosing a large-family parenting strategy (Sinelnikov et al., 2023).

At the same time, the transmission of attitudes across generations does not imply that reproductive behavior is simply replicated. Research on how large-family attitudes are passed down within families shows that even when the values of the parental family are adopted, the actual number of children in the next generation may fall short of the level needed for simple population replacement (Karpova, Lyalikova, 2023, p. 77). This suggests that the passing down of large-family attitudes occurs in the context of changing socio-economic conditions.

Accordingly, achieving positive demographic dynamics becomes increasingly difficult from one generation to the next (Arkhangelsky et al., 2024a, p. 57).

Thus, the literature shows that most existing studies focus either on general reproductive intentions or on individual determinants of their realization. What remains underdeveloped is a comprehensive approach that captures the dynamics of motivational structures amid the changing institutional conditions of state support. In particular, relatively little attention has been paid to how shifts in family policy parameters relate to changes in the hierarchy of motives for having many children across different socio-demographic groups. It is precisely this gap that defines the research niche of the present study and provides the rationale for a comparative analysis of the structure of motivation for large families under changing institutional conditions.

Materials, methods, and hypotheses of the study

This study carries out a comparative analysis of the personal motivations for creating large families between representatives of two generations:

- the first generation: families that became large before the introduction of financial state support measures in the form of maternity capital (from January 1, 2007, for the second and subsequent child);
- the second generation: families that became large after the introduction of this financial measure.

The study of the personal motivational and value orientations of multi-child parents was conducted using focus groups from November 22 to November 30, 2025. The city of Yekaterinburg was chosen as the research location owing to its representativeness for analyzing the situation in the Sverdlovsk Region. According to statistical data⁵, Yekaterinburg is the

⁴ Sample Survey of Reproductive Plans of the Population in 2022. Federal State Statistics Service. Available at: https://rosstat.gov.ru/free_doc/new_site/RPN22/reports.html

⁵ Main results of the Ministry's activities and priority areas. Ministry of Social Policy of the Sverdlovsk Region: official website. Available at: <https://msp.midural.ru/deyatelnost/otchety-o-deyatelnosti/osnovnye-itogi-deyatelnosti-ministerstva-i-prioritetnye-napravleniya.html> (accessed: 10.08.2026).

region's largest city by population, and in 2023 it accounted for 28.3% of the total number of large families in the region. At the same time, the number of large families in the city is growing steadily: from 17,304 families in 2021 to 18,309 in 2022 and 19,494 in 2023. This concentration and positive dynamic make it possible to regard Yekaterinburg as a relevant setting for studying the reproductive attitudes and motivations of multi-child parents, and also ensure sufficient accessibility of the target group for organizing focus groups.

The study involved four focus groups: one with women and one with men representing the first generation under study, and one with women and one with men belonging to the second generation (*Tab. 1*).

The choice of the focus group method was driven by its high informational value in qualitative research, since a semi-structured group discussion makes it possible to identify and substantively reveal the main motives and drivers behind the decision to have a large family. Respondents were differentiated along two dimensions: gender (men and women) and generation (first and second generation under study). A separate focus group was organized for each combination of these criteria. The choice of the two study generations was determined by differences in the institutional conditions under which reproductive strategies were realized. Representatives of the second generation had access to additional government financial support for families on the birth of a second and subsequent child; representatives of the first generation did not have such support measures. The focus groups were conducted separately for men and women because the topic of reproductive and multi-child parenthood is highly sensitive and can influence how participants express themselves. In particular, when planning the study, there were concerns that in a mixed-gender group men would be inclined to deny the importance of financial motives in the decision to have children. Discussing the material side

of the issue might have been perceived as undermining their role as family providers and calling their financial capacity into question. These assumptions were not confirmed, however: during the discussions, men openly considered state support measures as one of the factors motivating them to have many children.

The focus group guide was designed as a tool for uncovering the deep motivational attitudes of multi-child parents and was based on the principles of semi-structured interviewing. The structure of the guide drew on approaches close to methods for studying the value-motivational field, including the logic of value ranking similar to the technique of M. Rokeach. Participants were asked not only to answer direct questions but also to establish priorities, compare the significance of various factors (economic, social, value-based), and give examples from personal experience illustrating reproductive decisions. The discussions were focused on key thematic blocks: "Motivation for creating a large family", "Financial factors", and "Expectations of multi-child parents regarding the improvement of family policy". For the cohort of large families that received maternity capital, a separate module of questions was included to assess the real impact of this measure on reproductive behavior. This structure of the guide made it possible not only to record declared motives but also to reveal hidden attitudes, contradictions, and the hierarchy of respondents' values, as well as to distinguish situational statements from stable positions through a combination of direct, ranking, and projective questions.

The financial factors influencing reproductive behavior are highly diverse and include benefits, tax incentives, housing programs, regional payments, and others. In this study, maternity capital was considered as the key economic motive, owing to its institutional significance and its pronounced motivational function in the context of large families. First, maternity capital represents a relatively large one-time payment capable of

substantially influencing long-term family strategies, including the decision to have a second or subsequent child. Second, this measure is highly recognizable and is consistently associated in the public mind with support for large families, which increases its relevance for analyzing both declared and latent motives. Third, maternity capital has a long implementation period and a wide range of permitted uses, which makes it possible to treat it as a comprehensive institutional factor rather than a narrow current payment.

At the same time, no distinction was drawn between the federal and regional levels of implementation of this support measure. Maternity capital was analyzed as a single institutional factor capable of serving as a motive for having many children. This approach is justified from the standpoint of the study's focus on respondents' meaning-making attitudes. In the narratives of focus group participants, regional measures were often not

singled out as an independent significant stimulus but were perceived within the broader context of state support for the family.

The focus group sessions involved audio recording of respondents' oral answers to the guide questions, followed by transcription and the preparation of verbatim records. The results were processed by analyzing the verbatim statements of respondents, which at the next stage of analysis were grouped into thematic categories describing the motives for having a child. The constant comparison method was also used, which made it possible to identify similarities and differences in the motivation for having many children between the two groups of respondents, as well as between men and women.

Respondents were then grouped into the two target groups under study (*Tab. 1*).

The characteristics of the focus group participants are presented in *Table 2*.

Table 1. Target groups of the study

Generation	Characteristic	Composition
1	Families that became large before the introduction of financial state support measures in the form of maternity capital (from January 1, 2007, for the second and subsequent child)	Women – 1 focus group, Men – 1 focus group
2	Families that became large after the introduction of financial state support measures in the form of maternity capital (from January 1, 2007, for the second and subsequent child)	Women – 1 focus group, Men – 1 focus group

Table 2. Characteristics of the study's target groups

Indicator	Generation 1	Generation 2
Women		
Number of focus group participants, persons	8	8
Age of participants, years	45–59	34–45
Years of children's birth	First two children: 1990–2004 Third child: 1997–2006	Second child*: 2009–2018 Third child: 2014–2024
Men		
Number of focus group participants, persons	6	7
Age of participants, years	48–60	36–60
Years of children's birth	First two children: 1987–2005 Third child: 2000–2006	Second child**: 1987–2018 Third child: 2008–2024
* In the group of women, six participants received federal maternity capital for their second child and then received regional maternity capital for their third; two received federal maternity capital for their third child.		
** In the group of men, three received federal maternity capital for their second child and then received regional maternity capital for their third; four received federal maternity capital for their third child.		

Three key factors should be noted as methodological limitations of the study:

- first, the considerable time distance between the birth of a child and the moment of the survey may affect the representativeness of the declared motives: memories of reproductive decisions are subject to cognitive transformation, and the hierarchy of motives may be restructured under the influence of subsequent life circumstances;

- second, the generational differences between the compared groups create heterogeneity in their socio-economic and cultural-normative contexts. Representatives of different generations were socialized in dissimilar institutional conditions, which complicates direct comparison of the motivational grounds for having many children and calls for a cautious interpretation of intergroup differences;

- third, the regional specificity of the sample (the study covered multi-child parents living in Yekaterinburg) limits the possibility of extrapolating the results to other regions of the Russian Federation. The identified patterns of motivation and assessments of support measures may be shaped by local socio-economic features of family policy implementation and by regional cultural attitudes. Generalizing the findings requires verification of the results in other territorial contexts.

The working hypothesis of the study is that the institutional introduction of maternity capital has influenced the transformation of the motivational structure of reproductive behavior:

- in the narratives of Generation 1, predominantly sociocultural and value-based motives will dominate, while economic considerations will figure to a lesser extent and mainly in the context of general life difficulties rather than as an independent driver of reproductive decisions;

- in the narratives of Generation 2, financial aspects will occupy a more prominent place in justifying the decision to have a large family. It is assumed that this group perceives material support

measures as a significant factor complementing the value-normative foundations of reproductive choice.

Results and discussion

Motives for having many children

The positive decision to have a third child in the family is not always formulated in terms of values or life principles; more often it is expressed in more down-to-earth and concrete terms. For some it is planned in advance; for others it is situational (some motives are dictated by life changes, and the family becomes large as a result of certain events and circumstances), but in any case it is verbalized through terms and meanings of an internal psychological order rather than of a material-practical kind. The key drivers of having many children in the statements of respondents from the two study generations are systematized in *Table 3*.

The analysis of the narratives shows that the representatives of both generations share common motives for having many children. However, even the intentional orientation toward a large family is not present in all study participants, although all of them are multi-child parents.

Childhood experience of living in a large family can also be assessed negatively: *“My wife comes from a large family; she says, ‘It’s a nightmare when everything is divided among everyone, all this crowd, all these squabbles’”* (M). A skeptical attitude can be found in those who were the eldest child in a large family: *“My husband is the second child in his family; he didn’t get enough attention. His mother, it turns out, kept him busy – he was her older helper, she had a third child, and then a fourth was born. So she didn’t really give him much attention. That’s why he didn’t want a third child. Two is enough”* (F). One respondent, originally from Uzbekistan (an ethnic Uzbek), was raised in an environment with a cult of large families, but in his own family he did not strive to follow these traditional patterns: *“Back home, your parents or your grandmothers are always asking how many children you have and always pushing you –*

Table 3. Motivation and drivers of having many children

Generation 1	Generation 2
Intentional (goal-setting) orientation toward having many children: initially wanted to have at least three children (herself / together with her husband)	
<i>"My husband and I had planned on three" (F)</i> <i>"I always dreamed of having at least three children" (F)</i>	<i>"I planned back when I was 18 that I would have three children" (F)</i> <i>"Before our first [child], we discussed [with my husband] that we would have a large family" (F)</i> <i>"We discussed it romantically at first. How many kids will we have? – Let's have three, that would be nice. You can hardly call that planning. And what kind of apartment will we have? – A five-room one" (M)</i>
Positive examples of large families from older generations: large families of parents, uncles/aunts, exposure to practices of big close-knit families in childhood	
<i>"My parents, both on my dad's side and my mom's side, each had three children. And we, as kids – there were a lot of us at all the holidays. And now I have a lot of cousins, both sisters and brothers. So, yeah, I kind of looked at them and wanted the same" (F)</i> <i>"The more children, the better. I myself come from a large family" (F)</i>	<i>"My husband always wanted 10 children, so we'd have a big close-knit family, with kids and fun. His family line is all large families – some have 8 children, some 10" (F)</i> <i>"In the summer when I was a kid, they'd send us to grandma's dacha; all the cousins lived there, we all lived in the house, and there were lots of children. I really liked that" (F)</i> <i>"My wife comes from a large family; there were six kids in hers. She wanted three, but it didn't work out, and then suddenly it did" (M)</i>
Formation of a new family (second/subsequent marriage); new partner	
<i>"A different husband. I wanted to strengthen the relationship by having a child" (F)</i> <i>"The third child is from my second marriage" (F)</i>	<i>"My husband is my second; he has no children. And he really wanted a child" (F)</i>
Desire to provide one's children with the support of brothers/sisters in life	
<i>"I'm an only child, and for as long as I can remember, especially before my teens, I wanted to have brothers who would protect me. I felt lonely. And I decided that in my family, my child must have one or two brothers or sisters" (F)</i> <i>"The most stable structure rests on three points" (F)</i> <i>"Children 200% need at least a brother or a sister. That's for sure" (M)</i>	<i>"My husband is an only child. And he always said he really regrets not having a sister or a brother, that it's such support and backup in life. And so he said he wants his children to have brothers and sisters" (F)</i> <i>"I'm an only child. When I got married, I thought to myself that my children would definitely have brothers and sisters. Because I always wanted to have a brother or a sister, you know, blood siblings" (F)</i> <i>"I was an only child, and I dreamed of having brothers and sisters. Families with siblings are more united; they lean on each other at some point" (M)</i>
Desire to have children of both sexes	
<i>"I had two sons. I wanted a girl" (F)</i> <i>"I also wanted a daughter. My first two are sons" (M)</i> <i>"I have two older boys, so my wife and I thought: if only we could have a girl too" (M)</i>	<i>"We wanted children of both sexes. And if our first kids had been the same sex, we would have definitely, quite consciously, gone for a third" (F)</i> <i>"I had two daughters, they're already grown, and I dreamed of a son" (M). "That's the main motive – I wanted a daughter because all my children are sons" (M)</i>
Expansion of parental and family potential	
<i>"When you have your second or third child, more opportunities open up for you. Your motivation is different" (F)</i> <i>"Children give you a boost, because you want to achieve more, to move forward both financially and intellectually" (F)</i>	<i>"Something good always comes; with the birth of any child, something good appears in the family. It doesn't matter whether it's material or something else" (F)</i> <i>"My wife and I are having a second youth. My wife got younger after the birth of our third late child. I feel an impulse, of course I got younger. First of all, it's the care: you have to raise, bring up, provide for, educate them. That kind of care makes you younger" (M)</i>

have another, have another. When I moved here, in Russia, everything is different. My mentality has already changed” (M).

On the other hand, the intention to have many children is also found among those whose parental family was not large. One of the motives for creating a large family is so that the children have brothers and sisters as a support in life, a kind of “insurance” against loneliness. Characteristically, this attitude was voiced mainly by those who were themselves an only child in the family. Unfulfilled childhood dreams of a brother or sister were realized in their own families.

The attitude that children should be of both sexes strengthens or emerges if the first two children turned out to be of the same sex. At the same time, having many children may or may not be initially planned – and then the desire to have a child of the other sex becomes the main driver of having a large family. The desire to have both boys and girls among one’s children is akin to the ideal of completeness, of the finished model of a full-fledged family. The desire to have children of both sexes is far from universal among multi-child parents. Moreover, this attitude does not guarantee the desired result, and after becoming a large family, the family may still end up with children of the same sex.

The motive of expanding the parents’ opportunities and potential with the arrival of the next child is sometimes formulated in quite down-to-earth terms: *“Things actually got better for us after the third one was born. My husband’s career took off. Because the goal was three children – they need to be fed, clothed, and so on. That’s how it worked out: with each birth, his career growth increased”. Sometimes it is expressed almost magically: “God gave the bunny, He will also give the meadow” (F).* Men characterize this factor even more actively and in more detail: the increased volume of care and expenses associated with the birth of a child stimulates them to build up family resources, discover new opportunities, and find the strength to solve emerging problems.

Alongside the motives for having many children shared by both generations, the analysis revealed intergenerational differences in the structure of motivational attitudes. Several motives, in particular, appeared exclusively in the narratives of the second generation. The partial absence of comparable motives in the statements of first-generation respondents may stem from the time gap between the survey and the moment of the reproductive decision: the greater the distance from the event, the more memories may be reshaped and the subjective weight of certain motives diminished in retrospective assessment:

- a small child revitalizes and brings the family together: *“I had long been ready for another child, because a child improves the family and brings it together. That was extremely important. I felt that, to avoid sliding into everyday routine, we needed a child who would shake things up” (M);*

- the desire to feel the charm of babyhood again when the older children have already grown up: *“I wanted a little baby. To bring back the sound of children’s laughter. Like in the song, ‘little bare feet on the carpet’” (F); “Our first two children had grown up. My wife kept looking at little kids. She wanted to fuss over a baby again” (M);*

- the desire to give love that has not yet been spent: *“I want to give more love. There is love, and I want to keep giving it” (F);*

- to experience the joy of motherhood once more: *“I was able to feel it again, to breastfeed again. The third time was completely different, and everything I couldn’t feel with the first and second, I made up for with the third. My third child fulfilled all my motherhood needs” (F).*

Parents deciding to have a third child are well acquainted with the special emotional atmosphere created by a small child. Many parents – both women and men – want to experience these feelings of tactile love and tenderness again and again. When the older children have already grown up, parents gain an additional driver: the desire to have a baby

in the family again, to hear children's laughter once more. This is mentioned equally often by both women and men in Generation 2. In Generation 1, the youngest child was born twenty or more years ago; all the children have already become adults and bring completely different cares and worries, and having another child of their own is unlikely. This is probably why they do not recall this driver.

In addition to intergenerational differences, the study also revealed gender differences in the structure of motivational attitudes underlying the orientation toward having many children. Analysis of the focus group data made it possible to record differentiation in motivational priorities between men and women within both generations.

In particular, men hardly ever mention planning for a large family on their part. Many came to the birth of a third child without initially having such plans. Perhaps for them the very notion of planning implies a rather strict goal-setting of the "said and done" type, rather than just talk, since in matters of childbearing they feel dependent on the woman's readiness for motherhood. Men tend to emphasize that they did not plan the arrival of a third child (just as with the first two, when it comes to biological children). They do not deny their participation in the positive decision, but they prefer to use formulations of a providential plan: *"Since it was destined, we did not refuse what was given"* (M, Generation 1); *"It just happened the way it happened"* (M, Generation 1); *"If God gives, it would be a sin to refuse. One must give birth"* (M, Generation 1); *"We didn't think about whether [this child] should or should not be. And there was no scenario in which he could not be"* (M, Generation 2); *"Circumstances had already come together, and you accept everything as it is, as a given"* (M, Generation 2).

A related motive voiced by men in Generation 2 is that the arrival of a new little child renews the parents' energy; they feel younger, especially compared with their peers. *"It's more care, but I feel better, I feel younger. My little daughter is seven*

months old now. My classmates feel like grandmothers. And I'm still young, and it really keeps me going" (M). This is perhaps not so much a driver of family expansion as a tangible "bonus" of having many children – perhaps already at the stage of expecting the child, but especially after its birth.

Among women, a fairly typical factor in having many children is another marriage or a new partner. Almost half of the participants in each group had their third child in a new marriage or as a result of a new relationship, sometimes without a husband.

Two further motives for the decision to have a third child were mentioned only by women of Generation 2: the opportunity to give another child an unspent reserve of love, and the desire to complete the experience of motherhood with a third child.

The role of maternity capital in the decision to have a third child

No stark differences are observed in the motivation and drivers behind the birth of a third child between families that did not receive maternity capital for the third child and those that did. The possibility of receiving maternity capital did not influence the decision to have a large family: *"We started thinking: okay, we now have a small apartment. We need a bigger apartment, we need to earn more, we need this, that, and the other. But we didn't think, 'Oh, we'll also get maternity capital!'"* (M, Generation 2).

None of the study participants agrees that the presence or absence of the possibility of receiving maternity capital could affect their decision to have a third child. This may reflect established mental priorities and forms of self-presentation in Russian society. In other words, publicly admitting that the decision to have a child could have been externally stimulated by material considerations is not normatively encouraged.

Although expanding the family is seen above all as a spiritual act, the need for a material foundation to take such a step is not only recognized but also asserted.

Generation 1: *“There has to be readiness for the fact that this child will need to be supported, clothed, placed in a nursery, kindergarten, school, and then they will need to get into college. Readiness for all these expenses”* (M).

“I think you can’t ignore objective material factors. Because you have to raise the child, not just give birth. If you have a one-room apartment, you’d think very hard about whether to have even one” (F).

“If people are doing well, if they have good jobs, I’d say definitely yes. But if they are unemployed and their material situation is not great at all, then maybe it makes sense to first get on their feet and only then think about children” (F).

Generation 2: *“Children need to be provided for, they need education, they need the opportunity to go to clubs and activities, we must develop them and give them life experience. If you’re ready for that, then yes, no questions. But if you’re not, you start to think twice”* (M).

“We could see that our age, our finances, and our housing allowed it. Well, we simply understood that we were ready to go through all of it again” (F).

“Maybe we would have planned a third child earlier. But we understood that our apartment didn’t allow us to create individual conditions for each child. So until we saved up a certain amount to buy a house, we put our plans for a third child on hold” (F).

Most of the study participants confirm that the family’s material situation at the time of the decision allowed them to have another child and provide everything necessary.

At the same time, men of Generation 2 emphasize that the arrival of a third child forced the family to rethink its housing situation: *“We had to change the apartment; we had to change jobs. We had to earn more”* (M, Generation 2); *“When we were expecting the third, we had to move; there was a mortgage. We lived in a two-room apartment, and we had to make it a three-room one so that each child would have their own room”* (M, Generation 2); *“We moved from a*

three-room apartment to a five-room one. We took out the biggest mortgage” (M, Generation 2).

The existence of a socially approved idea that creating a large family should rest on a solid material foundation — housing and sources of income — does not exclude the possibility that some families become large without material certainty.

Among the men of Generation 1, there was a participant whose financial situation at the time of his children’s birth did not particularly allow for a large family, since he was a student, had no housing of his own, and the children came one after another, a year or two apart. The only thing that helped them stay afloat was material support from relatives: *“It was hard. We lived like students; the only thing that helped us was her parents, my wife’s parents”* (M, Generation 1; three children born in 2003–2006).

If we look at the cases of women who gave birth to a third child while risking their financial stability, including without a husband, there is no doubt about their strong character and readiness to overcome difficulties and “resistance from the environment”: *“My mother said I was out of my mind. But if I had been afraid of everything, I probably wouldn’t have had any children at all. It’s hard to knock me off course. I guess I just have a man’s character”* (F, Generation 1; the third child was born outside marriage); *“I worked at jobs that allowed me to still look after the children. I even had to work while nursing babies. And my husband worked two jobs”* (F, Generation 1); *“I found out from my acquaintances that there are various benefits. They weren’t very big, but they saved us. That year was very hard. We tightened our belts; for a year we didn’t allow ourselves and the children what we were used to. But it was okay; little by little we got back on our feet. God gave the bunny, He will also give the meadow. There is always an opportunity to earn. I sewed, I took in orders at home, I took on whatever I could get”* (F, Generation 2; the third child was born outside marriage).

Generation 1 holds the view that at the time their third child was born, the state did not provide support to large families (although some support measures did exist, and respondents remember them). The types of support offered back then were either extremely insignificant or did not actually work. Men of Generation 1 can recall little about the state support measures, partly because their wives handled these matters: *"We had some benefits; my wife dealt with all that, not me. So I just can't say right now"* (M).

Attitudes toward the availability of state support are more positive in Generation 2. Unlike Generation 1, some women of Generation 2 deliberately sought information about forms of assistance and thought about how to use them: *"We knew what we were supposed to receive; I found out about the regional payments right away. I immediately thought we would put it toward buying another apartment"* (F). Overall, according to Generation 2 respondents, the most significant state support measure is federal maternity capital, the amount of which makes a tangible contribution to purchasing housing. The role of regional maternity capital is much smaller, and it has virtually no effect on resolving the housing issue. In this context, women of Generation 2 who received federal maternity capital for their second child believe that the birth of a third child (for which only regional maternity capital is available) is not stimulated by the state at all: *"For a third child, the maternity capital is tiny. I mean, there's no full-fledged maternity capital. There's a top-up of 170 thousand, and what can you do with that? Look at our mortgage; it's not even enough for a down payment. So the state does not motivate the birth of a third child"* (F).

Conclusion

The study yields the following conclusions. The core motives for having many children identified among respondents from both generations include: an institutional orientation toward large families

(formed in childhood or reinforced by agreement between spouses when starting a family); an orientation toward positive images of large families (parents or relatives with many children) or, conversely, a desire to compensate for growing up as an only child by creating a large family and ensuring that one's children have siblings; the desire to have children of both sexes; and the motive of expanding one's life and parenting opportunities. At the same time, the study finds that childhood experience of living in a large family can be assessed ambivalently, including negatively, and that the intention to have many children also occurs among those without such experience.

Intergenerational differences in the structure of motivation proved to be insignificant. The only motive specific to the second generation was the desire to recreate within the family an atmosphere of special emotionality, tactile love, and tenderness associated with the arrival of a small child. This finding is interpreted as a methodological limitation of the study: the considerable time gap between the birth of a child and the survey may reshape memories and reduce the subjective weight of certain motives in retrospective assessment, which may explain the absence of a comparable motive in the narratives of the first generation.

The study reveals pronounced gender differences in the structure of motivational attitudes. Men less frequently articulate any planning of a large family, which may reflect their perception of "planning" as rigid goal-setting and their sense of dependence on the woman's readiness for motherhood. Among male motives, the effect of "renewal of parental energy" stands out, along with the subjective feeling of youth that accompanies the arrival of a new child. For women, significant motives include entering a new marriage, the opportunity to channel an unspent reserve of parental love, and the desire to complete the experience of motherhood with a third child.

The findings do not support the working hypothesis that the institutional introduction of maternity capital decisively shaped the motivational structure of reproductive behavior. Analysis of the focus group discussions shows that the key motives behind the decision to have a third child are predominantly value-normative and sociocultural in nature and are largely shared by representatives of both generations.

Although financial incentives do not act as independent drivers of reproductive choice, the material factor retains considerable importance as a normatively approved precondition for realizing reproductive intentions. Representatives of both generations express a desire to secure adequate housing and financial conditions before having a third child. Respondents from the second generation who had the opportunity to use maternity capital recognize its importance mainly in resolving the housing question but deny its influence on the decision to have a child itself. The material component is thus often implicitly embedded in reproductive decisions as a necessary condition, even when it does not figure among the declared value-based motives.

Given the identified priority of the housing factor in reproductive decisions, it is advisable to improve demographic policy instruments. Potentially effective measures to support large families could include increasing maternity capital to a level sufficient to cover the down payment on a mortgage for a large family; subsidizing mortgage repayment in the amount of 50% of the outstanding balance; and providing preferential mortgage loans for each child in the family. The regional context and differences in housing costs should be taken into account when designing such measures. Their implementation could serve as a significant stimulus for the formation of large families and improve the effectiveness of demographic policy.

A promising direction for future research is to study the impact of maternity capital on reproductive behavior through a comparative analysis of one-child and two-child families. Comparing families in which a second child was born before and after 2007 would help identify how this institutional support measure affects reproductive decisions and assess changes in motivational attitudes depending on the program's implementation.

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Use of AI Tools

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Personal Health Resources of the Population of a Russian Region: Impact Assessment and Typology



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Abstract. The lack of a well-established healthy lifestyle model among most Russians, combined with insufficient personal responsibility for one's own health, calls for a closer look at internal (protective) factors. This study seeks to assess the influence of salutogenic factors on health indicators and to identify population types according to the degree of their expression. The empirical base draws on the sociological monitoring of the physical health of the Vologda Region population conducted in 2026 (N = 1,500). A review of international and Russian research on the impact of salutogenic factors on health shows that their relationship with physical health and overall health remains underexplored. Using factor analysis of the survey data, we identify three salutogenic factors: "self-sufficiency and sociability", "striving for knowledge and development", and "passivity and externality". We then design logistic regression models in which the dependent variables are good self-rated health, the presence of chronic diseases, and sickness absence from work, while the independent variables include the salutogenic factors alongside socio-demographic, socio-economic, and behavioral indicators. To test the assumption that salutogenic factors affect health indirectly through health self-care, we also design a separate logistic model with health self-care as an independent variable. No statistically significant association is found between salutogenic factors and self-rated health; however, all three factors are associated with the presence of chronic diseases, self-sufficiency and sociability is associated with sickness absence from work, and striving for knowledge and development and passivity and externality are associated with health self-care. Three population

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types are identified according to the expression of salutogenic health factors: “cognitively deficient type”, “salutogenic-resource type”, and “socially inert type”. Their distinct profiles make it possible to treat them as new target groups for health protection policy.

Key words: salutogenic health factors, self-rated health, presence of chronic diseases, sickness absence from work, health self-care, sociological survey, Vologda Region.

Introduction

An important objective of state policy in the field of population preservation is to foster the active maintenance of health and raise health consciousness. This is reflected in the national project “Long and Active Life”, particularly in the federal project “Health for Everyone”, which includes an increase in the share of those maintaining a healthy lifestyle among its target indicators¹. However, the successful implementation of this objective is hindered by the underdeveloped responsibility toward health among Russians and low healthy lifestyle rates. Studies show that most citizens follow an “irresponsible” behavior pattern, giving up or reducing alcohol and tobacco consumption but not paying attention to a balanced diet, sufficient sleep, physical and medical activity (Aksenova et al., 2023), and such patterns are formed at a young age. A.A. Orekhov and A.B. Zakharov confirmed based on data from the longitudinal study “Educational and Professional Trajectories” that only 36% of Russian youth have adopted a healthy lifestyle, 27% of young respondents are prone to harmful habits, 37% are neutral (Orekhov, Zakharov, 2026). Also, there is a gap between the recognition of personal responsibility for health (and its declaration) by the majority and the relatively low rate of adoption of health-maintaining practices (Shabunova et al., 2021). This points up the issues of health consciousness (connected with the sense of agency), which is determined by the mature understanding of health phenomenology, a healthy

lifestyle, health-promoting behavior, and personality

traits (Poluektova, Smirnova, 2016). The sense of agency regarding health manifests in recognizing it as a supreme life value, understanding its role in ensuring life effectiveness, in being aware of health and a healthy lifestyle, in knowing threats to the health, in examining it regularly, in understanding the ways to recover and develop it, in choosing strategies to support and regulate it. (Poluektova, Smirnova, 2016). This position aligns with the principles of the increasingly popular salutogenesis and salutogenic design framework, which focuses on active attitude toward life and health, as well as on individual’s awareness of the importance of his or her own resources for maintaining health and the ability to manage them. This area of research is concerned with protective factors that determine physical and mental health under insufficiently favorable external conditions (Zhuravleva, 2025). Salutogenic factors may be psychological in nature (e.g., optimism as a personality trait), related to the social environment (social support), or even linked to the physical environment (lighting levels, green spaces, etc.) (Tville et al., 2025). This article puts emphasis on internal (personal) salutogenic factors.

The aim of the study was to assess the influence of salutogenic factors on health indicators and to classify population by them. To achieve this aim, the following objectives were set: 1) to analyze international and Russian research on the influence of salutogenic factors on health; 2) to identify

¹ Long and Active Life: National Project. Government of Russia. Available at: <http://government.ru/rugovclassifier/917/about>

key salutogenic health factors based on a survey; 3) to determine the influence of salutogenic factors, along with other factors, on health indicators; 4) to identify groups with varying degrees of salutogenic factor expression and their distinctive characteristics.

Theoretical and methodological aspects

The founder of the concept of salutogenesis and salutogenic (protective) factors is the medical sociologist A. Antonovsky. He considered the leading salutogenic factor to be the sense of coherence (SOC), which reflects an individual's resilience to psychological crises, social conflicts, and potential mechanisms of illness (Zhuravleva, 2025). A strong SOC helps mobilize resources to overcome stressors and successfully relieve tension. It manifests in one's confidence that the internal and external environment is predictable and that, with a high degree of probability, things will turn out as one might reasonably expect (Mittelmark et al., 2022). In Antonovsky's framework, the SOC is based on three components: comprehensibility (perceiving the world as structured and predictable), manageability (confidence that problems can be overcome using both internal and external resources), and meaning (viewing problems as challenges to be met rather than avoided; emotional engagement with what is happening around) (Osin, 2007; Zhuravleva, 2025). Antonovsky developed an original instrument – the 29-item SOC scale – that measures all three components (Antonovsky, 1988). This scale, in various modifications, is widely used in medico-sociological research. For instance, the scale has been found to show moderate to high correlations with various indicators of mental and somatic health; high negative correlations with anxiety; moderate correlations with depression, perceived stress, burnout, and neuroticism; high positive correlations with optimism, meaning in life, and life satisfaction; moderate positive correlations with positive affect, hardiness, internal locus of control, self-efficacy, and self-esteem (Osin, 2007).

Table 1 presents the results of contemporary empirical studies assessing the influence of salutogenic factors on the physical, mental, and public health. Most of these studies employ quantitative cross-sectional designs, while systematic reviews, longitudinal studies, and qualitative research are used less frequently. The relationship between salutogenic factors, psychological well-being and mental health is most commonly examined, whereas links to objective and subjective indicators of physical or overall health are less often investigated. Salutogenic factors are predominantly measured using questionnaires that assess the SOC, its key components, or related characteristics (authenticity, motives, trust, cohesion, etc.), while objective statistical indicators are used less often. Health outcomes include measures of mental health (overall state, stress and burnout levels, symptoms of anxiety and depression, etc.), physical health (physical functioning, disease symptoms, disability, sleep quality, etc.), and social health (quality of life and life satisfaction, social well-being), as well as behavioral indicators and self-rated health.

In general, findings show a direct relationship between salutogenic factors and health status, especially mental health: higher levels of sense of coherence are associated with better self-rated health, fewer symptoms of ill-health, higher psychological well-being, and consequently, better quality of life. However, some studies confirm a more complex nature of this relationship, including with physical outcomes, due to the mediating influence of other factors – socio-demographic (gender, age), socio-economic (income and inequality levels), behavioral, and others.

Despite increased attention to this issue, gaps remain due to the heterogeneity of the indicators used and insufficient study of mediating mechanisms, requiring further development, especially in the context of influence on health, including its subjective perception.

Table 1. Research on salutogenic health factors (mental, physical, social)

Reseachers	Salutogenic factors and health indicators	Method	Findings (relationship between salutogenic factors and health indicators)
K.A. Bocharov, A.B. Danilov, S.K. Nartova-Bocharov et al. (2019)	<u>Factors:</u> - personal authenticity (genuineness/realness); - moral motives (diligence, support, social justice, social order); <u>health indicator</u> – professional/emotional burnout, burnout index	Survey of physicians (N=700) in 10 Russian regions; questionnaires – “Model of Moral Motivations” scale, authenticity of personality scale, Maslach Burnout Inventory, biographical questionnaire	- Mutual influence of salutogenic factors and burnout indicators confirmed: on the one hand, burnout is detrimental to personal authenticity (the stronger the physician’s burnout, the more they are alienated from themselves and behave unnaturally and disharmoniously, and authenticity decreases); on the other hand, low authenticity, high self-alienation, and susceptibility to external influences are associated with signs of burnout; - relationship found between moral motives and burnout: self-restraint negatively associated with depersonalization (alienation from patients) and positively with reduction of accomplishments (anxious doubts about the professional path); diligence and non-maleficence negatively associated with depersonalization and burnout, and positively with reduction of accomplishments; helping and honesty positively associated with reduction of accomplishments, negatively with burnout; social justice negatively associated with depersonalization and burnout
Mana A., Super S., Sardu C. et al. (2021)	<u>Factors:</u> - individual resources (SOC); - social resources (social support); - national resources (sense of national coherence, or SONC, and trust in governmental institutions); <u>health indicators</u> – levels of mental health and anxiety during the COVID-19 pandemic	Survey of individuals aged 18–88 in Israel (N=640), Netherlands (N=622), Italy (N=924), Spain (N=489); questionnaires assessing anxiety disorder, mental health, SOC, SONC, trust in governmental institutions, social support; ANOVA, hierarchical regression	Individual and national coping resources influence levels of anxiety and mental health; the patterns of the coping resources in explaining anxiety and mental health were similar in the four samples, and SOC was the main predictor of these outcomes; different patterns and predictive values of coping resources were found for the two different reactions: anxiety vs. mental health; while SOC and situational factors (e.g., state of health and financial threat) were significant in explaining anxiety levels, the SOC and national resources were found as significant in explaining mental health levels
Pijpker R., van der Kamp D., Vader S., den Broeder L., Wagemakers A. (2022)	<u>Factors:</u> - SOC; - sense of community coherence (SOCC); - sense of national coherence (SONC); - social support; - demographic indicators (gender, age, religion, and COVID-19 experience); <u>health indicator</u> – mental health	Online survey (N=91); t-test for independent samples; multiple linear regression analysis	Both SOC and SOCC influenced mental health during the pandemic; people who perceived their community as comprehensible, manageable, and meaningful demonstrated higher mental health levels than those who did not; no difference in mental health, SOC, SOCC, SONC, and social support between low and high socio-economic status groups; SOC predicted good levels of mental health in both groups, and SOCC predicted mental health in the low socio-economic status group

Continuation of Table 1

Reseachers	Salutogenic factors and health indicators	Method	Findings (relationship between salutogenic factors and health indicators)
Tušl M., de Bloom J., Bauer G.F. (2022)	<u>Factors</u> : - SOC; - off-job crafting (OJC, activities during leisure time); <u>health indicator</u> – mental well-being (MWB)	Online questionnaire – three-wave longitudinal panel design (wave 1 N=2217, wave 2 N=1727, wave 3 N=1196); cross-lagged panel model	Confirmed that OJC partially mediates the relationship between SOC and MWB; a positive reciprocal relationship found between SOC and MWB, as well as between OJC and MWB; OJC is one mechanism underlying the recently postulated path of positive health development in the salutogenic model; promoting SOC and OJC may help to strengthen individual well-being and lead to positive feedback loops that foster personal development and thriving
Lv J., Qian M., Deng M., Yu M. (2023)	<u>Factors</u> : SOC; <u>health indicators</u> : - physical (number of symptoms, functional status, disability, daily activity ability, pain, sleep quality, oral health); - psychological (perceived stress, self-perception of aging, depression, posttraumatic stress reaction); - social (subjective well-being, life satisfaction, quality of life, adjustment to aging later in life, etc.)	Systematic review (29 studies – 1 longitudinal, 1 cohort, 27 cross-sectional)	- Higher SOC levels are associated with better physical health (less symptom reporting, better functional status, less disability, better daily activity ability, less pain, better sleep quality, and better oral health) and better psychological health (less perceived stress, more positive self-perception of aging, less depression, and less posttraumatic stress reaction) in older adults; - higher SOC levels are also correlated with greater preventive/self-management behaviors ability, subjective well-being, adjustment to aging later in life, cumulative survival, quality of life, life satisfaction, and self-perceived health
Lee H.-P., Hsu W.-Y., Liu Y.-H. et al. (2024)	<u>Factors</u> : SOC as a mediator between different functional status classes and health-related quality of life (HRQOL) in patients with heart failure (HF); <u>health indicators</u> : functional status classes of patients with HF (I–IV)	Cross-sectional study on patients with HF in April-September 2020 (N=295); questionnaires identifying SOC, functional classification of patients with HF	- SOC was found to mediate the effects of functional status on HRQOL more significantly in patients in Class II than those in Class III but not more significantly in patients in Class I than those in Class III; - a weaker mediating effect of SOC was noted on the relationship between functional status and HRQOL in patients with HF in Class II than those in Class III

End of Table 1

Reseachers	Salutogenic factors and health indicators	Method	Findings (relationship between salutogenic factors and health indicators)
Alkharafi N. (2025)	<u>Factors:</u> - comprehensibility indicator (percentage of the population using the internet); - manageability indicator (industry value added); - meaningfulness indicator (subjective well-being); - GDP; - regulatory quality of government; - income level; <u>health indicator</u> – life expectancy	Panel regression with fixed effects; dataset of 135 countries for the period 2017–2020 with 501 observations across all regions and income levels	- Sense of coherence affects population health worldwide, regardless of income level; - no evidence that comprehensibility is positively associated with life expectancy; - the relationship between manageability and meaningfulness with life expectancy varies by income level; upper-middle income countries need to focus on manageability and meaningfulness to improve population health, as industry and subjective well-being positively affect life expectancy; in low and lower-middle income countries, subjective well-being is particularly important; - in high income countries, policies aimed at increasing manageability are associated with increased life expectancy; - policies aimed at meaning in life are associated with life expectancy regardless of income level
Matić I., Vuletić G. (2025)	<u>Factors:</u> SOC; <u>health indicators:</u> general health status; functional physical status; mental health status; vitality (hardiness); social functioning; emotional functioning	Longitudinal cohort study – survey of adolescents aged 15 (N=441) and 17 (N=354); hierarchical regression	- Strong significant positive correlation found between SOC and mental health, and significant difference between adolescents with low and high SOC in physical functioning, general health, vitality, social functioning, emotional role functioning and mental health; - boys had higher SOC and most of the health dimensions; - having a stronger SOC, being male, and living with both parents were predictors of better mental health
Urzúa A., Henríquez D., Caqueo-Urizar A. et al. (2025)	<u>Factors:</u> SOC; <u>health indicators:</u> lifestyle, family and friends, physical and social activity, nutrition, smoking, alcohol/other drugs, sleep and stress, personality type and school/job satisfaction, self-image, health and sexuality management, order/other behaviors	Survey of migrants living in Chile (N=1844); SOC and FANTASTICO questionnaires.	SOC was positively correlated with lifestyle in the migrant population, with the meaning component having the strongest association; factors mediating the relationship between SOC and healthy lifestyle were identified: sex, age, years living in the country, country of origin, income, educational level and city of residence
Compiled based on: (Bochaver et al., 2019; Mana et al., 2021; Pijpker et al., 2022; Tušl et al., 2022; Lv et al., 2023; Lee et al., 2024; Alkharafi, 2025; Matić, Vuletić, 2025; Urzúa et al., 2025).			

I.V. Zhuravleva, summarizing research experience in salutogenesis, provides an expanded list of salutogenic (protective) personal factors that positively influence human health: sociability and willingness to cooperate; self-confidence; active attitude toward life and sense of responsibility; high level of intelligence and creativity; self-esteem; increased internal locus of control (internality), which is associated with a sense of responsibility for one's health (Zhuravleva, 2025). All of these correspond to the key components of the salutogenic model – comprehensibility, manageability, and meaning – and can be applied in national and regional studies.

This study examines several assumptions about the role of salutogenic factors in health: salutogenic factors contribute to improved self-rated health, reduced probability of chronic diseases and sickness absence from work; their impact on subjective health indicators is mediated by behavioral patterns, particularly care for health.

Materials and methods

The information base for this study was the results of sociological monitoring of the physical health in the Vologda Region². The 2026 monitoring questionnaire contained a question on the intensity of salutogenic factors. Its design was based on I.V. Zhuravleva's classification (*Tab. 2*). Respon-

Table 2. Distribution of responses to the question: "Please rate your agreement with the following statements. Select one option per line on a 5-point scale from 1 – completely disagree to 5 – completely agree", %

Factor	Statement for evaluation / Variable	Distribution of responses*		
		1, 2 points (disagree)	3 points	4, 5 points (agree)
Sociability and cooperative attitude	1. I get on well with new people	11.6	19.8	68.6
	2. I don't mix well	60.3	21.6	18.1
Self-confidence	3. I am capable of handling difficulties on my own	14.6	25.8	59.6
	4. I often rely on the help of others in difficult situations	47.0	29.0	23.9
Active attitude toward life	5. I always set new goals for myself	20.2	26.6	53.2
	6. I rarely use my initiative	51.0	26.1	22.8
Intelligence and creativity	7. I can easily analyze large amounts of information and draw logical conclusions	19.9	27.0	53.1
	8. I prefer not to "overload my head", to act out of habit	36.6	33.3	30.1
	9. I find it difficult to come up with something new, to find non-standard solutions	40.1	31.1	28.7
	10. I constantly strive for new knowledge and often find non-standard solutions	26.4	29.2	44.3
Self-respect	11. I respect myself regardless of circumstances	7.3	17.6	75.1
	12. I often find it difficult to assert my boundaries	41.4	32.0	26.7
Locus of control	13. I am responsible for my own life and health	5.4	18.5	76.2
	14. My life largely depends on external circumstances	25.8	41.1	33.2
* 100% is the sum in the row. Source: own compilation.				

² Survey method – handout questionnaire. Sample size – 1500 respondents. The survey was conducted in the cities of Vologda, Cherepovets, and 8 districts/okrugs of the Vologda Region (Babayevsky, Velikoustyugsky, Vozhegodsky, Gryazovetsky, Kirillovsky, Nikolsky, Tarnogsky, Sheksninsky). The sample was purposive, quota-based. Representativeness was ensured by maintaining proportions between urban and rural populations, proportions between residents of different settlement types (rural settlements, small and medium-sized cities), and proportions of the gender-age structure of the adult population of the region. The sampling error does not exceed 5%. Technical data processing was performed using SPSS and Excel.

dents were asked to rate their agreement with statements on a 5-point scale, which indirectly characterize the intensity of salutogenic factors. Table 2 shows the distribution of responses to this question.

The first stage of the study employed *factor analysis* to identify the main salutogenic factors by reducing the number of original variables. Principal component analysis was chosen as the dimensionality reduction method, Varimax with Kaiser normalization was used for rotation. The choice of principal component analysis was primarily driven by the need for variable reduction rather than the assessment of latent factors (e.g., in maximum likelihood estimation), as the original indicators were theoretically based on the concept of salutogenesis. In the second stage, binary logistic regression was used to study the influence of the identified salutogenic factors on health indicators. To characterize the health status, we used well-established subjective health indicators such as self-rated health, presence of chronic diseases, and sickness absence from work. Self-rated health is a generalized indicator of health status, reflecting various physical and mental components of well-being and providing an overall picture of current health (Kozyreva, Smirnov, 2020). However, self-rated health is subject to non-random measurement error and heterogeneity resulting from a range of indirect conditions and situational factors (Kuz'mich, Roshchin, 2008; Kaneva, Baidin, 2018). Indicators of chronic disease presence and sickness absence from work are more objective in this regard. Therefore, the *dependent variables* in this study were binary variables representing all three indicators: 1) *good self-rated health* (1 – very good, good; 0 – so-so, poor, very poor); 2) *presence of chronic diseases* (1 – have chronic diseases; 0 – do not have chronic diseases); 3) *sickness absence from work* (1 – missed workdays due to sickness during the year (with or without sick leave); 0 – did not miss workdays due to sickness).

Alongside the identified salutogenic factors, *independent variables* included socio-demographic and socio-economic indicators: age, gender, marital status (married/not married), income level (high/medium/low), education (incomplete and complete secondary/secondary technical or vocational/higher and postgraduate), accessibility of medical care in public and private healthcare facilities (high/medium/low/services unavailable), territory of residence (urban/rural), employment status (employed/unemployed), as well as behavioral factors: care for health (yes/ little or no care), smoking (yes/no), alcohol consumption (yes/no), refusal to do physical exercises (exercise/not exercise), non-adherence to a nutrition regimen (follow/not follow a nutrition regimen). Additionally, we constructed a separate logistic model with care for health as the dependent variable, keeping the same set of predictors. This decision was based on the assumption that care for health may mediate the relationship between salutogenic factors and health indicators. The presence of chronic diseases was additionally included as an independent variable in the models of good self-rated health, sickness absence from work, and care for health. The odds ratio (OR) with 95% confidence intervals (CI) was used as a measure of the influence of various factors on health indicators (Kislitsyna, 2023).

Cluster analysis was used to identify respondent groups based on the intensity of salutogenic factors. First, hierarchical clustering (Ward's method on a random sample of 50 observations; distance measure – squared Euclidean distance) was conducted to determine the number of clusters. Then, iterative k-means cluster analysis was carried out, and the resulting final cluster centers were used to interpret the identified groups and analyze descriptive statistics.

Data analysis and processing were carried out using IBM SPSS Statistics 22.

Findings

Factor analysis identified 3 components reflecting key salutogenic factors of health, which together explain 55% of the total variance. The obtained characteristics allowed interpreting them as follows: factor 1 “self-sufficiency and sociability”, factor 2 “striving for knowledge and development”, and factor 3 “passivity and externality”. The identified factors generally

align with Antonovsky’s components of sense of coherence: factor 1 corresponds to meaning, factor 2 to comprehensibility, and factor 3 represents a reverse version of manageability (*Tab. 3*).

Preliminary checks for multicollinearity among independent variables showed its absence³, allowing their inclusion in the regression models. The set of variables used for modeling and their prevalence in the sample are presented in the Appendix.

Table 3. Key salutogenic factors identified through factor analysis*

Statement	Component (factor) name		
	Factor 1 Self-sufficiency and sociability (meaning)	Factor 2 Striving for knowledge and development (comprehensibility)	Factor 3 Passivity and externality (reverse to manageability)
I am responsible for my own life and health	0.718		
I don't mix well	-0.671		
I respect myself regardless of circumstances	0.659		
I get on well with new people	0.610		
I am capable of handling difficulties on my own	0.584		
I constantly strive for new knowledge and often find non-standard solutions		0.838	
I always set new goals for myself		0.799	
I can easily analyze large amounts of information and draw logical conclusions		0.772	
I prefer not to “overload my head”, to act out of habit			0.662
My life largely depends on external circumstances			0.633
I often find it difficult to assert my boundaries			0.626
I rarely use my initiative			0.546
I often rely on the help of others in difficult situations	-0.523		0.526
I find it difficult to come up with something new, to find non-standard solutions			0.505
*Factor loadings > 0.5 are shown. Preliminary checks confirmed data suitability for factor analysis: the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.861, indicating a high degree of suitability for factor analysis. Bartlett’s test of sphericity confirmed the presence of substantial correlations between variables and justified factor analysis ($\chi^2 = 6984.462$; $df = 91$; $p < 0.001$). Source: own compilation.			

³ Correlations between independent variables < 0.5. Multicollinearity check within test linear regression: VIF < 5.

The logistic regression model on good self-rated health showed that age, high income level, territory of residence, smoking, refusal to do physical exercises, and the presence of chronic diseases are significantly associated with it (*Tab. 4*). The likelihood of good self-rated health increases with high income levels (3-fold) and urban residence (1.5-fold), while decreases with age (by 6% annually), the presence of chronic diseases

(by 82%), and behavioral risk factors – smoking (by 47%) and refusal to do physical exercises (by 30%).

Notably, the influence of all three salutogenic factors in this model was statistically insignificant. This could be due to issues of bias and heterogeneity in self-assessment, or to a more complex nature of their relationship (non-linear and/or mediated by other factors).

Table 4. Good self-rated health logistic regression model, accounting for salutogenic factors (dependent variable – good self-rated health: 1 – very good, good; 0 – so-so, poor, very poor)

Variable	B	p-value	OR	95% CI
Age	-0.062	0.000	0.940	[0.929–0.950]
Gender (male vs female)	-0.032	0.839	0.969	[0.717–1.314]
Marital status (married vs single)	0.243	0.127	1.275	[0.933–1.743]
Income level:				
high vs low	1.082	0.000	2.950	[1.780–4.888]
medium vs low	0.144	0.488	1.155	[0.768–1.737]
Education:				
secondary technical or vocational vs incomplete and complete secondary	0.001	0.996	1.001	[0.558–1.797]
higher and postgraduate vs incomplete and complete secondary	-0.005	0.988	0.995	[0.535–1.852]
Territory of residence (urban vs rural)	0.427	0.015	1.533	[1.088–2.161]
Employment (employed vs unemployed)	0.145	0.446	1.157	[0.796–1.681]
Accessibility of medical care in public healthcare facilities:				
high vs services unavailable	0.425	0.369	1.530	[0.605–3.867]
medium vs services unavailable	-0.309	0.491	0.734	[0.305–1.768]
low vs services unavailable	-0.543	0.237	0.581	[0.236–1.429]
Accessibility of medical care in private healthcare facilities:				
high vs services unavailable	0.018	0.958	1.018	[0.529–1.959]
medium vs services unavailable	0.179	0.583	1.196	[0.632–2.263]
low vs services unavailable	0.644	0.072	1.905	[0.944–3843]
Alcohol consumption (yes vs no)	0.179	0.284	1.196	[0.862–1.658]
Smoking currently (yes vs no)	-0.643	0.000	0.526	[0.368–0.752]
Refusal to do physical exercises (yes vs no)	-0.362	0.045	0.697	[0.489–0.992]
Non-adherence to a nutrition regimen	0.152	0.421	1.164	[0.804–1.686]
Care for health (yes vs little or no care)	0.313	0.053	1.368	[0.996–1.880]
Chronic disease presence (have vs do not have)	-1.688	0.000	0.185	[0.116–0.295]
Factor 1 “Self-sufficiency and sociability”	0.072	0.340	1.075	[0.927–1.247]
Factor 2 “Striving for knowledge and development”	-0.072	0.377	0.931	[0.793–1.092]
Factor 3 “Passivity and externality”	0.059	0.409	1.061	[0.922–1.221]

Note: The Hosmer – Lemeshow test indicated that the model fits the real data well ($\chi^2 = 4.838$; $df = 8$; $p = 0.775$). 77% of observations were correctly predicted.

Source: own calculation and compilation.

In the second model, with chronic disease presence as the dependent variable, significant associations were found for age, education, employment, care for health, and all three salutogenic factors (*Tab. 5*). The probability of chronic diseases increases with age (by 6% annually), secondary vocational/technical and higher education (2.2 and 3.9-fold respectively), and care for health (by 61%), while employment decreases it (by 33%).

All three salutogenic factors were found to be significantly associated with the presence of chronic diseases: factors 1 “self-sufficiency and sociability” and 2 “striving for knowledge and development” decrease the probability of developing them (by 18% and 30% respectively), whereas factor 3 “passivity and externality” increases it (by 21%).

According to the results of the third model on sickness absence from work, significant associations were found with gender, territory of residence,

Table 5. Chronic diseases logistic regression model, accounting for salutogenic factors
(dependent variable – chronic disease presence: 1 – have diseases, 0 – do not have diseases)

Variables	B	p-value	OR	95% CI
Age	0.056	0.000	1.058	[1.044–1.072]
Gender (male vs female)	-0.140	0.420	0.870	[0.619–1.221]
Marital status (married vs single)	-0.087	0.599	0.916	[0.662–1.269]
Income level:				
high vs low	0.090	0.735	1.094	[0.649–1.845]
medium vs low	0.052	0.796	1.053	[0.711–1.559]
Education:				
secondary technical or vocational vs incomplete and complete secondary	0.805	0.035	2.237	[1.059–4.724]
higher and postgraduate vs incomplete and complete secondary	1.371	0.001	3.939	[1.797–8.637]
Territory of residence (urban vs rural)	0.145	0.415	1.156	[0.816–1.638]
Employment (employed vs unemployed)	-0.398	0.041	0.672	[0.459–0.983]
Accessibility of medical care in public healthcare facilities:				
high vs services unavailable	-0.290	0.561	0.748	[0.281–1.990]
medium vs services unavailable	-0.463	0.325	0.630	[0.250–1.583]
low vs services unavailable	-0.094	0.845	0.911	[0.357–2.323]
Accessibility of medical care in private healthcare facilities:				
high vs services unavailable	-0.312	0.303	0.732	[0.404–1.326]
medium vs services unavailable	-0.048	0.870	0.953	[0.536–1.694]
low vs services unavailable	0.198	0.539	1.219	[0.648–2.296]
Alcohol consumption (yes vs no)	-0.184	0.286	0.832	[0.593–1.167]
Smoking currently (yes vs no)	0.152	0.471	1.164	[0.770–1.759]
Refusal to do physical exercises (yes vs no)	0.307	0.159	1.359	[0.886–2.084]
Non-adherence to a nutrition regimen (yes vs no)	0.364	0.086	1.440	[0.950–2.180]
Care for health (yes vs little or no care)	0.478	0.007	1.613	[1.140–2.282]
Factor 1 “Self-sufficiency and sociability”	-0.201	0.012	0.818	[0.699–0.957]
Factor 2 “Striving for knowledge and development”	-0.363	0.000	0.696	[0.590–0.821]
Factor 3 “Passivity and externality”	0.187	0.019	1.206	[1.031–1.411]

Note: The Hosmer – Lemeshow test indicated that the model fits the real data well ($\chi^2 = 11.425$; $df = 8$; $p = 0.179$). 80% of observations were correctly predicted.
Source: own calculation and compilation.

employment, accessibility of private medical services, care for health, and one of the three salutogenic factors (*Tab. 6*). The probability of sickness absence from work is higher (11-fold) for those who are employed, have chronic diseases (5.5-fold), and live in urban areas (2-fold). Additionally, medium accessibility of private medical services (2.4-fold) and care for health (1.4-fold) significantly increase this probability. Men are 33% less likely

to miss work due to illness compared to women. Self-sufficiency and sociability also decrease this probability (by 19%), while the influence of the other two salutogenic factors was not significant.

The additional model, with care for health as the dependent variable, showed statistically significant associations with gender, income level, education, accessibility of medical care, behavioral

Table 6. Sickness absence from work logistic regression model, accounting for salutogenic factors (dependent variable – sickness absence from work: 1 – missed workdays due to sickness; 0 – did not miss workdays due to sickness)

Variable	B	p-value	OR	95% CI
Age	-0.004	0.599	0.996	[0.982–1.010]
Gender (male vs female)	-0.415	0.016	0.661	[0.472–0.925]
Marital status (married vs single)	0.376	0.040	1.457	[1.018–2.085]
Income level:				
high vs low	-0.472	0.088	0.624	[0.362–1.073]
medium vs low	-0.379	0.098	0.685	[0.437–1.073]
Education:				
secondary technical or vocational vs incomplete and complete secondary	0.094	0.801	1.098	[0.529–2.278]
higher and postgraduate vs incomplete and complete secondary	-0.075	0.847	0.928	[0.434–1.983]
Territory of residence (urban vs rural)	0.681	0.001	1.975	[1.321–2.953]
Employment (employed vs unemployed)	2.426	0.000	11.310	[6.335–20.190]
Accessibility of medical care in public healthcare facilities:				
high vs services unavailable	-0.267	0.561	0.765	[0.310–1.877]
medium vs services unavailable	-0.382	0.377	0.682	[0.292–1.593]
low vs services unavailable	-0.549	0.217	0.577	[0.241–1.381]
Accessibility of medical care in private healthcare facilities:				
high vs services unavailable	0.547	0.191	1.727	[0.761–3.920]
medium vs services unavailable	0.896	0.026	2.449	[1.113–5.387]
low vs services unavailable	0.413	0.346	1.511	[0.641–3.566]
Alcohol consumption (yes vs no)	0.217	0.250	1.242	[0.859–1.795]
Smoking currently (yes vs no)	0.265	0.186	1.304	[0.880–1.931]
Refusal to do physical exercises (yes vs no)	-0.041	0.836	0.960	[0.651–1.415]
Non-adherence to a nutrition regimen (yes vs no)	-0.198	0.332	0.821	[0.550–1.224]
Care for health (yes vs little or no care)	0.363	0.047	1.438	[1.004–2.058]
Chronic disease presence (have vs do not have)	1.707	0.000	5.512	[3.597–8.446]
Factor 1 “Self-sufficiency and sociability”	-0.209	0.016	0.812	[0.685–0.961]
Factor 2 “Striving for knowledge and development”	-0.078	0.392	0.925	[0.775–1.105]
Factor 3 “Passivity and externality”	0.130	0.102	1.139	[0.975–1.332]
Note: The Hosmer – Lemeshow test indicated that the model fits the real data well ($\chi^2 = 5.490$; $df = 8$; $p = 0.704$). 80% of observations were correctly predicted.				
Source: own calculation and compilation.				

risk factors (alcohol consumption, smoking, refusal to do physical exercises, non-adherence to a nutrition regimen), presence of chronic diseases, and two salutogenic factors (Tab. 7). The likelihood of care for health is increased by the presence of chronic diseases (1.5-fold), high income compared to low (1.6-fold), secondary vocational/technical and higher education compared to incomplete/complete secondary (over 2-fold), high and medium accessibility of medical care in public facilities compared to complete unavailability (over 3-fold). Additionally, alcohol consumption is associated

with higher probability of care for health (1.4-fold), which could be related to concomitant health problems; however, this was not confirmed in the models on self-rated health or chronic disease presence, requiring further investigation. The probability of care for health is lower among men (by 42%) and those with behavioral risk factors – smokers (by 57%), those not adhering to a nutrition regimen (by 63%), and those not doing physical exercises (by 70%). Medium and low accessibility of private medical services reduces the likelihood of care for health more than 2-fold.

Table 7. Care for health logistic regression model, accounting for salutogenic factors
(dependent variable – care for health: 1 – yes; 0 – little or no care)

Variable	B	p-value	OR	95% CI
Age	0.008	0.097	1.008	[0.998–1.018]
Gender (male vs female)	-0.547	0.000	0.579	[0.437–0.767]
Marital status (married vs single)	0.284	0.051	1.328	[0.999–767]
Income level:				
high vs low	0.496	0.035	1.643	[1.035–2.608]
medium vs low	-0.210	0.241	0.810	[0.570–1.151]
Education:				
secondary technical or vocational vs incomplete and complete secondary	0.813	0.005	2.255	[1.285–3.960]
higher and postgraduate vs incomplete and complete secondary	0.782	0.009	2.186	[1.211–3.946]
Territory of residence (urban vs rural)	-0.171	0.273	0.843	[0.621–1.144]
Employment (employed vs unemployed)	-0.102	0.544	0.903	[0.648–1.257]
Accessibility of medical care in public healthcare facilities:				
high vs services unavailable	1.293	0.002	3.644	[1.589–8.357]
medium vs services unavailable	1.111	0.005	3.039	[1.394–6.625]
low vs services unavailable	0.630	0.120	1.877	[0.848–4.156]
Accessibility of medical care in private healthcare facilities:				
high vs services unavailable	0.287	0.310	1.332	[0.766–2.318]
medium vs services unavailable	-0.703	0.010	0.495	[0.290–0.845]
low vs services unavailable	-0.762	0.010	0.467	[0.262–0.832]
Alcohol consumption (yes vs no)	0.311	0.045	1.365	[1.007–1.849]
Smoking currently (yes vs no)	-0.841	0.000	0.431	[0.310–0.599]
Refusal to do physical exercises (yes vs no)	-1.215	0.000	0.297	[0.207–0.425]
Non-adherence to a nutrition regimen (yes vs no)	-0.991	0.000	0.371	[0.257–0.536]
Chronic disease presence (have vs do not have)	0.393	0.021	1.481	[1.062–2.066]
Factor 1 “Self-sufficiency and sociability”	-0.054	0.434	0.947	[0.827–1.085]
Factor 2 “Striving for knowledge and development”	0.304	0.000	1.356	[1.171–1.570]
Factor 3 “Passivity and externality”	0.159	0.021	1.172	[1.024–1.341]
Note: The Hosmer – Lemeshow test indicated that the model fits the real data well ($\chi^2 = 4.597$; df = 8; p = 0.800). 73% of observations were correctly predicted. Source: own calculation.				

Regarding the salutogenic factors, “striving for knowledge and development” had the strongest association with care for health (increases its probability by 36%). A somewhat unexpected result showed “passivity and externality” which also has a direct correlation with care for health (increases its probability by 17%). This is explained by the previously confirmed relationship between this salutogenic factor and chronic disease presence: the link between passivity/externality and care for health is mediated by long-term illnesses. People with such conditions, on the one hand, exhibit higher passivity and externality (which may have contributed to disease development), but on the other hand, they inevitably need to care more for their health due to their chronic diseases.

We carried out cluster analysis using the identified salutogenic factors and identified 3 population types (clusters) based on their characteristics⁴ (Tab. 8). The first type, comprising

26% of respondents, is characterized by significantly reduced striving for knowledge and development, moderately high self-sufficiency and sociability, and low passivity and externality. The second type, found among 35% of respondents, exhibits the most favorable characteristics of salutogenesis (“salutogenic-resource type”): increased sociability and self-sufficiency, striving for knowledge and development, and reduced externality and passivity. The third type, identified in 39% of the population, is distinguished by low self-sufficiency and sociability, moderately expressed striving for knowledge, and increased passivity and externality.

To understand the differences between these identified population types, we analyzed descriptive statistics, reflecting the profile of representatives of each cluster based on socio-demographic, socio-economic, behavioral characteristics, and health status assessments (Tab. 9).

Table 8. Types (clusters) of population in terms of salutogenic factor intensity

Cluster	Final cluster centers			Cluster characteristics	Prevalence	
	Factor 1	Factor 2	Factor 3		abs	%
1	0.315	-1.304	0.084	Sharply reduced orientation toward knowledge and development, moderately increased self-sufficiency and sociability, unobserved passivity and externality (“ cognitively deficient type ”)	383	26.0
2	0.663	0.620	-0.627	Increased sociability and self-sufficiency, orientation toward self-development and knowledge, but reduced externality and passivity (“ salutogenic-resource type ”)	520	35.4
3	-0.819	0.311	0.518	Reduced sociability and self-sufficiency, moderately increased striving for development and knowledge, notably increased passivity and externality (“ socially inert type ”)	568	38.6
Source: own calculation.						

⁴ Cluster analysis quality was assessed via internal (silhouette coefficient) and external (Kruskal – Wallis test) evaluation. The silhouette coefficient for 3 clusters ($k = 3$) was 0.30, indicating moderate cluster separation quality. For $k = 2$ it was 0.27, for $k = 4$ – 0.31, for $k = 5$ – 0.31, for $k = 6$ – 0.30, indicating that increasing number of clusters does not change the quality, allowing using three-cluster model. The Kruskal – Wallis test showed that the clusters differ significantly from each other in the original variables: for factor 1 $\chi^2 = 685.673$; $df = 2$; $p < 0.001$, for factor 2 $\chi^2 = 843.723$; $df = 2$; $p < 0.001$, for factor 3 $\chi^2 = 401.262$; $df = 2$; $p < 0.001$. ANOVA also confirmed that all original variables significantly distinguish the clusters: factor 1 ($F = 578.045$, $p < 0.001$), factor 2 ($F = 1181.454$, $p < 0.001$), and factor 3 ($F = 237.521$, $p < 0.001$).

Table 9. Characteristics of population types (clusters) in terms of salutogenic factor intensity, %

Indicator		Type 1 “Cognitively deficient”	Type 2 “Salutogenic- resource”	Type 3 “Socially inert”
Socio-demographic and socio-economic characteristics				
Gender ^{NS}	Male	45.7	42.9	45.2
	Female	54.3	57.1	54.8
Age ^{***}	18–29	10.4	16.7	14.4
	30–44	25.6	38.5	27.5
	45–59	22.5	22.9	28.0
	60 and over	41.5	21.9	30.1
Average age, years		51.8	45.0	48.2
Marital status ^{NS}	Single	37.0	32.7	31.7
	Married	63.0	67.3	68.3
Education ^{***}	Incomplete secondary, complete secondary	8.4	4.1	6.7
	Secondary vocational, technical	70.2	54.4	59.7
	Higher and postgraduate	21.5	41.5	33.6
Income level ^{***}	Low	26.7	9.4	26.9
	Medium	59.0	69.5	58.7
	High	14.3	21.0	14.4
Territory of residence ^{***}	Urban	49.9	84.2	75.7
	Rural	50.1	15.8	24.3
Employment ^{***}	Employed	59.3	74.4	62.3
	Unemployed	40.7	25.6	37.7
Behavioral characteristics				
Consider health a supreme life value ^{***}		85.1	85.2	73.1
Care for health ^{***}	Care little or not care at all	58.5	38.0	33.3
	Do care	41.5	62.0	66.7
Alcohol consumption ^{***}		67.9	65.2	54.6
Often drink beer (daily, on weekends) ^{NS}		38.2	39.3	36.1
Often drink unfortified wine (daily, on weekends) ^{***}		24.9	33.8	51.5
Often drink fortified wine (daily, on weekends) ^{**}		33.2	34.8	43.2
Often drink spirits (daily, on weekends) ^{***}		9.8	6.9	10.5
Smoking (currently) ^{NS}		30.8	30.2	25.9
Refusal to do physical exercises ^{***}		90.9	66.3	74.5
Refusal to follow a nutrition regimen ^{***}		53.8	42.5	35.6
Sought medical care during the year	in public facilities ^{***}	59.0	52.9	69.0
	in private facilities ^{NS}	19.8	23.7	22.4
Sought care for preventive reasons*		17.8	21.7	25.9
Sought care for treatment**		42.0	37.1	48.1
Sought care for occupational health examination*		12.8	13.1	18.1
Sought care for periodic health examination ^{***}		22.7	15.6	29.4
Did not seek medical care ^{***}		34.5	38.8	23.2
Health characteristics:				
Have chronic diseases ^{***}		33.9	13.7	25.0
Missed workdays due to sickness*		20.2	21.0	28.2
Self-rated health*	Very good, good	35.5	44.6	38.6
	So-so	53.8	50.8	53.6
	Poor, very poor	10.7	4.6	7.8
Note: *p < 0.05, ** p < 0.01, ***p < 0.001; ^{NS} – differences are statistically insignificant. Source: own calculation.				

Profile of cluster 1. This cluster is primarily represented by older people (42% aged 60 and over, average is 52 years), rural residents (50%), unemployed individuals (41%), and those with secondary vocational education (70%). On the one hand, its representatives are more likely to consider health a supreme life value (85%), but on the other hand, they show less care for health (59% care little for their health or not care at all) and are more vulnerable to behavioral risk factors than others: 91% do not do physical exercises, 68% consume alcohol, and 54% do not adhere to a nutrition regimen. One-third have chronic diseases (34%) and generally rate their health worse (36% rate “very good, good” and 11% rate “poor, very poor”).

Profile of cluster 2. This is a younger group compared to others: it has higher proportions of those under 30 (17%) and aged 30–44 (39%), with an average age of 45. It also has more urban residents (84%), employed individuals (74%), those with higher education (42%), middle and high income (70% and 21% respectively). This cluster demonstrates the most positive self-rated health (45% “good, very good”, only 14% have chronic diseases) and consequently seeks medical care less often (39% did not seek care during the year). Like representatives of the first cluster, they value health highly (85% consider it a supreme life value), but show greater care for health (62% care about their health), are more likely to do physical exercises (34%), yet are more prone to alcohol consumption compared to cluster 3 (62%).

Profile of cluster 3. This cluster has a higher proportion of individuals aged 45–59 (28%). Similar to cluster 2, it has a high proportion of urban residents (76%), and like cluster 1, many individuals with low income (27%). A specific feature of this group is more pronounced care for health (67%) and medical activity, particularly visits to public healthcare facilities (69%). Furthermore, the main motives for seeking medical care are more developed, including prevention (26% sought care

for preventive reasons, 29% underwent periodic health examinations) and treatment (29%). Notably, despite a lower total share of alcohol consumers, representatives of this cluster are more prone to frequent consumption of fortified and unfortified wines (52% and 43% respectively), spirits (11%), and more often missed workdays due to sickness (28%).

Differences between the identified groups in terms of gender, marital status, smoking, and visits to private healthcare facilities were statistically insignificant.

Discussion of findings and conclusion

To sum up, this study identified three key salutogenic factors based on data from a mass survey – “self-sufficiency and sociability”, “striving for knowledge and development”, “passivity and externality” – which correspond to Antonovsky’s main components of sense of coherence: meaning, comprehensibility, and manageability. The logistic models constructed to assess the relationship between salutogenic factors and public health indicators (alongside other socio-demographic, socio-economic, and behavioral factors) allowed drawing several important conclusions.

The study did not find a statistically significant association between salutogenic factors and self-rated health. This may be due to issues of bias and heterogeneity in self-assessments, or to a more complex (non-linear and/or mediated) nature of their relationship. Notably, as with the salutogenic factors, the modeling did not reveal an influence of care for health on self-rated health. This suggests that self-rated health is determined more by current well-being and existing functional limitations (the study found the strongest significant association between self-rated health and the presence of chronic diseases), as well as by socio-economic conditions (income level). Obviously, care for health is more reactive and intensifies with deteriorating health, indicating reverse causality (health problems promote care for health). The effect of salutogenic

resources in this situation is replaced by other factors, which does not negate their indirect influence on health – through stress resilience, physical activity, treatment adherence, and other behavioral mechanisms.

All three salutogenic factors were found to be significantly associated with the presence of chronic diseases among respondents: self-sufficiency and communicativeness, as well as striving for knowledge and development, notably reduce the probability of their development, while passivity and externality increase it. Only one salutogenic factor – self-sufficiency and communicativeness – demonstrated a significant association with sickness absence from work, decreasing its likelihood. These findings regarding the role of salutogenic factors in maintaining health align with the results of a qualitative study on longevity factors, which identified key factors such as “respondents’ responsible attitude to themselves, their health, setting of short- and long-term goals and objectives, as well as an their inexhaustible motivation for keeping their mental and physical health in a good condition, a broad circle of friends and, which is the most important, high cognitive activity give the long-livers an opportunity to effectively manage their lives, and therefore have confidence in the future” (Kalachikova et al., 2016).

Furthermore, a significant direct association was found between care for health and chronic diseases, as well as sickness absence from work. This can be explained by the reverse nature of their relationship (the presence of chronic diseases stimulates care for health), which is confirmed in other Russian studies (Pokida, Zygunovskaya, 2021). This result also serves as evidence of the prevalence of the instrumental value of health among people, with health acting as a tool for achieving goals rather than a goal itself (Zhuravleva, 2006). At the same time, the study showed that care for health correlates with income and education. Specifically, its probability is significantly higher

among those with high income compared to those with low income, and among individuals with higher and secondary vocational education compared to those with incomplete and complete secondary education. This aligns with findings from other scholars demonstrating a close relationship between health-related lifestyle and social status (Roshchina, 2016).

The identified associations of socio-demographic, socio-economic, and behavioral factors with self-rated health are also evidenced by Russian research. For instance, the significant influence of age, presence of chronic diseases, income level, smoking, and low physical activity was demonstrated by M.A. Kaneva (Kaneva, 2016). Furthermore, the findings regarding the absence of a relationship between self-rated health and alcohol consumption or employment status are consistent with that study. However, contrary to several works (Kaneva, 2016; Lebedeva-Nesevria et al., 2017), the present study did not find an influence of marital status on self-rated health. This result may be a consequence of its more complex relationship. A study by A.B. Sinel’nikov showed that the influence of marital status on health is heterogeneous: for men under 30 and women under 45, no association is observed; for men over 30 and women over 45, living as spouses (or partners) has a stronger positive effect on health than living with children; for the same men over 30 and women over 45, the worst family arrangement for health is to be single and without children (Sinel’nikov, 2012).

The absence of a relationship between education and self-rated health may be due to the mediating role of other factors. O.A. Kislitsyna demonstrated that inclusion of all possible explanatory factors in the model reduces the association between education and self-rated health by 52–62%. The main contribution to explaining this relationship comes from employment, income level, inability to meet with relatives and friends, and alcohol

consumption (Kislitsyna, 2023). Conversely, the higher probability of care for health among individuals with higher education was evidenced by A.N. Pokida and co-authors (Pokida et al., 2022).

The identified significant association between medium accessibility of private medical services and sickness absence from work may be explained by the increasing popularity of private facilities. K.G. Chetaeva notes that people are forced to visit private clinics due to long queues, inability to schedule an appointment at a specific time, lack of required specialists, and low service quality in public facilities (Chetaeva, 2025). The increased likelihood of care for health with greater accessibility of medical care corresponds with findings by A.N. Pokida and N.V. Zybunovskaya, indicating that the lack of access to necessary medical services due to the unavailability of required specialists leads to refusal to seek medical advice and high levels of self-treatment (Pokida, Zybunovskaya, 2021).

The assumption about the mediating role of care for health in the relationship between salutogenic factors and health indicators was partially supported. It was found that two salutogenic factors – striving for knowledge and development, and passivity and externality – are significantly associated with care for health. Both factors increase the likelihood of care for health, suggesting the existence of different behavioral patterns in society: for some, care for health is promoted by passivity and externality (which are associated with chronic diseases), while for others, it is promoted by striving for knowledge and development (through involvement in active health practices). For example, a Hungarian study based on survey of secondary school students (2024) provided evidence of a positive correlation between sense of coherence and physical activity (Karácsony, Hideg-Fehér, 2025). A qualitative study of physical activity among adults in Sweden showed that sense of coherence, especially its comprehensibility component, is strongly associated with knowledge about the benefits of physical activity and the ability

to apply this knowledge, enabling the achievement of recommended activity levels despite economic difficulties (Johansson et al., 2024).

Three population types based on salutogenic factor expression were identified: “cognitively deficient” (reduced knowledge and development, moderately increased self-sufficiency and sociability), “salutogenic-resource type” (increased sociability and self-sufficiency, striving for self-development and knowledge, reduced passivity and externality), and “socially inert type” (reduced sociability and self-sufficiency, notably increased passivity and externality). The profiles of these types reflecting their age, education, income level, employment, territory of residence, health behavior, and self-rated health allow considering them as new target groups for health promotion policy. For the salutogenic-resource type, despite its favorable salutogenic parameters and profile characteristics, measures to increase preventive medical activity (involvement in occupational and periodic health examinations) are relevant. For the cognitively deficient type, measures aimed at informing about health and a healthy lifestyle, stimulating care for health, increasing medical activity, and preventing behavioral risk factors are required. Given the high proportion of older individuals in this group, their broader involvement in active longevity programs is particularly important. For the socially inert type, measures to enhance the value of health and prevent behavioral risks, particularly excessive alcohol consumption, are advisable.

To sum up, it is important to list the limitations of the study: the specific nature of the information base (cross-sectional data) and logistic regression analysis do not allow identifying the direction of causal relationships between independent and dependent variables (e.g., the influence of salutogenic factors on chronic disease development, as reverse causality is possible, when the presence of a disease makes some salutogenic factors more pronounced); the subjective nature of survey data

has drawbacks, as self-rated health estimates are usually biased and heterogenous, requiring caution in interpreting the results; this study did not consider the full range of determinants mediating the relationship between salutogenic factors and self-rated health.

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Appendix

Set of variables for logistic regression and their prevalence in the sample

Variable	Value	Prevalence, %, average
Dependent variables		
Good self-rated health	1 – Very good, good	39.9
	0 – So-so, poor, very poor	60.1
Chronic disease presence*	1 – Have chronic diseases	23.2
	0 – Do not have chronic diseases	76.8
Sickness absence from work	1 – Missed workdays due to sickness during the year	23.4
	0 – Did not miss workdays due to sickness	76.6
Independent variables		
Age, years		48.1
Gender	1 – Male	44.4
	0 – Female	55.6
Marital status	1 – Married	66.5
	0 – Single	33.5
Income level	1 – High	16.8
	2 – Medium	62.4
	3 – Low	20.8
Education	1 – Incomplete and complete secondary	6.1
	2 – Secondary technical or vocational	60.6
	3 – Higher and postgraduate	33.3
Territory of residence	1 – Urban	71.9
	0 – Rural	28.1
Employment	1 – Employed	65.8
	0 – Unemployed	34.2
Accessibility of medical care in public healthcare facilities	1 – High	19.6
	2 – Medium	53.7
	3 – Low	24.1
	4 – Services unavailable	2.7
Accessibility of medical care in private healthcare facilities	1 – High	31.4
	2 – Medium	45.0
	3 – Low	15.7
	4 – Services unavailable	8.0
Alcohol consumption	1 – Yes	61.5
	0 – No	38.5
Smoking currently	1 – Yes	28.6
	0 – No	71.4
Physical activity	1 – Not exercise (refusal)	75.9
	0 – Exercise	24.1
Nutrition regimen	1 – Not follow	78.9
	0 – Follow	21.1
Care for health**	1 – Yes (very much, in general)	58.4
	0 – Little or no care	41.6
* Acts as both an independent variable (in models on good self-rated health, sickness absence from work, care for health) and a dependent variable (in the chronic disease presence model). ** Acts as both an independent variable (in models on good self-rated health, chronic disease presence, sickness absence from work) and a dependent variable (in the care for health model). <i>Note:</i> mean values of the salutogenic variables are not shown as they are all equal to 0 because the data are standardized (centered and normalized) within the principal component analysis.		

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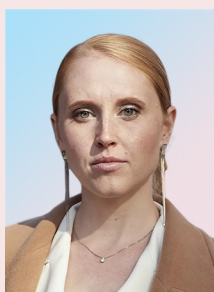
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Expanding the Toolkit for Poverty Research: An Analytical Review of Research Practices



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Abstract. This article aims to systematize the main directions in which the toolkit for poverty research is expanding and to identify how new data sources complement traditional methods, enhancing the capacity to measure, explain, and monitor various manifestations of poverty. The review draws on a multi-stage selection of Russian and international publications on poverty and a comparative analysis of these studies in terms of the instruments they employ. It focuses on both classical quantitative and qualitative tools – household surveys, official statistics, field research, and so forth – and approaches that use digital traces: mobile phone data, satellite imagery, transaction and e-commerce data, and data from online platforms. For the analysis of the classical toolkit, priority was given to the most authoritative and widely cited international and Russian publications, making it possible to reconstruct a stable methodological and instrumental core of poverty research. For the discussion of new approaches, relevant recent works on

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big data, satellite imagery, digital traces, and other data sources were included, provided they offered sufficient methodological detail. The scientific novelty of the study lies in its contribution to the ongoing debate on the use of new poverty research tools and in substantiating hybrid approaches as one of the most promising strategies for studying poverty under conditions of digital transformation and increasingly complex social inequalities. Expanding the toolkit can help improve the spatial and temporal granularity of poverty measurement, better operationalize its multidimensional aspects, and more precisely delineate vulnerable groups. The limitations of the study stem from differences in the selection procedures for the two parts of the corpus, which allow configurations of practices to be compared but do not provide grounds for broad judgments about the theoretical elaboration of the digital literature. Prospects for further research lie in applying the proposed framework to a larger corpus of publications and in empirically testing hybrid designs.

Key words: poverty, poverty concepts, poverty measurement, digital methods of poverty research, hybrid methods of poverty research, social policy.

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Introduction

Poverty is one of the most persistent and socially significant challenges of modern society, affecting not only income distribution but also access to basic public goods, human capital, social mobility, and inclusion of individuals and households in economic and social life. For Russia, which currently experiences a decline in absolute poverty, this problem is nevertheless relevant due to its large socio-economic space, regional differentiation of poverty, the complex structure of vulnerable groups, and, consequently, the possible dependence of social policy effectiveness on the accuracy of their identification (Ovcharova, 2012; Kartseva, 2020; Surinov, Luppov, 2022).

Traditional mechanisms based on official statistics and representative household surveys remain crucial for obtaining reliable and comparable estimates of the scale, depth, and socio-demographic structure of poverty (Moatsos, 2025). At the same time, their capabilities are limited when addressing the tasks of prompt and spatially

differentiated adjustment of social policy. Irregular surveys, insufficient samples for certain social groups and outlying areas, the prevalence of cross-sectional data and the dominance of the monetary approach hinder the timely identification of changes, the analysis of poverty trajectories, and the recognition of heterogeneous forms of need (Eliseeva, Raskina, 2017; Dang et al., 2019; Van der Weide et al., 2022). In this context, there is growing demand for the toolkit capable of working with constantly changing information, capturing the heterogeneity of poverty, and enabling earlier recognition of the risks of its emergence, deepening, and reproduction.

New opportunities may include the expansion of information base and introduction of digital data. Lately, researchers increasingly apply satellite imagery, mobile phone data, transaction data, digital traces, and platform data for assessing well-being, mapping poverty, identifying vulnerable groups, and improving social assistance mechanisms (Hall et al.,

2023)¹. Such approaches allow obtaining regular, spatially detailed estimates, and their practical contribution has been demonstrated in a number of empirical works based on combinations of mobile, geospatial, and algorithmic data (Steele et al., 2017; Aiken et al., 2022).

Russian research already uses some elements of the new toolkit. However, its expansion and integration into the established system of poverty research is lagging behind international practice. Russian poverty studies actively analyze absolute, relative, and multidimensional approaches (Tikhonova, 2011; Kartseva, 2020; Slobodenyuk, Mareeva, 2020; Nazarbaeva et al., 2022), whereas digital and hybrid methods are typically discussed in general scientific reviews (Markeeva, Gavrilenko, 2021; Konstantinovsky et al., 2025). Despite the growing number of works devoted to some digital sources and analytical methods, there remains a gap in research practice analysis, in understanding how modern works use new opportunities for studying poverty and how they develop traditional approaches. The article aims to classify the main directions of poverty toolkit development and to assess associated analytical opportunities and limitations. New methods are considered as supplementary to existing tools for addressing research and practical tasks of poverty alleviation policy. This article therefore attempts to answer the following question: how new methods and data sources expand the poverty research toolkit, and how does it enhance measuring, explaining, and monitoring various manifestations of poverty?

The review includes theoretical, methodological, and informational levels of research. Approaches for studying poverty represent a theoretical framework and determine the content and key manifestations of poverty; methods of collection, measurement, and analysis constitute

the research toolkit; the latter is based on data sources, or information base. Research practices are understood as the logical combination of theoretical approaches, research tools, and information base aimed at addressing some poverty issues and presented in the scientific literature. Accordingly, toolkit expansion is viewed as the development of methods of collection, measurement, and analysis associated with new data sources and ways to combine them.

Data and methods

The research design includes a scientific review in Web of Science and RSCI (eLibrary) databases based on a multi-stage search, selection, and comparative analysis of Russian and international publications from 2000 to 2025. This period allows comparing publications with traditional and modern tools developed after 2000.

At the first stage, publications were collected using queries related to poverty. The keywords were poverty and collocations related to main theoretical frameworks of poverty research: social space, social exclusion, capability approach, welfare regimes, institutional theory, co-production (Klyuev et al., 2025). We selected articles with high citation rates and developed theoretical framework published in peer-reviewed journals. At the next stage, works without a description and justification of research methods were excluded. At the full-text analysis stage, publications directly devoted to measuring poverty with an explicit description of the research method and measurement procedure were included in the final list. For the analysis of publications with traditional toolkits, priority was given to the most distinguished and cited publications, which constitute the methodological core of poverty research and represent international and Russian research fields. Using this approach, we collected a pool of 16 publications with traditional toolkits.

¹ Stubbers M., Holvoet N. Big data for poverty measurement: insights from a scoping review. IOB Discussion Papers, 2020, No. 2020.03. Antwerpen: Universiteit Antwerpen, Institute of Development Policy (IOB).

Publications that used digital toolkits for poverty research were selected in a different manner: the review included relevant recent works on big data, satellite imagery, digital traces, and other alternative data sources; the other factor was sufficient methodological description. The following keywords were used: poverty prediction, poverty estimation, poverty analysis, big data, machine learning, svm, deep learning. The main challenge at this stage was that there was no explicit list of research practices for studying poverty using digital toolkits. The main directions were therefore identified based on the studied articles which analyzed non-manually collected data. To select these publications, we estimated the transparency of data description, the logic of interpretation, and understanding of the analytical advantages and limitations of the method rather than citation indicators. Such a differentiated approach, on the one hand, relied on established approaches, and on the other, covered the new digital toolkit. In total, 22 publications with digital poverty research toolkits were selected.

In accordance with the analytical framework, publications with established research practices were selected that meet the following conditions:

- substantiated theoretical framework, methods, and information base;
- frequent occurrence of the practice among the most cited Russian and international publications; high citation rate as an indicator of scientific influence of the work; the share of publications of the corresponding practice as an indicator of its reproduction among most cited works.

For further analytical work, the dominant research practices were identified in the selected publications:

Traditional toolkit: monetary-statistical measurement; econometric modeling of factors and risks; multidimensional index measurement; institutional-

comparative analysis; qualitative study of poverty and social exclusion; analysis of public perceptions of poverty.

Digital toolkit: poverty assessment based on mobile phone data; satellite-geospatial poverty mapping; digital price and consumption data, social media and information from online platforms.

This structure avoids excessive detail while preserving the key dimensions that provide the basis for a consistent comparison of traditional and digital toolkits, identifying their advantages and limitations, and determining the possibilities for their complementarity in the Russian context.

Results

Publications with traditional toolkits were coded by dominant research practice and then classified into three groups.

1. The core – monetary-statistical and econometric practices. In the body of the most cited works, monetary-statistical and econometric practices account for 38%; their concentration is higher in the Russian sub-body – over 50% versus one-third in the international one.

2. The center – multidimensional index measurement, covering 19% of the total body of analyzed works. There are three times fewer Russian works of this kind than in the international sub-body.

3. The periphery – institutional-comparative, qualitative, and discursive practices, collectively accounting for over one-third of publications. Notably, each individual practice is represented by an equal number of works.

The results of the analysis of traditional research practices for studying poverty are presented in *Table 1*.

To sum up, traditional poverty assessment tools have played a key role in the development of poverty research. They have ensured the comparability of measurements, the reproducibility of results, and the connection between poverty analysis and the

Table 1. Established research practices for studying poverty from the most cited publications with traditional toolkits

Research practice	Theoretical framework	Main methods	Information base	Publications
Monetary-statistical dimension (1)	Monetary approach; absolute and relative poverty; welfare approach	Poverty line determination; calculation of level, depth, and dynamics; statistical comparisons	Official statistics; household budget surveys	Ovcharova, Popova, 2013; Shaidullina, Stepanova, 2020; Erokhina, Dzhergeniya, 2020
Econometric modeling of factors and risks (1)	Stratification approach; social risk theory; welfare regimes	Regression analysis; risk factor modeling; intergroup and spatial comparisons	Survey microdata; panel data; mass surveys	Lezhnina, 2010; Van Oorschot, 2006; Larsen, 2008
Multidimensional index measurement (2)	Capability approach; deprivation and resource approaches	Construction of composite indices; threshold identification; aggregation; classification	Household and special-purpose surveys; health, education, employment, and living conditions indicators	Alkire, Foster, 2011; Alkire, Santos, 2014; Rimashevskaya et al., 2013
Institutional-comparative analysis (3)	Institutional theory; precarization theory; social regimes approach	Analysis of institutions, legislation, and documents; comparative and historical analysis; case studies	Normative acts; social policy documents; historical materials; employment data	Bobkov et al., 2011; Ferraro et al., 2015; Smith et al., 2013; Lucas, 2012
Qualitative research on poverty and social exclusion (3)	Social exclusion theory; constructivist approach	In-depth interviews; monitoring; case studies; biographical and thematic analysis	Interviews; field data; life histories; monitoring data	Bayat, 2000; Mosse, 2010; Sheremet, 2022
Analysis of public perceptions of poverty (3)	Subjective and constructivist approaches; concept of deservingness of support	Mass surveys; scaling; content and discourse analysis; analysis of attitudes	Survey data; media and social policy texts; expert estimates	Mareeva, Tikhonova, 2016; Van Oorschot, 2006; Larsen, 2008
Compiled based on the analysis of selected publications.				

practice of supporting the poor. The development of the toolkit was driven by an expansion of the theoretical understanding of poverty: from income deficits to multidimensional deprivations, social risks, institutional mechanisms, and social exclusion (D'Attoma, Matteucci, 2024). In the selected works, these approaches are implemented through statistical, econometric, index-based, comparative, and qualitative methods applied to official statistics, household surveys, mass surveys, documents, and field data.

As noted earlier, the body of poverty research based on digital data was collected according to a different principle: it included all identified relevant publications that described the actual

use of digital data for studying poverty and explained the methodological procedure in detail. Therefore, this part of the review predictably included publications with varied research designs, including empirical works focused on testing data sources, building predictive models, and spatial mapping. The heterogeneity of research design required a more complex approach to assessing the conceptualization of these practices, and we identified three types of conceptualization: theoretically grounded studies, where framework determines the choice of parameters, digital features, and interpretation (1); studies with a theoretical framework in the background, where theories of poverty are

mentioned but not attached to the toolkit (2); methodologically oriented studies, where the main focus is on data (3). In total, works included in the first group accounted for 18% (4 out of 22), studies with a background theoretical framework – 32% (7 out of 22), and methodologically oriented – 59% (13 out of 22) (two publications (Geng et al., 2023; Marty, Duhaut, 2024) were included in two groups). The most pronounced methodological

orientation was found in works based on mobile data. A more explicit connection with concepts of multidimensional and spatial deprivation is typical for satellite-geospatial studies, while monetary and relative poverty is related to digital prices and consumption.

Overall, the analysis of publications revealed four practices of research based on digital data, which are presented in *Table 2*.

Table 2. Research practices for studying poverty based on digital toolkits

Digital research practice	Theoretical framework and conceptualization type	Key methods	Data	Publications
Poverty assessment based on mobile phone data (n = 7)	1 – 0%, 2 – 28,6% (2/7): monetary and resource approaches, social vulnerability; 3 – 71,4% (5/7): income, consumption, assets, or poverty status are set as an external variable	Construction of digital features; regression; machine learning; spatial prediction	Call detail records; mobility and communications; geodata; survey indicators of income, consumption, and assets	Soto et al., 2011; Frias-Martinez, Virseda, 2012; Pokhriyal, Jacques, 2017; Steele et al., 2017; Njuguna, McSharry, 2017; Aiken et al., 2022; Aiken et al., 2023
Satellite-geospatial mapping of poverty (n = 8)	1 – 25,0% (2/8): multidimensional poverty, spatial and infrastructural deprivation; 2 – 25,0% (2/8): multidimensionality and spatial heterogeneity set the context; 3 – 50,0% (4/8): satellite data are used for prediction	Computer vision; machine learning; geospatial modeling; analysis of luminosity and infrastructure	Daytime and nighttime imagery; maps of roads, land use, built-up areas, and infrastructure	Jean et al., 2016; Tingzon et al., 2019; Yeh et al., 2020; Smythe, Blumenstock, 2022; Hall et al., 2023; Nzelibe, 2024; Geng et al., 2023; Marty, Duhaut, 2024
Analysis of digital data on price and consumption (n = 3)	1 – 33,3% (1/3): relative and monetary poverty, local cost of living; 2 – 33,3% (1/3): consumption is considered an indicator of economic welfare; 3 – 33,3% (1/3): transactions are used for prediction	Local price indices; transaction analysis; construction of consumption features; predictive modeling	Price bigdata; retail chain data; e-commerce and marketplace data; income and expenditure indicators	Marchetti et al., 2024; Wijaya et al., 2022; Wijaya et al., 2024
Analysis of data from social media and digital platforms (n = 6)	1 – 16,7% (1/6): social and digital inclusion are associated with feature selection; 2 – 33,3% (2/6): social exclusion, digital inequality, and spatial heterogeneity set the context; 3 – 50,0% (3/6): platform features are considered as indirect characteristics of poverty	Construction of digital features; audience analysis; machine learning; spatial prediction; data fusion	Social media data; advertising dashboard and audience data; interests and digital presence; geoinformation; external poverty indicators	Fatehkia et al., 2020; Fatehkia et al., 2022; Giurgola et al., 2022; Ledesma et al., 2020; Geng et al., 2023; Marty, Duhaut, 2024
Compiled based on the analysis of selected publications.				

The two parts of the review therefore reveal different attitudes to research. In the highly cited body of traditional studies, practices are reconstructed through established combinations of theoretical framework, methods, and information base. In the digital body, more than half of the works are based on the methodological framework, while the theoretical framework is often expressed indirectly – through the poverty indicator used for model training or validation. The obtained distribution characterizes the composition of the selected body and should be interpreted considering differences in selection procedures between the two bodies.

Discussion

The review results show that the expansion of the poverty research toolkit is a complex and multi-level process rather than a linear one:

- the toolkit is expanding faster at the methodological and informational levels than at the theoretical level;
- there is a significant increase in methods of data collection and analysis, primarily in the area of spatial granularity and predictive modeling;
- there are breakthroughs in data and information base collection.

Notably, traditional toolkits retain a key role in defining the boundaries and content of poverty, ensuring comparability of measurements, and identifying factors of its reproduction. Digital toolkits complement them with capabilities for more detailed spatial analysis and forecasting, while the regularity of digital data generation creates prerequisites for more rapid monitoring of changes. Therefore, the main outcome of the development of the toolkit is not the replacement of one type of data by another, but the expansion of the range of research problems that can be addressed through the functional combination of theoretical approaches, methods, and information sources. This conclusion is consistent with studies showing

that monetary indicators retain their fundamental importance for measuring the scale of poverty but need to be supplemented with multidimensional characteristics to identify differences in the composition and forms of need (Eliseeva, Raskina, 2017; Kartseva, 2020). At the same time, the review results revealed inconsistency across the theoretical, methodological, and informational levels of research. In the body of most cited publications with traditional toolkits, practices are formed by established combinations of theoretical framework, methods, and information base. Digital body, however, has a different structure. Only a limited number of publications demonstrate a pronounced association between the theoretical framework and the choice of measurements, digital features, and interpretation of results. This distribution should be interpreted considering differences in selection procedures between the two bodies; however, it shows that among the reviewed works, the instrumental exploration of new data sources is developing faster than connections between theoretical frameworks of poverty, digital features, and interpretation of results. The identified asymmetry indicates a research problem of ensuring theoretically accurate operationalization of poverty in digital data. Mobile connections, satellite imagery, transactions, digital prices, and platform characteristics require coherence of the theoretical understanding of poverty, the measured manifestation, the digital feature, and the final indicator.

Another important finding of the review is the promise of hybrid designs that combine traditional and digital data sources. In analyzing the publications, we identified two interrelated dimensions of hybridization. The first characterizes the configuration of data interaction: cross-validation of estimates (Van der Weide et al., 2022), in which a poverty map based on household surveys and remote sensing data is compared with a benchmark

map combining survey and census data); mutual deepening through increased granularity (Jean et al., 2016; Yeh et al., 2020; Chi et al., 2022); and supplementation of the information base with new features (e.g., inclusion of mobile, platform, price, and transactional data capturing characteristics absent from the traditional information base (Steele et al., 2017; Fatehkia et al., 2020; Marty, Duhaut, 2024)).

In thematic terms, the spatial direction is the most developed. Satellite imagery, night-time luminosity, built-up area, road network, land use, and infrastructure data allow survey estimates to be extended to small territories and reveal intra-territorial heterogeneity of poverty (Jean et al., 2016; Yeh et al., 2020; Chi et al., 2022). The temporal direction is associated with the use of regularly generated data on prices, transactions, mobility, and digital activity. However, such sources are still predominantly used to assess the current state, while their ability to reliably reflect changes in poverty is much less confirmed (Wijaya et al., 2022; Marchetti et al., 2024; Marty, Duhaut, 2024). The behavioral direction is represented by mobile, transactional, and platform features characterizing mobility, communications, consumer activity, and digital inclusion of the population (Pokhriyal, Jacques, 2017; Steele et al., 2017; Fatehkia et al., 2020; Aiken et al., 2022). These data expand the observable space of poverty, but in most works they are used to predict an external indicator rather than to explain behavior and strategies of the population.

Thus, hybridization develops unevenly: mutual deepening and spatial granularity are most consistently represented; behavioral supplementation has already formed as an empirical direction but remains weakly integrated into poverty theory; temporal hybridization has not yet formed a stable practice for studying dynamics and trajectories.

Therefore, the significance of a hybrid design is determined not by the number of data sources combined, but by their functions, thematic content, and connection to the overall theoretical framework.

Overall, the comparison of research practices shows that the evolution of poverty research methods does not reduce to a sequential replacement of one dominant approach by another. On the contrary, there is a layering of research strategies, in which new methods do not displace old ones but compensate for their limitations and expand the analytical toolkit.

The review results allow for an improved understanding of the process of developing research practices in terms of rapidly identifying changes in the situation of specific population categories and territories. The demand from social policy for a research toolkit capable of working with dynamically updated information, capturing the heterogeneity of poverty, and providing early recognition of the risks of its emergence, deepening, and reproduction, noted above, is generally supported, as the review materials show (Aiken et al., 2022; Marty, Duhaut, 2024). At the same time, it should be noted that new data cannot automatically be transformed into policy decisions and should be used primarily as poverty monitoring tools: for preliminary diagnostics, territorial profiling, and selection of objects for in-depth research. This approach makes it possible to overcome the limited monitoring potential of traditional research practices, due to their dependence on the periodicity of surveys, statistical updates, and data availability. Digital data, including mobile communications and other digital footprints, provide greater opportunities for poverty monitoring, as they enable rapid and spatially granular estimates.

Deepening the analysis of the review results shows that the development of research practices leads to a distinction between measurement and

monitoring, since for the latter it is necessary to demonstrate the temporal stability of features, account for changes in user behavior, platform composition, data generation algorithms, and digital infrastructure. A change in a digital feature may reflect both a transformation of material conditions and a change in technology or service usage practices. In this context, the conducted review allows us to identify a new major research problem – the use of new data for studying dynamics and improving poverty reduction policy.

Thus, the generalization of the obtained data allows us to conclude that it is advisable to move from a competitive logic of comparing methods to a logic of their functional complementarity. For contemporary poverty research, what becomes fundamentally important is not the search for a single universal tool, but the construction of analytical combinations that are simultaneously sensitive to the multidimensional nature of poverty, explain the mechanisms of its reproduction, provide regular monitoring, and remain institutionally applicable in social policy practice.

Conclusion

The conducted review systematizes established and emerging research practices for studying poverty and identifies the main directions of expansion of its toolkit. The findings show that its development is driven by the expansion of methods and the information base, complication of research tasks, and gradual shift to hybrid designs.

We contributed to the analysis of poverty research by proposing the approach to assessing interconnectedness of the theoretical framework, methods, and information base. This approach assesses the research design in its integrity rather than by separate elements. Its application showed that the rapid adoption of digital sources and methods is not always accompanied by a comparable

development of their theoretical justification.

The review clarifies the problematic area of contemporary poverty research and identifies underdeveloped aspects. The first is theoretically grounded operationalization of poverty in digital data and how to ensure it. The second aspect is the challenges of using new data to study poverty trends and improve poverty reduction policy. Regular digital data generation may provide more frequent observations, but still requires additional tests proving its suitability for monitoring.

The article contributes to the discussion of the potential of digital toolkits for solving practical and managerial issues. It can provide reliable operational monitoring, individual poverty trajectories, personalized social support, improved quality of decision-making – but it requires further research, including in the area of hybridization of methods and data. A two-dimensional systematization of data hybridization in poverty research is proposed. First dimension includes identified ways of interaction between traditional and digital sources – cross-validation, mutual deepening, and supplementation; second dimension is based on the type of added information and includes spatial, temporal, and behavioral directions. The proposed classification does not claim to be exhaustive but covers the main directions of development of hybrid research designs and levels of their representation in the reviewed body of research. The findings have a number of limitations. The two parts of the review were formed according to different principles: the body of established practices included predominantly the most cited publications, while the digital body was focused on actual application of new data. Therefore, their comparison identifies differences in the composition of research practices but does not provide evidence that digital literature is in general theoretically weaker than traditional one.

Prospects for further research are associated primarily with the development of the proposed analytical framework and its application to a broader range of publications based on a unified selection and coding procedure. This will enhance assessment of the relationship between theoretical approaches, methods, and data sources in different types of poverty research.

The second direction involves the development and testing of hybrid designs. In them, traditional

toolkits should provide definition and external validation of poverty, digital data – territorial granularity and additional features, and qualitative methods – substantive explanation of mechanisms and population strategies. Their advantage should be confirmed by comparison not only of predictive accuracy but also of temporal stability, interpretability, cost, coverage of vulnerable groups, and suitability for specific managerial tasks.

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Public Opinion Monitoring of the State of the Russian Society

Continuing the established tradition of our journal, we present the results of public opinion monitoring on the state of Russian society, conducted by the Vologda Research Center of the Russian Academy of Sciences (VoIRC RAS) in the Vologda Region¹.

The tables and figures below show the dynamics of a number of indicators of social well-being and socio-political attitudes among the region's population based on the most recent wave of the monitoring (June 2026), as well as over the period from August 2025 to August 2026 (the last seven surveys, i.e., one year of measurements).

The survey results are compared with the average annual data for 2000 (the first year of V.V. Putin's first presidential term), 2007 (the last year of his second presidential term, when presidential performance ratings reached their highest), 2012 (the first year of his third presidential term), 2018 (the first year of his fourth presidential term), and 2023 (the last full year of his fourth presidential term).

Annual data for 2007–2025 are also presented².

In June–August 2026, the approval rating of the President of the Russian Federation remained unchanged at 61%. The share of negative assessments stands at 23–24%.

Over the past 12 months (from August 2025 to August 2026), the share of positive assessments of the head of state's performance declined by 6 percentage points (from 67 to 61%), while the share of negative assessments increased by 5 percentage points (from 19 to 24%).

¹ The surveys are conducted six times a year in the cities of Vologda and Cherepovets and in the Babayevsky, Velikoustyugsky, Vozhegodsky, Gryazovetsky, Tarnogsky, Kirillovsky, Nikolsky, and Sheksninsky municipal okrugs of the region. The survey is carried out through face-to-face questionnaire interviews at respondents' places of residence. The sample size is 1,500 people aged 18 and over. The sample is purposive and quota-based. The representativeness of the sample is ensured by maintaining the proportions between the urban and rural populations, between residents of different types of settlements (rural settlements, small and medium-sized towns), and by the gender and age structure of the region's adult population. The sampling error does not exceed 3%.

More detailed information about the results of surveys conducted by VoIRC RAS is available at <http://www.vsecc.ac.ru>.

² In 2020, four waves of the monitoring were conducted. The surveys scheduled for April and June 2020 were not carried out due to quarantine restrictions during the spread of COVID-19.

How would you assess the current work of...? (% of respondents)

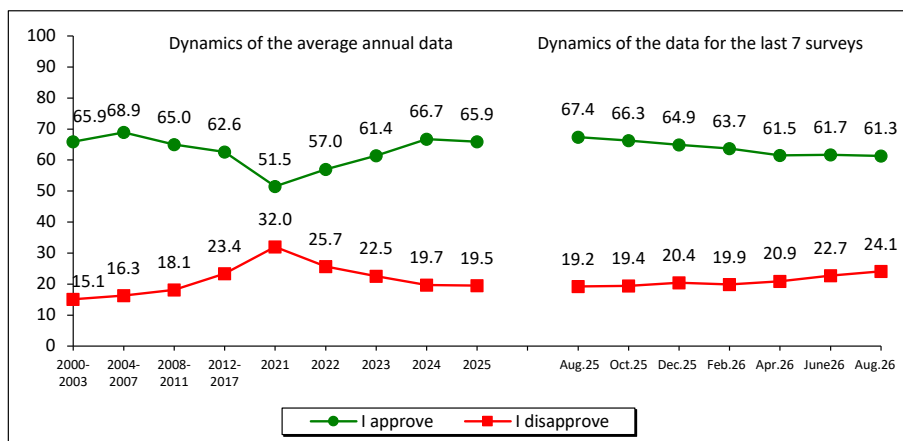
Response	Dynamics of the average annual data										Dynamics of the data for the last 7 surveys							Dynamics (+/-), Aug. 2026 to	
	2000	2007	2012	2018	2021	2022	2023	2024	2025		Aug. 2025	Oct. 2025	Dec. 2025	Feb. 2026	Apr. 2026	June 2026	Aug. 2026	Aug. 2025	June 2026
RF President																			
I approve	66.0	75.3	51.7	66.4	51.5	57.0	61.4	66.7	65.9		67.4	66.3	64.9	63.7	61.5	61.7	61.3	-6	0
I disapprove	14.8	11.5	32.6	21.7	32.0	25.7	22.5	19.7	19.5		19.2	19.4	20.4	19.9	20.9	22.7	24.1	+5	+1
Chairman of the RF Government																			
I approve	–	–	49.6	48.0	39.9	45.4	50.1	54.1	54.4		55.1	55.7	54.0	51.1	48.9	49.1	48.6	-7	-1
I disapprove	–	–	33.3	31.6	37.6	32.0	27.6	24.8	22.5		20.6	23.1	22.2	21.3	22.8	25.1	26.8	+6	+2
Vologda Region Governor**																			
I approve	56.1	55.8	41.9	38.4	36.7	40.9	48.1	51.7	42.5		41.0	41.8	42.8	40.2	38.2	37.3	36.3	-5	-1
I disapprove	19.3	22.2	33.3	37.6	40.5	35.8	30.9	28.4	37.2		39.1	41.3	39.3	39.0	41.2	42.3	44.1	+5	+2

Note: The wording of the question: "How do you currently assess the performance of...?" Respondents were then offered a list of government bodies at various levels to evaluate their work, with the following answer options: "fully approve", "mostly approve", "mostly disapprove", "fully disapprove", "not familiar with their activities", "difficult to answer".

* Positive changes are highlighted in green, negative changes in red, and no change in blue. Since changes of ± 3 percentage points fall within the sampling error, they are considered non-significant and are marked in blue.

** On October 31, 2023, by Decree of the President of the Russian Federation, Georgy Filimonov was appointed acting governor of the Vologda Region. Following the regional elections held on September 6–8, 2024, Filimonov received 62.3% of the vote and became the elected Governor of the Vologda Region.

How would you assess the way that the RF President is handling his job?
(% of respondents, VolRC RAS data)*



Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
I approve	-6	0
I disapprove	+5	+1

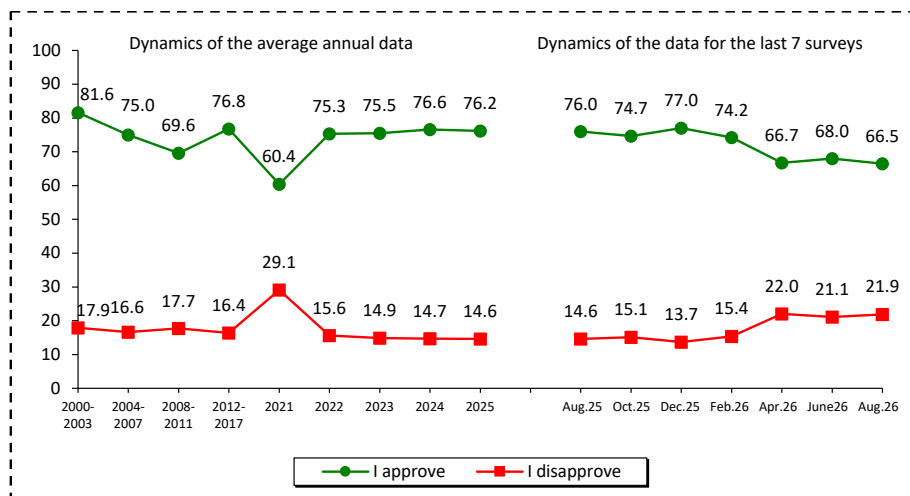
* Here and below, all graphs present average annual data for 2020, 2021, 2022, 2023, 2024, and 2025, as well as average annual data for the periods 2000–2003, 2004–2007, 2008–2011, and 2012–2017, corresponding to presidential term periods.

For reference:

Over the summer months of 2026 (June–August), the presidential approval rating recorded by VCIOM showed a slight negative trend, declining by 2 percentage points.

In annual terms, the decline was more pronounced: from August 2025 to August 2026, the rating fell by 10 percentage points (from 76 to 66%).

Do you approve or disapprove of the way that the RF President is handling his job?
(% of respondents; VCIOM data)



Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
I approve	-10	-2
I disapprove	+7	+1

Wording of the question: "In general, do you approve or disapprove of the way that the Russian President is handling his job?"

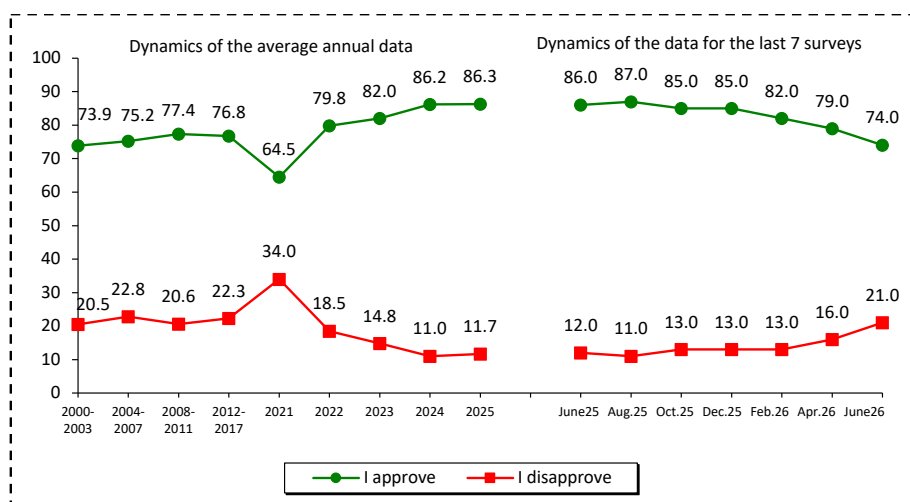
Source: VCIOM. Available at: <https://wciom.ru/>

Data for August are the average of two surveys: August 2, 2026, and August 9, 2026.

According to Levada-Center data, the share of positive assessments of the President of the Russian Federation's performance in April–June 2026 decreased by 5 percentage points (from 79 to 74%).*

Compared with August 2025, in August 2026 the share of positive assessments declined by 12 percentage points (from 86 to 74%).

In general, do you approve or disapprove of the way that Vladimir Putin is handling his job as President of Russia? (% of respondents; Levada-Center* data)



Response	Dynamics (+/-), June 2026 to	
	June 2025	Apr. 2026
I approve	-12	-5
I disapprove	+9	+5

Wording of the question: "In general, do you approve or disapprove of the way that Vladimir Putin is handling his job as President of Russia?"

Source: Levada-Center*. Available at: <https://www.levada.ru/>

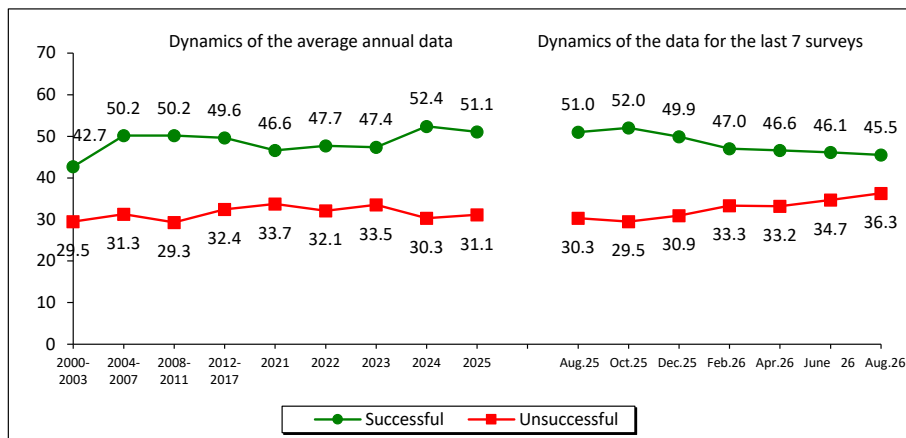
* Included in the register of foreign agents.

In your opinion, how successful is the RF President in handling challenging issues? (% of respondents; VoIRC RAS data)

The share of regional residents who consider the President's efforts to strengthen Russia's international standing successful did not change between June and August 2026.

Over the past 12 months, the share of positive judgments about the head of state's handling of international affairs declined by 6 percentage points (from 51 to 45%).

Strengthening Russia's international standing

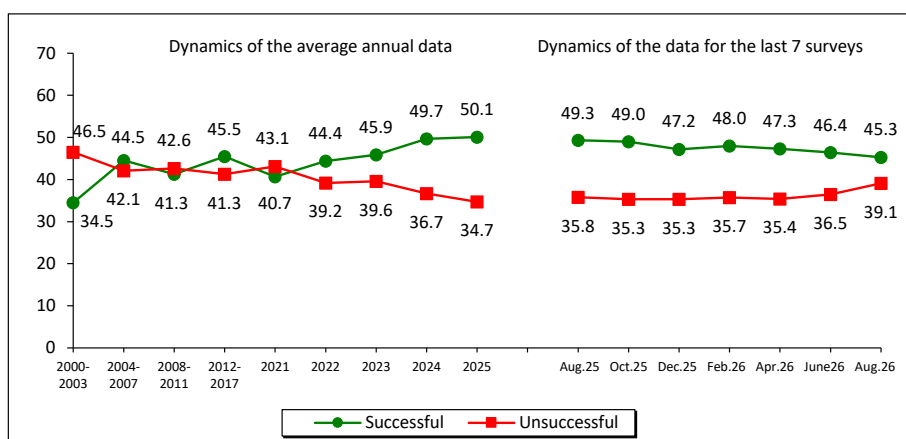


Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
Successful	-6	-1
Unsuccessful	+6	+2

Over the past two months, regional residents' opinion of the President's efforts to restore order in the country remained unchanged: the share of positive judgments stood at 45–46%, and negative ones at 37–39%.

From August 2025 to August 2026, the proportion of people who believe the President is successfully restoring order in the country declined from 49 to 45%.

Restoring order in the country

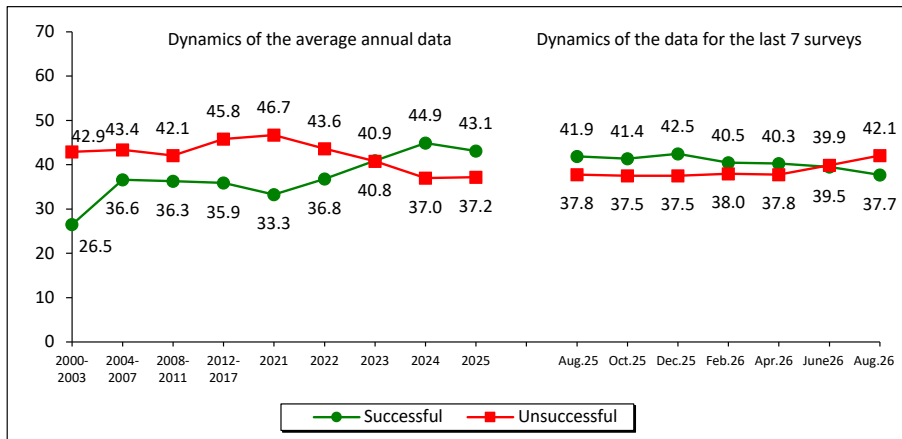


Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
Successful	-4	-1
Unsuccessful	+3	+3

In August 2026, the share of regional residents who positively assess the President's efforts to protect democracy and civil liberties remained virtually unchanged compared with June, standing at 38–39%.

Negative changes have been observed over the past 12 months. The share of those who approve of the head of state's work to protect democracy and strengthen civil liberties declined by 4 percentage points (from 42 to 38%).

Protecting democracy and strengthening civil liberties

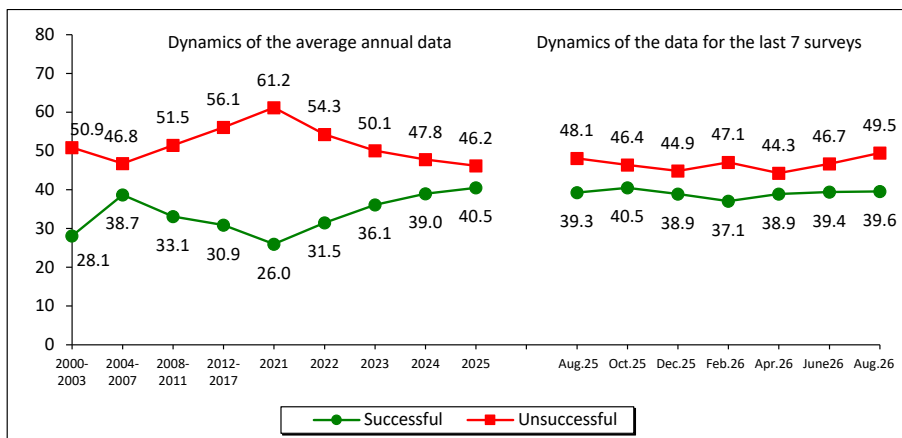


Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
Successful	-4	-2
Unsuccessful	+4	+2

In June–August 2026, the share of residents who positively assess the President's efforts to revive the economy and improve citizens' well-being remained at 39%.

In the year-on-year comparison (August 2025 – August 2026), the distribution of opinions is likewise stable: 48–49% of respondents consider the head of state's work successful, while 39–40% hold the opposite view.

Boosting the economy and improving citizens' well-being



Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
Successful	0	0
Unsuccessful	+1	+3

In June–August 2026, the structure of regional residents' party-political preferences remains stable. The majority of respondents (36–37%) continue to support the United Russia party. This is followed by the CPRF (9–10%), the LDPR (8–9%), A Just Russia (3–4%), and New People (2–3%).

Over the past 12 months, the share of people who say that United Russia represents their interests declined by 5 percentage points (from 41 to 36%).

Which party expresses your interests?
(% of respondents; VoIRC RAS data)

Party	Dynamics of the average annual data													Dynamics of the data for the last 7 surveys							Dynamics (+/-), Aug. 2026 to	
	2011	Election to the RF State Duma 2011, fact	2012	2016	Election to the RF State Duma 2016, fact	2018	2020	Election to the RF State Duma 2020, fact	2021	2022	2023	2024	2025	Aug. 2025	Oct. 2025	Dec. 2025	Feb. 2026	Apr. 2026	June 2026	Aug. 2026	Aug. 2025	June 2026
United Russia	31.1	33.4	29.1	35.4	38.0	37.9	31.5	49.8	31.7	35.2	39.5	42.9	40.3	41.2	40.5	38.1	36.1	35.7	36.8	36.1	-5	-1
CPRF	10.3	16.8	10.6	8.3	14.2	9.2	8.4	18.9	9.3	10.1	9.6	8.9	9.6	11.5	10.5	9.7	9.2	8.1	8.9	10.5	-1	+2
LDPR	7.8	15.4	7.8	10.4	21.9	9.6	9.5	7.6	9.9	7.3	7.0	7.1	8.2	8.7	7.8	8.6	8.9	7.9	7.6	8.6	0	+1
Just Russia – Patriots for the Truth	5.6	27.2	6.6	4.2	10.8	2.9	4.7	7.5	4.7	4.9	4.4	3.5	3.5	4.2	3.4	4.1	3.1	4.3	3.7	4.5	0	+1
New People*	–	–	–	–	–	–	–	5.3	2.3	1.5	1.9	2.0	2.5	1.8	2.2	2.5	2.4	2.3	2.6	2.5	+1	0
Other	1.9	–	2.1	0.3	–	0.7	0.5	–	0.2	0.3	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.5	0	0
None	29.4	–	31.3	29.4	–	28.5	34.2	–	33.9	30.6	26.5	25.2	25.8	23.3	24.3	26.1	29.1	31.5	30.5	27.9	+5	-3
Difficult to answer	13.2	–	11.7	12.0	–	11.2	11.1	–	10.0	10.1	11.1	10.3	10.0	9.2	11.3	10.7	11.0	9.8	9.7	9.3	0	0

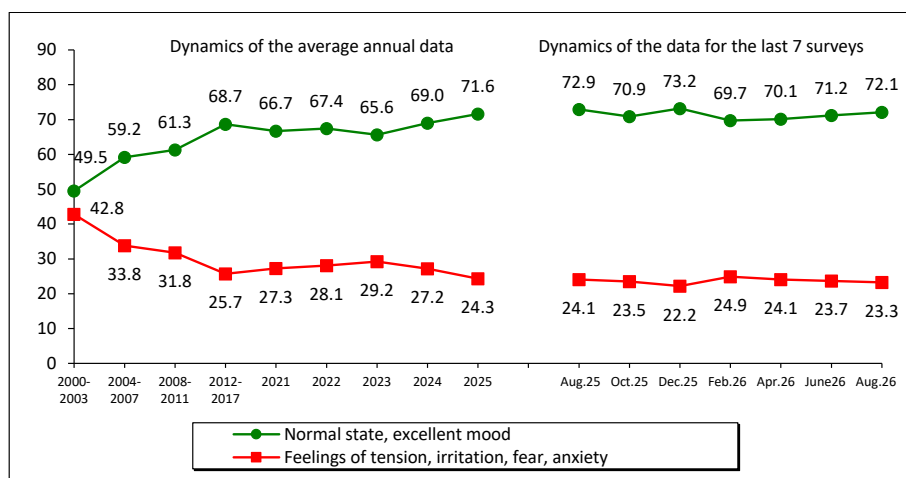
* The New People party won a seat in the State Duma of the Russian Federation for the first time following the elections held on September 17–19, 2021.

Assessment of social condition (% of respondents; VolRC RAS data)

Over the past two months, the share of positive assessments of social well-being remained at the previous level (71–72%).

The annual dynamics (August 2025 – August 2026) are also stable: the share of those who describe their mood as “normal” or “excellent” stands at 72–73%. At the same time, 23–24% of respondents experience the opposite emotions – “tension, irritation, fear, anguish”.

Social mood

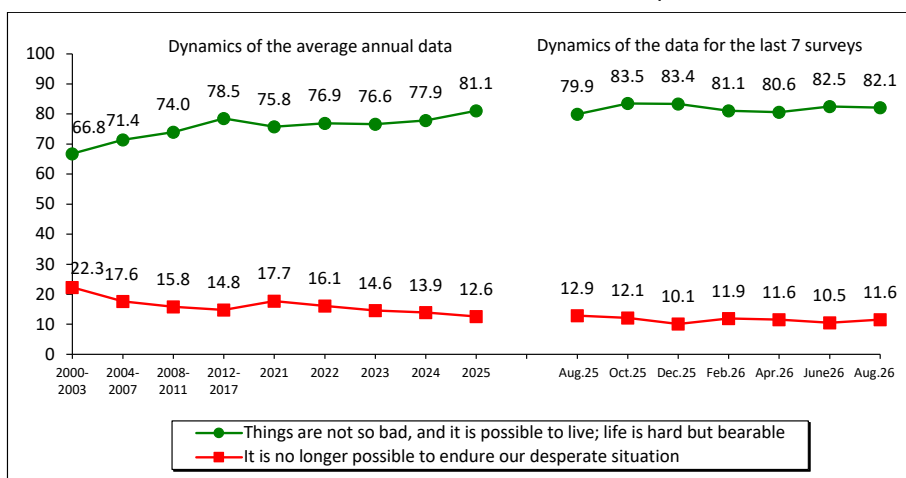


Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
Normal state, excellent mood	-1	+1
Feelings of tension, irritation, fear, anxiety	-1	0

In June–August 2026, the patience reserve remains at a consistently high level: 82–83% of regional residents noted that “everything is not so bad and one can live”. The share of those who believe that it is “no longer possible” to endure their plight stood at 10–12%.

In August 2026, the patience reserve indicator remained at the level of August 2025.

Reserve of patience

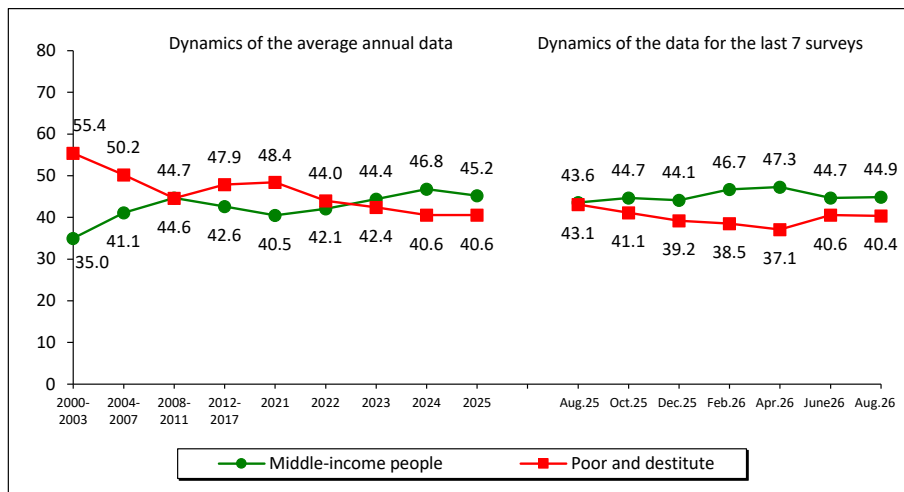


Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
Things are not so bad, and it is possible to live; life is hard but bearable	+2	0
It is no longer possible to endure our desperate situation	-1	+1

In August 2026, compared with June, the structure of social self-identification among the region's residents remained unchanged. The share of citizens who identify as middle-income stood at 45%, while 40–41% of respondents chose the category “poor and destitute”.

Over 12 months, the share of those who consider themselves poor and destitute declined by 3 percentage points (from 43 to 40%).

Social self-identification



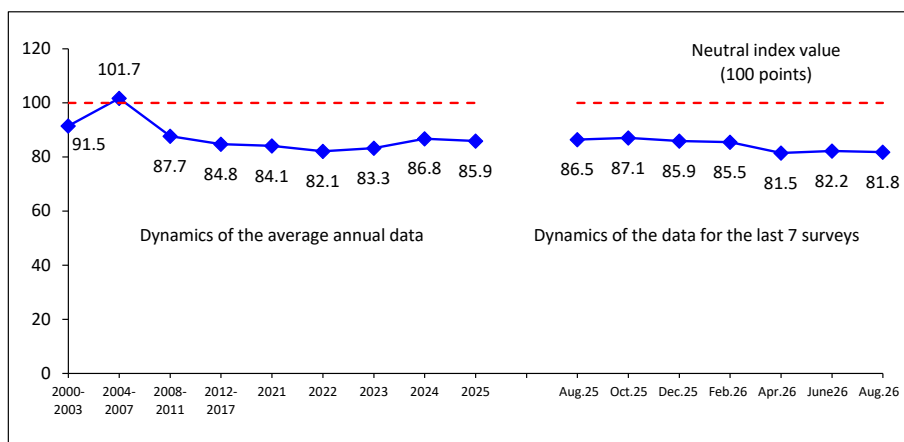
Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
Share of those considering themselves middle-income	+1	0
Share of those considering themselves poor and destitute	-3	0

Question wording: “Which category do you belong to, in your opinion?”.

The Consumer Sentiment Index (CSI) in June–August 2026 stood at 82 points and remained unchanged.

From August 2025 to August 2026, negative dynamics have been observed: the CSI declined by 5 points (from 87 to 82 points).

Consumer Sentiment Index (CSI, points; VoIRC RAS data for the Vologda Region)



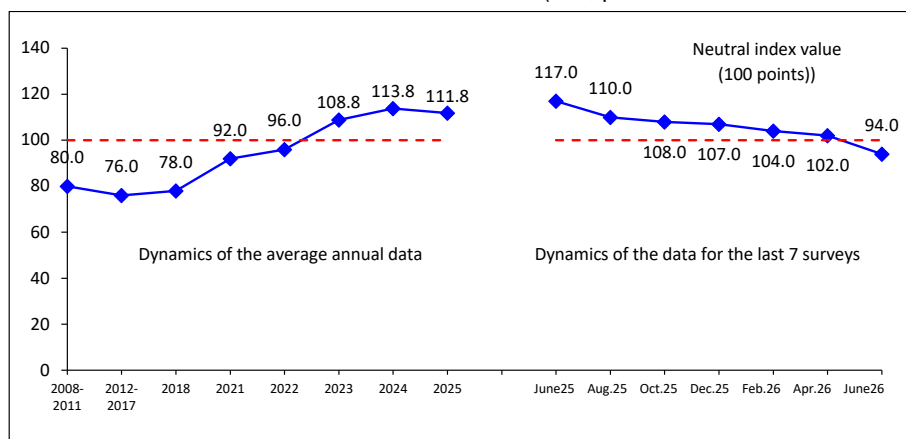
Response	Dynamics (+/-), Aug. 2026 to	
	Aug. 2025	June 2026
Index value, points	-5	0

For reference:

According to the latest nationwide Levada-Center* polls (for the period April–June 2026), the Consumer Sentiment Index declined from 102 to 94 points.

From June 2025 to June 2026, the CSI values decreased by 23 points, from 117 to 94.

Consumer Sentiment Index (CSI, points; Levada-Center* data for Russia³)



Response	Dynamics (+/-), June 2026 to	
	June 2025	Apr. 2026
Index value, points	-23	-8

The index has been calculated since 2008.

Latest data are for June 2026.

Source: Levada Center* data. Available at: <https://www.levada.ru/indikatory/sotsialno-ekonomicheskie-indikatory/>

In the period from June to August 2026, no significant changes in social mood were observed in most socio-demographic groups. Positive dynamics were recorded in one category: among the bottom 20% income group, the share of positive assessments of social mood increased by 4 percentage points).

Over the year, no growth in the share of positive assessments of social mood is observed across socio-demographic groups. A deterioration in mood occurred in one group: among young people under 30, a decline of 10 percentage points (from 78 to 68%).

³ Since March 2025, Levada-Center* has updated its CSI data. The Consumer Sentiment Index in Russia has been calculated since 1993 based on five questions, following the approach of the index developed in the 1940s by the Institute for Social Research at the University of Michigan. The individual indices for each question are calculated as the difference between the share of positive and negative responses plus 100. The aggregate CSI is the arithmetic mean of the individual indices (range 0–200, where >100 indicates a predominance of positive assessments). In 2009, the CSI was pegged to the values of March 2008 (base 100%), reflecting a change in survey methodology and the economic crisis. However, this meant that the index only reflected changes relative to 2008. In March 2025, the decision was made to return to the original CSI calculation methodology, abandoning the 2008 benchmark, because many indicators in 2023 exceeded the 2008 highs, and the old version of the index no longer adequately reflected the current situation. The return to the original methodology is intended to solve this problem. Source: Updated Consumer Sentiment Index: February 2025 figures. Available at: <https://www.levada.ru/2025/03/26/obnovlennyyj-indeks-potrebitelskikh-nastroenij-pokazateli-fevralya-2025-goda/>

* Included in the register of foreign agents.

Social mood in various social groups
(response option “Excellent mood, normal, even state”,
% of respondents; VoIRC RAS data)

Population group	Dynamics of the average annual data								Dynamics of the data for the last 7 surveys							Dynamics (+/-), Aug. 2026 to	
	2007	2012	2018	2021	2022	2023	2024	2025	Aug. 2025	Oct. 2025	Dec. 2025	Feb. 2026	Apr. 2026	June 2026	Aug. 2026	Aug. 2025	June 2026
Gender																	
Men	65.9	69.1	72.8	65.7	66.8	65.5	66.5	70.7	72.1	68.2	73.3	69.1	71.9	70.7	72.1	0	+1
Women	61.7	65.8	69.8	67.4	67.9	65.7	70.9	72.3	73.5	73.1	73.1	70.1	68.7	71.6	72.1	-1	+1
Age																	
Under 30	71.3	72.3	79.9	73.5	77.6	75.0	76.6	76.8	78.1	75.2	74.3	69.5	67.6	66.2	68.6	-10	+2
30–55	64.8	67.9	72.6	69.5	69.4	68.8	71.3	74.3	74.9	73.9	78.4	73.6	73.1	73.5	75.2	0	+2
Over 55	54.8	62.1	65.2	60.5	61.1	58.2	63.3	66.5	68.6	65.9	66.6	64.9	67.5	70.2	69.5	+1	-1
Education																	
Secondary and incomplete secondary	58.4	57.2	64.8	62.1	64.6	62.0	64.6	67.2	70.3	68.4	66.1	60.6	60.4	65.0	67.0	-3	+2
Secondary vocational	64.6	66.7	72.1	66.7	68.3	66.1	70.3	73.6	73.6	71.4	75.6	71.6	74.7	73.4	72.2	-1	-1
Higher and incomplete higher	68.6	77.0	76.7	71.5	69.5	68.8	72.3	73.9	74.7	73.1	77.6	74.7	74.0	75.5	77.4	+3	+2
Income group																	
Bottom 20%	51.6	51.5	57.2	54.6	57.0	50.1	53.5	55.2	58.3	53.3	50.7	48.2	51.3	55.6	59.4	+1	+4
Middle 60%	62.9	68.7	72.1	67.3	68.1	67.4	70.7	73.2	73.1	73.1	75.2	72.2	72.7	72.0	74.4	+1	+2
Top 20%	74.9	81.1	82.4	79.9	78.3	73.9	77.6	83.6	83.8	84.8	89.4	87.7	83.4	84.7	86.7	+3	+2
Territory																	
Vologda	63.1	73.6	71.0	60.3	59.8	59.6	66.0	70.2	72.9	71.4	71.9	68.1	68.8	68.1	69.5	-3	+1
Cherepovets	68.1	76.2	75.7	71.0	71.2	68.1	69.8	73.1	75.0	73.2	76.3	73.0	73.5	75.3	76.0	+1	+1
Districts	61.6	59.8	68.6	67.8	69.5	67.7	70.2	71.6	71.6	69.3	72.2	68.7	69.0	70.8	71.3	0	+1
Region	63.6	67.3	71.2	66.6	67.4	65.6	69.0	71.6	72.9	70.9	73.2	69.7	70.1	71.2	72.1	-1	+1
Total number of groups: positive changes / no changes / negative changes																14: 0 / 13 / 1	14: 1 / 13 / 0

SUMMARY

The latest wave of public opinion monitoring was conducted in July–August 2026. The measurements were carried out against the backdrop of stalled negotiations on settling the Ukrainian conflict, continuing drone attacks on Russian regions, a fuel crisis, and the height of the election campaign for the State Duma of the Russian Federation.

The escalation of national security threats (more frequent attacks by the “Kyiv regime” deep into Russian territory, which triggered, among other things, a gasoline crisis in a number of the country’s regions), set against broad public expectations of a swift and successful end to the conflict in Ukraine, may have been the cause of the deterioration in assessments of the authorities’ performance observed in the

year-on-year retrospective. It should be noted that the decline in the share of positive assessments of the President's performance over the past 12 months has been recorded not only in the research conducted in the Vologda Region but also nationwide, according to VCIOM and Levada Center* data.

In August 2026, compared with August 2025, the approval rating of the head of state declined by 6 percentage points (from 67% to 61%). A decline in the share of positive assessments of his work is recorded across virtually all key areas:

- ✓ strengthening Russia's international standing, by 6 percentage points (from 51 to 45%);
- ✓ restoring order in the country, by 4 percentage points (from 43 to 39%);
- ✓ protecting democracy and strengthening civil liberties, by 4 percentage points (from 42 to 38%).

A decline in support is also recorded for other levels of government: the share of positive assessments of the performance of the Chairman of the Government of the Russian Federation declined over the year by 7 percentage points (from 55 to 48%), that of the head of the region by 5 percentage points (from 41% to 36%), and support for the United Russia party by 5 percentage points (from 41% to 36%). At the same time, the share of respondents who see no party representing their interests grew over the year by 5 percentage points (from 23 to 28%).

A worrying signal is the steady decline in the Consumer Sentiment Index (CSI), which fell over the year by 5 points (from 87 to 82). This points to a gradual deterioration in the population's economic expectations and declining confidence in the future. At the nationwide level, the negative dynamics are even more pronounced: according to Levada-Center* data, the CSI decreased by 23 points (from 117 to 94 points).

At the same time, despite the recorded decline in a number of key indicators, important stabilizing factors persist in society. The patience reserve remains consistently high: 82–83% of the region's residents believe that "everything is not so bad and one can live", while the share of those who state that it is impossible to endure their plight does not exceed 10–12%. Social mood in 13 of the 14 socio-demographic groups has not undergone significant changes over the past two months, indicating that social equilibrium is being maintained. The structure of party-political preferences remains stable, and the distribution of votes among parties is steady, suggesting an absence of political destabilization ahead of the September 2026 elections to the State Duma of the Russian Federation.

Thus, the public opinion monitoring data for August 2026 recorded the further development of the negative trends identified at the beginning of the year and the transition of certain indicators from the category of fluctuations to a sustained downward trend. On the one hand, the relatively high level of support for the President of the Russian Federation and the population's patience reserve persist. On the other hand, the decline in a number of key indicators is becoming more systemic in nature.

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* Included in the register of foreign agents.

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