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## Diagnostics of strategic spatial development scenarios of the national economy

**Abstract.** Spatial development of the national economy is one of the priorities of state strategic management. Development and implementation of the spatial development strategy plays systemically important role in strategic and territorial planning and defines the sequence and directions of the systemic spatial development. An integral assessment of economic, social and spatial development of eight Russian Federation territories is presented in the paper on the basis of twenty statistical indicators. Social and economic development indicators which can be used to implement two alternative scenarios of spatial development have been acquired during calculations and presented as a matrix. It has been concluded that eight federal territories have different combinations of social and economic development which is important to take into account in the strategic spatial planning.

**Keywords:** Spatial Development; Spatial Development Strategy; Development Level; Economic Space; Structure; Spatial Development Scenarios; Spatial Organization of the Economy; Efficiency of the Strategy; Regional Policy

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**Діагностика сценаріїв стратегічного просторового розвитку національної економіки**

**Анотація.** Просторовий розвиток національної економіки є одним з пріоритетних векторів державного стратегічного управління. У стратегічному й територіальному плануванні розробка і реалізація стратегії просторового розвитку відіграє системоутворювальну роль, визначаючи послідовність і напрямки системного освоєння простору.

У статті на основі 20 статистичних показників проведена інтегральна оцінка економічного, соціального та просторового розвитку регіонів Росії (8 чинних федеральних територіальних округів). У результаті розрахунків отримано показники рівня соціально-економічного розвитку, які можуть бути використані для реалізації двох альтернативних сценаріїв просторового розвитку на основі сформованої авторами матриці відповідності економічного та соціального розвитку регіонів.

Авторами зроблено висновок про те, що в чотирьох федеральних округах економічний і соціальний розвиток рівноцінні, у трьох федеральних округах рівень соціального розвитку вище, ніж економічного, а в одному окрузі економічний розвиток перевершує соціальний.

**Ключові слова:** просторовий розвиток; стратегія просторового розвитку; рівень розвитку; економічний простір; структура; сценарії просторового розвитку; просторова організація економіки; ефективність стратегії; регіональна політика.

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**Диагностика сценариев стратегического пространственного развития национальной экономики**

**Аннотация.** Пространственное развитие национальной экономики является одним из приоритетных векторов государственного стратегического управления. В стратегическом и территориальном планировании разработка и реализация стратегии пространственного развития играет системообразующую роль, определяя последовательность и направления системного освоения пространства.

В статье на основе 20 статистических показателей проведена интегральная оценка экономического, социального и пространственного развития регионов России (8 действующих федеральных территориальных округов). В результате расчетов получены показатели уровня социально-экономического развития, которые могут быть использованы для реализации двух альтернативных сценариев пространственного развития на основе сформированной авторами матрицы соответствия экономического и социального развития регионов. Авторами сделан вывод о том, в четырех федеральных округах экономическое и социальное развитие равноценны, в трех федеральных округах уровень социального развития выше, чем экономического, а в одном округе экономическое развитие превышает социальное.

**Ключевые слова:** пространственное развитие; стратегия пространственного развития; уровень развития; экономическое пространство; структура; сценарии пространственного развития; пространственная организация экономики; эффективность стратегии; региональная политика.

## 1. Introduction

Harmonization directions of the Russian economic space are defined by the «The Strategy for the Spatial Development of the Russian Federation up to 2025.» (SSD of the Russian Federation). It was officially adopted in February 2019 (Government of the Russian Federation, 2019) in accordance with the Federal Law «On State Strategic Planning» (cit. by The Ministry of Economic Development of the Russian Federation, 2014).

Public resonance during the discussion of the draft strategies was caused by the specifics of the modern Russian space and the original historical trajectory of social and economic development of the state. These factors objectively require continuous diagnostics of strategy implementation process and updating research in the field of spatial organization improvement as an economic growth driver. The development process, discussion of projects and adoption of Spatial the SSD of the Russian Federation have made researches in this area quite topical.

P. A. Minakir (2018) describing the «spatial development strategy» in the structure of spatial organization concepts of economy concludes that it is necessary to synchronize spatial concentration and spread of the effects of concentrated placement of resources in space. O. B. Ivanov and E. M. Bukhvald (2019) focus in SDS content on the analysis of «geostrategic territories» and «growth points» in spatial development strategizing.

Diagnostics of spatial development scenarios of the Russian economy as substantial alternatives of spatial image formation of the country and assessment of expected results on the basis of scenario approach is described by N. N. Mikheyeva (2018). Priorities and tools of the Strategy for the Spatial Development are described by N. V. Zubarevich (2019).

I. N. Molchanov and N. P. Molchanova (2019) studying formation features of the spatial development strategy in Russia, refer to the most debatable the provisions regarding detection of effective economic specializations for regions.

Our paper is devoted to integral assessment of economic, social and spatial development of territories and diagnostics of strategic spatial development scenarios of the national economy. The article has a brief literature review, the purpose of the study, and results of the analysis. Directions of future work in this field are determined on the basis of the research conclusions.

## 2. Brief Literature Review

Significant potential of theoretical-methodological, predictive-analytical and applied research in the field of organization and management of economic space has been done in the national economic science. Spatial development is studied by the economists of Productive Forces Study Council from the Institute of National Economic Forecasting of the Russian Academy of

Science (INEF RAS), by the Institute of Economics and Industrial Production Organization of the Russian Academy of Science (IEIPO SO RAS), by the regional schools of spatial research and others.

Development of spatial systems research methodology has been analyzed in details by E. A. Kolomak (2013, 2014) and S. A. Suspitsin (Kolomak & Suspitsin, 2018). The authors focus on both theoretical-methodological and predictive-analytical studies in the field of spatial economy, development of territorial systems and regional policy.

The study of causes and consequences of uneven spatial development in Russia are described by E. A. Kolomak as well (2013, 2014). He estimates spatial concentration of economic activity in conditions of a quite high rate of interregional divergence.

G. M. Lappo (2019) considers that cities and their diversity are the factor of successful spatial development of Russia. Priority directions of territorial and economic development systems are to set the ratio of urbanized and nature territories ensuring sustainable development.

Directions for improving economic space based on the implementation of priorities and forms of the cluster policy in the Russian regions, as well as on the results of regional specialization and geographical concentration analysis of the Russian industry are studied by S. N. Rastvortseva (2014) and N. A. Cherepovskaya (Rastvortseva & Cherepovskaya, 2013).

Stability of territory development taking into account morphology of economic space is described by Yu. V. Vertakova, S. M. Klevtsov and M. G. Klevtsova (2016), as well as various types of regional policy (social, scientific-technological, industrial, cluster, investment, etc.), their content and implementation mechanism, role and importance in the spatial development.

The spatial organization is in focus of foreign economists since W. Isard and T. Reiner (1966) described a new direction - regional science. Various factors for improving spatial organization and economic growth have been identified in studies by F. Perroux (1950, 1954), J. Boudeville (1970), P. Potier (1963), D. Friedman (1988), M. Porter (1990), P. Krugman and R. Wells (2015), L. Christiansen, M. Schindler and Th. Tressel (2013), L. Artige and L. van Neuss (2014).

F. Perroux's growth pole theory according to which propulsive industries spread innovation and investment activity through various connections and infrastructure formation has been repeatedly used in the development of Russian regional policy (Perroux, 1950, 1954). Developing growth pole theory J. Boudeville highlighted various kinds of economic spaces (homogeneous, polarized and planned) and proved that developed economic space always becomes polarized (Boudeville, 1970). J. R. Lasuén (1969, 2009) on the contrary believes that economic development does not necessarily require spatial polarization. Growth pole system develops through demand and competition.

P. Potier (1963) argues in the concept of development axes that development is transmitted along transport channels (development axes) that connect industrial production centers. The process of spatially spreading economic innovation or «innovation diffusion» is the basis of D. Friedman's (1988) centre-periphery model. Cluster approach to the economic space organization is stated by the famous American economist M. Porter (1990).

The concept of new economic geography (NEG) by P. Krugman and R. Wells (2015) gained worldwide prominence in spatial economics. The NEG concept states that production tends to be concentrated in the certain countries, regions or cities that later will have become more densely populated and profitable instead of being evenly distributed around the world. L. Christiansen, M. Schindler and Th. Tressel (2013) consider industrial economy structure as a source of economy's spatial organization improvement.

L. Artige and L. van Neuss (2014) determine development of economic space on the basis of the region's aggregate productivity growth in relation to an average in the country which takes place due to the influence of the economic structure and its sectors' growth rate.

The diversity of views on possible resources of strategic economic space management demonstrates the need for further research in this area. The results of the study in the field of economic space strategy are not always based on the use of formalized methods of analysis and forecasting. In some works, conclusions are drawn on the basis of qualitative logical reasoning, whereas quantitative assessment of the studied processes is not carried out. It is obvious that in the process of managing strategic spatial changes, formation and sustainable development of socio-economic space of the country, quantitative diagnostic and predictive measurements are necessary as they allow timely correct spatial development scenarios and make reasonable changes.

### 3. Purpose

The purpose of the paper is theoretical and methodological justification and practical use of individual and integral indicators of strategic spatial development scenarios diagnostics, as far as management of strategic changes in the spatial development should be based on the methodology of placement and transformation of spatial systems under the maximum use of actual and projected resource potential of territories.

### 4. Results

Complex integrated indicators used in the study are calculated on the basis of standards comparison (target, sample) and actual indicators. This technique was used by A. V. Evchenko and S. S. Zhaleznyakov (2004). Benchmarks represent the achieved state of economic and social development. We suggest to assess spatial organization of territories on the basis of correlation of economic and social development levels.

The following calculating method of development level of the territory (*DL*) according to formula (1) was used:

$$DL = 1 - \frac{d_{io}}{c_0}, \quad (1)$$

where:

$d_{io}$  is an indicator characterizing variation of actual and benchmarked values of indicators for each region, calculated according to formula (2):

$$d_{io} = \sqrt{\sum_{j=1}^n (x_{ij} - x_{0j})^2}, \quad (2)$$

$x_{ij}$  is implementation of  $j$ -th attribute on  $i$ -th object;

$x_{0j}$  is implementation of  $j$ -th attribute in the benchmarked object;

$c_0$  is an indicator determined by the totality of sequential calculations (formulas (3), (4), (5)):

$$\bar{x} = \frac{\sum_{i=1}^t d_{io}}{t}, \quad (3)$$

$$S_d = \sqrt{\frac{\sum_{i=1}^t (d_{io} - \bar{x})^2}{t}}, \quad (4)$$

$$c_0 = \bar{x} + 2S_d. \quad (5)$$

The development level (DL) changes from 0 to 1, object development level is one. 1 will be equal to the level of development of object with all benchmarked indicators which is theoretically possible, but has not yet been observed in practical calculations.

The objects for the spatial development assessment are 8 federal territories («okrug», district) of the Russian Federation as they are the largest territorial units which have detailed statistical description (Regions of Russia: Main characteristics of the constituent entities of the Russian Federation, 2018; Socio-economic indicators, 2018; Federal State Statistics Service: Russian Statistical Yearbook, 2018).

Statistical indicators are structured into two groups: economic and social development. We calculate development level (DL) according to two sets: level of economic development (LED) and level of social development (LSD).

Assessment of the actual economic development of the federal territories has been carried out based on the set of indicators:

1. E1 - gross regional product per capita, USD;
2. E2 - fixed investment to gross regional product, %;
3. E3 - volume of shipped goods of domestic production, performed works and services in-house by types of activities per one employee, USD;
4. E4 - agricultural products in farms of all categories per worker, USD;
5. E5 - amount of work performed under the type of activity «Construction» per employee, USD;
6. E6 - operational length of public railway tracks, km/per thousand km<sup>2</sup>;
7. E7 - length of public roads with hard surface, km/per thousand km<sup>2</sup>;
8. E8 - freight turnover of motor transport per one employed in the economy, million thousand km.



9. E9 - balanced financial result of organization activities per employee, USD;  
10. E10 - value of fixed assets per employee, USD.

The acquired set of indicators provides an opportunity to assess development of the main sectors of the economy (industry, agriculture, construction, transport) and economic efficiency of the territory's development (Table 1).

Table 1:  
Indicators of economic development, 2018

FD*	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
CFD	9861.86	15.95	12586.22	981.96	1453.14	26.23	358.33	2625.81	2742.01	45637.64
NWFD	8997.95	23.99	15016.93	505.90	2442.30	7.82	61.59	2537.88	3583.01	48797.93
SFD	4777.38	28.53	7422.54	1915.40	1348.51	16.20	232.32	2255.8	1008.13	32894.68
NCFD	2951.46	28.02	2468.7	18249.37	75610.58	12.33	400.7	877.2	99.01	20072.4
VFD	5598.16	23.24	12743.99	1377.32	1489.58	14.22	229.31	2694.23	404.73	31315.98
UFD	12142.16	30.68	27184.65	813.2	2190.49	4.68	40.58	3277.99	3577.24	90353.71
SFD	5906.4	21.32	12905.01	1060.24	1447.29	2.86	35.85	1957.09	2276.64	30380.53
FEFD	9712.06	32.4	13409.42	825.02	2486.44	1.38	9.5	1789.51	1415.46	62221.99

\* Note: FD (Federal District); CFD (Central Federal District); NWFD (North West Federal District); SFD (Southern Federal District); NCFD (North Caucasus Federal District); VFD (Volga Federal District); UFD (Ural Federal District); SFD (Siberian Federal District); FEFD (Far Eastern Federal District).

Source: Compiled by the authors based on data by Federal State Statistics Service (2019)

The Matrix of standardized characteristic values is generated on the basis of actual indicators. The scaling (standardization) of indicators can be carried out in any convenient way to convert data into a comparable form, taking into account differentiation between indicators - incentives (the growth of which positively characterizes economic development) and indicators - disincentives (the growth of which negatively characterizes economic development).

All of the values in Table 1 refer to stimulants. Thus, the scaled values are calculated by the formula (6):

$$X_{ij} = \frac{E_{ij} - E_{ijmin}}{E_{ijmax} - E_{ijmin}}, \quad (6)$$

where:

$X_{ij}$  is scaled value of indicator;

$E_{ij}$  is actual value of economic development indicator;

$E_{ijmax}$ ,  $E_{ijmin}$  are maximum and minimum values of actual indicator of economic development.

The results of scaling up indicators of economic development are presented in Table 2.

Assessment of economic development level (EDL) indices for the federal territories (districts) are carried out on the basis of standardized characteristic values matrix (Table 3).

According to the integrated values achieved, Southern and North Caucasus territories of Russia have the highest assessment of economic development, followed by the Volga Federal District and Far East.

The following indicators are chosen to measure social development of the federal districts:

S1 - average monthly nominal salary of employees, USD;

S2 - average amount of pensions, USD;

S3 - retail trade turnover per capita, USD;

Table 2:  
Scaling of economic development indicators

FD	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
CFD	0.752	0.000	0.409	0.027	0.001	1.000	0.892	0.728	0.759	0.364
NWFD	0.658	0.546	0.508	0.000	0.015	0.259	0.133	0.692	1.000	0.409
SFD	0.199	0.854	0.200	0.079	0.000	0.596	0.570	0.574	0.261	0.182
NCFD	0.000	0.819	0.000	1.000	1.000	0.441	1.000	0.000	0.000	0.000
VFD	0.288	0.495	0.416	0.049	0.002	0.517	0.562	0.757	0.088	0.160
UFD	1.000	1.000	1.000	0.017	0.011	0.133	0.079	1.000	0.998	1.000
SFD	0.322	0.365	0.422	0.031	0.001	0.060	0.067	0.450	0.625	0.147
FEFD	0.736	0.981	0.443	0.018	0.015	0.000	0.000	0.380	0.378	0.600

Source: Compiled by the authors

- S4 - housing commissioning, m<sup>2</sup> per 1000 people;
- S5 - number of connected mobile subscriber devices per 1000 people (at the end of a year), pcs.;
- S6 - total accommodation area, average per person (the end of a year), m<sup>2</sup>;
- S7 - public catering turnover per capita, USD;
- S8 - volume of paid services per capita, USD;
- S9 - number of active subscribers of broadband access to the mobile Internet per 100 people;
- S10 - pre-school educational organizations commissioning, places per 1000 people.

The set of social indicators allows assessing the standard of living and the development of social infrastructure (Table 4).

**Table 3:**  
**Assessment of the federal territories' (districts) economic development level**

FD	$d_{i0}$	$(d_{i0} - \bar{x})^2$	$\frac{d_{i0}}{c_0}$	EDL	Grade
CFD	2.221	0.003	0.803	0.197	5
NWFD	2.443	0.077	0.883	0.117	7
SFD	2.010	0.024	0.727	0.273	2
NCFD	1.531	0.400	0.554	0.446	1
VFD	2.043	0.015	0.739	0.261	3
UFD	2.548	0.148	0.921	0.079	8
SFD	2.400	0.055	0.868	0.132	6
FEFD	2.117	0.002	0.765	0.235	4
Estimated figures	$\bar{x} = 2.164$	$S_d = 0.301$			
		$c_0 = 2.77$			

Source: Compiled by the authors

**Table 4:**  
**Indicators of social development of federal districts of Russia**

FD	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
CFD	735.09	200.62	4132.45	617.8	2409.9	26.5	158.33	1294.37	92.1	0.324
NWFD	711.2	238.75	3358.38	642.7	2358.7	27.0	180.68	1083.04	87.0	0.434
SFD	459.39	195.58	3037.63	585.2	1787.2	24.1	147.38	977.35	72.4	0.183
NCFD	390.4	180.11	2646.24	517.33	1371.5	21.0	234.05	660.29	65.7	0.18
VFD	467.02	203.62	2822.58	529.44	1851.5	26.1	123.31	814.92	74.1	0.22
UFD	703.63	231.47	3310.78	510.03	1905.5	25.0	194.66	1008.86	75.0	0.327
SFD	539.47	211.31	2418.62	380.19	1796.7	23.9	115.92	721.01	73.2	0.135
FEFD	783.23	249.89	3412.82	319.95	1742.9	23.7	194.97	1360.2	88.4	0.665

Source: Compiled by the authors

All of the values in Table 4 are stimulants. Thus, the scaled values are calculated by the following formula (7):

$$X_{ij} = \frac{S_{ij} - S_{ijmin}}{S_{ijmax} - S_{ijmin}}, \quad (7)$$

where:

$X_{ij}$  is scaled value of indicator;

$S_{ij}$  is actual value of social development indicator;

$S_{ijmax}$ ,  $S_{ijmin}$  are maximum and minimum values of actual indicator of social development.

The results of scaling up indicators of social development are shown in Table 5.

Based on the standardized characteristic values matrix (Table 5), the social development level (SDL) indices are calculated for the federal territories (districts) in Table 6.

**Table 5:**  
**Scaled indicators of social development**

FD	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
CFD	0.877	0.294	1.000	0.923	1.000	0.917	0.359	0.906	1.000	0.357
NWFD	0.817	0.840	0.548	1.000	0.951	1.000	0.548	0.604	0.807	0.564
SFD	0.176	0.222	0.361	0.822	0.400	0.517	0.266	0.453	0.254	0.091
NCFD	0.000	0.000	0.133	0.612	0.000	0.000	1.000	0.000	0.000	0.085
VFD	0.195	0.337	0.236	0.649	0.462	0.850	0.063	0.221	0.318	0.160
UFD	0.797	0.736	0.521	0.589	0.514	0.667	0.667	0.498	0.352	0.362
SFD	0.379	0.447	0.000	0.187	0.409	0.483	0.000	0.087	0.284	0.000
FEFD	1.000	1.000	0.580	0.000	0.358	0.450	0.669	1.000	0.860	1.000

Source: Compiled by the authors

Table 6:  
**Assessment of the federal territories' (districts) social development level**

FD	$d_{i0}$	$(d_{i0} - \bar{x})^2$	$\frac{d_{i0}}{c_0}$	SDL	Grade
CFD	1.052	0.422	0.142	0.858	5
NWFD	0.742	0.920	0.310	0.690	8
SFD	2.003	0.091	0.031	0.969	2
NCFD	2.627	0.858	0.289	0.711	7
VFD	2.107	0.165	0.055	0.945	3
UFD	1.255	0.199	0.067	0.933	4
SFD	2.396	0.484	0.163	0.837	6
FEFD	1.426	0.076	0.026	0.974	1
Estimated figures	$\bar{x} = 1.701$	$S_d = 0.634$			
		$c_0 = 2.97$			

Source: Compiled by the authors

According to the integrated values achieved, the highest rating of social development is in the Far Eastern and Southern territories of Russia, followed by the Volga and Ural Federal districts.

Comparative analysis of economic and social development of the federal districts characterizes spatial organization of economy and social sphere (Figure 1).

According to received Matrix (Figure 1), economic and social development are equal in four federal districts. The level of social development is higher than the level of economic development in three federal districts. Economic development is higher than social development in one district.

The Strategy for the Spatial Development of the Russian Federation includes two scenarios of spatial development - an inertial and a priority (target) one. The inertial scenario presupposes the continuation of current trends in the development of settlement system and economy. It can be recommended for territories with balanced socio-economic development. The priority (target) spatial development scenario presupposes reducing of differences in the basic socio-economic indicators between the territories. This development scenario should be implemented in the districts where disparities in economic and social development have been identified.

Economic development level (EDL)	Social development level (SDL)							
	1	2	3	4	5	6	7	8
1								
2		<b>SFD</b>						
3			<b>VFD</b>					
4	FEFD							
5					<b>CFD</b>			
6						<b>SFD</b>		
7	NCFD							NWFD
8				UFD				

Figure 1:  
**The Matrix of economic and social development relevance**  
Source: Compiled by the authors

## 5. Conclusions and Prospects for Further Research are identified in ISP

Nowadays, priority geostrategic territories of development as well as two spatial development scenarios and target indicators for their implementation are identified in the SSD of the Russian Federation. However, perspective of the country's spatial organization will be more objective if we use an analytical and predictive comparison of economic and social development of the territories. And that is what has been provided in the paper.

Further researches will be aimed at studying territorial structure of the country according to macro-region scheme defined by the Spatial Development Strategy. Diagnostics of economic and social development in the federal districts and macro-regions will allow comparing existing and alternative territorial structures. An effective strategy of territorial development will allow ensuring economically safe and socially oriented strategic changes of the social life in future.

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