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Formation of a macro-region for the effective management of the industrial complex

Conformación de una macro-región para la gestión efectiva del complejo industrial

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ABSTRACT

When justifying the relevance of the research task of measuring the contribution of macroregions to the country's economy, which has not yet found a scientific and methodological solution, it should be emphasized that the scientific literature does not present a system of parameters for assessing the contribution of macroregions to the national economy, there are practically no comprehensive methods for analyzing the impact of the functioning of macroregional socio-economic systems on the development of the country's economy. The article is devoted to the scientific and theoretical research of methodological approaches to determining the importance of macroregional socio-economic systems. A system of indicators is proposed for assessing the role of a macroregion in the national economy, reflecting its specificity as an integration territory and characterizing the level, degree and intensity of interaction between the actors of the macroregional economic and industrial complex.

Keywords: sphere, competitiveness, electronic platforms, marketplaces, problems.

RESUMEN

Al justificar la pertinencia de la tarea investigativa de medir el aporte de las macrorregiones a la economía del país, que aún no ha encontrado una solución científica y metodológica, se debe enfatizar que la literatura científica no presenta un sistema de parámetros para evaluar el aporte de las macrorregiones a la economía nacional, prácticamente no existen métodos integrales para analizar el impacto del funcionamiento de los sistemas socioeconómicos macrorregionales en el desarrollo de la economía del país. El artículo está dedicado a la investigación científica y teórica de los enfoques metodológicos para determinar la importancia de los sistemas socioeconómicos macrorregionales. Se propone un sistema de indicadores para evaluar el papel de una macrorregión en la economía nacional, reflejando su especificidad como territorio de integración y caracterizando el nivel, grado e intensidad de interacción entre los actores del complejo económico e industrial macrorregional.

Palabras claves: esfera, competitividad, plataformas electrónicas, mercados, problemas.

1. INTRODUCTION

Despite the large number of studies of the country's macroregions, analytical work is mainly related to the assessment of the socio-economic situation and economic efficiency (Vladyka et al., 2020; Kravchenko, Markova, 2018). The authors attempted to assess the effectiveness and development trends of macroregional socio-economic systems, but their specificity as integral spaces was not fully taken into account (Lakhter, 2015; Ovodenko, 2020; Stryabkova et al., 2018).

This indicates the need to develop tools for measuring the contribution of the macroregion.

2. METHODS

By and large, the modern macroregion of Russia should become a multi-agent territorial system functioning on the principles of managerial and technological complementarity (Gimarov et al., 2012; Kovaleva, 2013). Consequently, the assessment of the role of the macroregion in the national economy can be presented as a technology for identifying the effectiveness of the mechanism for ensuring interaction between participants of the territorial economic complex.

Analytical work on the assessment of the role of the macroregion in the national economy should take into account its secondary nature as a second-order substance. Since the basic substances can be considered the socio-economic systems of the territories that are part of the macroregion.

From the point of view of causality, a macroregion is, on the one hand, an accident of territories, and on the other, a substance of the second order. Consequently, the assessment of the role of the macroregion in the national economy should make it possible to give a quantitative and qualitative description of all modes as individual manifestations of the macroregional space.

The general approach to analytical work is based on a descriptive assessment, that is, a description of the achieved quantitative levels and the calculation of deviations from the rational behavior of macroregional elements and parameters.

That is, the assessment methodology describes the real behavior of participants in the macroregional industrial and economic complex in situations of choice and reveals the mechanisms of decision-making.
Taking into account the peculiarities of macroregions, to determine their role in the country's economy, a system of parameters is proposed that characterize aspects of the functioning of territorial entities, which are unique indicators peculiar only to integration spaces (Table 1).

Table 1. Is a system of parameters for studying the role of a macroregion in the national economy

Evaluation parameters	Analyzed indicators
The level of connectivity of territories (conditions for resource mobility)	- Quantitative assessment of transport infrastructure - Indicators of the number and availability of macroreginal media - Quantitative parameters of the activity of the macroregional digital resource center
The level of intensity of cooperation	- The number of macroregional partnerships - The number of spatial clusters, technoparks, network structures
Efficiency of cooperation (interaction) of participants of the macroregional industrial and economic complex (PCC)	- The share of revenue of macroregional partnerships in the gross macroregional product (VMP) - The cost of the resources involved in the PCC of the

	macroregion, previously unclaimed
Socio-economic spatial data infrastructure	- The number of enterprises interacting with partners through a macroregional digital resource center - The volume of the socio-economic data base of the macroregional digital resource center in digital format
The effectiveness of spatial development policy	- The dynamics of government spending on supporting weak regions - Reduction of transport costs from the interaction of organizations of macroregions
The effectiveness of the macroregion	- The share of VMP in GDP - Quantitative and qualitative assessment of the transformations of the socio-economic systems of the constituent territories

Compiled by the authors

All the parameters of the methodology are grouped by their content value, that is, they are combined on the basis of uniformity.

The level of connectivity of the territories of the macroregion and the opportunities for resource mobility, as a key parameter of the integration space, should be assessed based on the calculation of transport infrastructure indicators, the number and availability of common mass media, the availability of a macroregional digital network resource center (Magomedov et al., 2021; Shishaev, Masloboev, 2008; Kasatkina, Ketova, 2021; Starshinova et al., 2020).

The intensity of cooperation between the actors of the macroregion is characterized by the quantitative parameters of the activities of macroregional partnerships, network structures of innovative complex business structures.

3. RESULTS AND DISCUSSION

To analyze the effectiveness of interaction between macroregional actors, it is proposed to calculate the share of revenue of integration partnerships in the gross regional product, as well as the cost of resources and waste involved in the turnover that were not previously involved.

The assessment of the spatial data infrastructure is necessary to determine the sufficiency of socio-economic information for the interaction of actors of the macroregional industrial and economic complex.

The creation of macroregions is associated with an increase in the effectiveness of the spatial development policy, so it is advisable to calculate the dynamics of state expenditures on supporting the territory, savings from their interaction.

The final stage of the assessment is the study of the parameters of the effectiveness of the functioning of the macroregion, the share of gross macroregional product in GDP, transformations in territorial socio-economic systems.

The indicators of the parameters of the study of the role of the macroregion in the national economy are presented in Table 2.

Table 2. Indicators Of The Parameters Of The Study Of The Role Of The Macroregion In The National Economy

Parameter	Indicator and its formula	Symbols
Territory connectivity level (resource mobility conditions)		
Quantitative assessment of transport infrastructure: Engel coefficient	$d = \frac{L}{\sqrt{SH}}$	L – the total length of transport routes; S – the area of the territory; H – the population
Quantitative assessment of transport infrastructure: The Char coefficient	$d = \frac{L}{\sqrt{S\Pi}}$	П – is the number of settlements.
Indicators of the number and availability of macroregional media: The number of media outlets with macroregional coverage.	Nmm = Σ MM	MM - the absolute value of the number of macroregional mass media
Indicators of the number and availability of macroregional media: The percentage of the population of territories with access to macroregional media.	Pmm = Nmmp / P x 100%	Nmmp – he number of the population of territories with access to macroregional media; P – population of the territories of the macroregion
Quantitative parameters of the activity of the macroregional digital resource center: The rate of circulation of macroregion resources (CO)	Rr = GMP / R	GMP – gross macroregional product; R – resources involved in the production turnover.
The level of intensity of cooperation		
The level of intensity of cooperation Number of macroregional partnerships	Nmp = Σ MP	MP - absolute value of the number of macroregional partnerships
The number of spatial clusters, technoparks, network structures	Nct = Σ SP + T + NS	SP - the absolute value of the number of spatial clusters; T - is the absolute value of the number of technoparks; NS - the absolute value of the number, network structures
Efficiency of cooperation (interaction) of participants of the macroregional industrial and economic complex (IEC)		
The share of revenue of participants of macroregional partnerships in the gross macroregional product (DV)	SR = Smp / GMP x 100%	Smp – revenue of participants of macroregional partnerships; GMP – gross macroregional product
The cost of the resources involved in the IEC of the macroregion, previously unclaimed (DR)	CR = $AR_1 – AR_0$	$ИР_1$ – is the amount of resources used after the interaction of the participants of the industrial and economic complex (IEC) of the macroregion in the center; $ИР_0$ – is the amount of resources used before the interaction of the participants of the IEC of the macroregion in the center
Socio-economic spatial data infrastructure		
Number of enterprises interacting with partners through the macroregional Digital resource center	DC = Σ E	E - the absolute value of the number of enterprises interacting with partners through the macroregional digital

(DC)		resource center
The volume of the socio-economic data base of the macroregional digital resource center in digital format (DB)	$DB = \Sigma D$	D - absolute value of macroregional data
Effectiveness of spatial development policy		
Dynamics of state expenditures to support weak regions (SE)	$SE = SE_1 – SE_0$	SE_1 – state expenditures to support weak regions, after the transformation of the industrial and economic complex (IEC) of the macroregion based on a multi-agent approach; SE_0 – state expenditures to support weak regions, before the transformation of the industrial and economic complex (IEC) of the macroregion based on a multi-agent approach
Reduction of transport costs from the interaction of organizations of macroregions (RTC)	$RTC = TC_1 – TC_0$	TC_1 – transport costs, after the transformation of the industrial and economic complex (IEC) of the macroregion on the basis of a multi-agent approach; TC_0 – transport costs, before the transformation of the industrial and economic complex (IEC) of the macroregion based on a multi-agent approach
Macroregion performance		
The share of GMP in GDP (Svmp)	Svmp = GMP / GDP x 100%	GDP – gross macroregional product
Quantitative and qualitative assessment of the transformations of the socio-economic systems of the constituent territories: Increase in income of the population (IIP)	$IIP = IP_1 – IP_0$	IP_1 – income of the population of the macroregion, after the transformation of the industrial and economic complex (IEC) of the macroregion on the basis of a multi-agent approach; IP_0 – income of the population of the macroregion, before the transformation of the industrial and economic complex (IEC) of the macroregion based on a multi-agent approach
Quantitative and qualitative assessment of the transformations of the socio-economic systems of the constituent territories: Improving the comfort of the macroregion for the population (ICM)	ICM = Cc / P x 100%	Cc – the number of citizens of the macroregion who positively assess the level of comfort of living in the macroregion; P – population of the macroregion
Quantitative and qualitative assessment of the transformations of the socio-economic systems of the constituent territories:	$PPn = P_1 – P_0$	P_1 – the population of the macroregion, after the transformation of the industrial and economic complex (IEC) of the macroregion on the basis of a multi-agent approach;

Increasing the attractiveness of the macroregion for the population (PPn)		P_0 – the population of the macroregion, before the transformation of the industrial and economic complex (IEC) of the macroregion based on a multi-agent approach

Compiled by the authors

The proposed methodology involves the calculation of several indicators that characterize the production and economic processes taking place in the macroregion, in its various spheres. The greatest emphasis in the methodology is given to assessing the unique features and opportunities that arise in macroregional systems for the business community.

The choice of each of the proposed indicators is justified by the need to measure specific parameters of the functioning of the production and economic system of the macroregion.

The use of the above six criteria in unity makes the process of identifying the contribution of macroregional territories more reasonable, effective, knowledge-intensive and protected from various kinds of errors.
The calculation of the proposed indicators can be based on both measurable and non-measurable data. The initial objective and subjective statistical information is subject to processing using mathematical and instrumental approaches. Immeasurable or difficult measurable information can be processed mainly by an expert method. A distinctive feature of the formed set of indicators can be considered its objectivity, that is, the system includes only measurable parameters.

Each of the indicators has a positive or negative interpretation, and its value is amenable to analysis and allows you to develop measures to improve the situation.

The meaningful meaning of the elements of the system for assessing the role of the macroregion in the national economy is revealed in the identification and quantitative measurement of synergetic effects.
At the moment, the proposed system of indicators does not provide for special scales of ranges for the distribution of the final values of the assessment by levels. However, in future studies, it is expected to establish standard values of indicators, as well as measurement scales.

Additional consideration of the system of indicators in dynamics contributes to understanding the impact of the processes taking place in the macroregion.

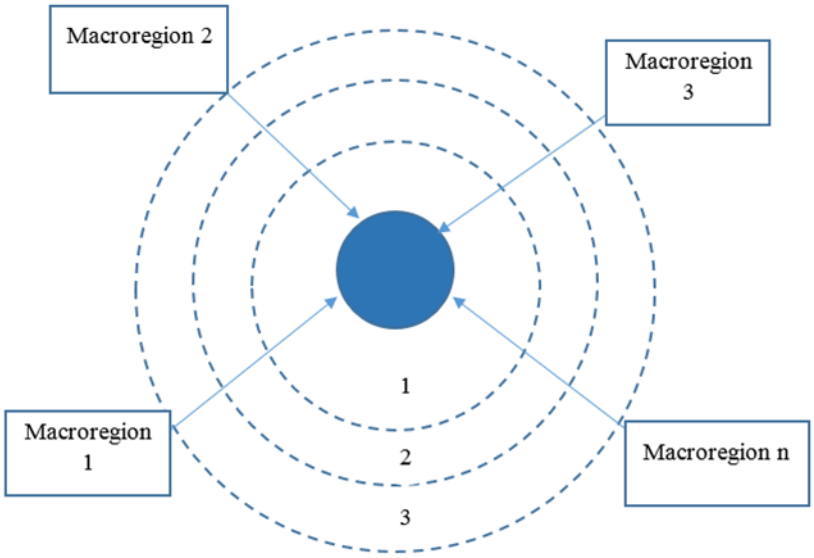
The presented set of indicators for assessing the significance of the macroregion for the national economy can also be used to analyze the effectiveness of measures for the development of multi-agent technologies of the territory.

In the economic literature, the authors most often use well-known indicators to assess the impact of a macroregion on the national economy, which can be calculated for socio-economic systems of different levels, that is, for municipalities, regions, macroregions and the country as a whole. However, the role of macroregional systems is the emergence of specific positive effects, which, in our opinion, will most significantly reflect the contribution of these territories to the country's results.

The author's approach to measuring the impact of macroregions on the effectiveness of the national economy is based on a combination of analysis of diverse indicators that take place only in territorial structures.
The presented algorithm and a set of estimated parameters make it possible to illustrate the influence of the macroregion on the effectiveness of the country's economy. Most of the indicators characterize the

level, degree and intensity of interaction between actors of the macroregional economic and industrial complex.
The choice of indicators is determined by their functionality, that is, it reflects the possibility of objectively measuring the degree of influence of the territorial economy on the national system, reveals the effectiveness of existing measures of government support for specific territories.

The scale of interpretation of parameters and indicators of the study of the role of the macroregion in the national economy is shown in Figure 1.



Zones of the role of the macroregion in the national economy:	The values of indicators and parameters
1 - the high importance of the macroregion in the national economy	The values of most of the indicators are higher than the national average
2 – the average significance of the macroregion in the national economy	The values of most of the indicators are at the level of the national average (deviations of no more than 10%)
3 – the weak significance of the macroregion in the national economy	The values of most of the indicators are below the national average

Compiled by the authors

Figure 1. Scale of interpretation of parameters and indicators of the study of the role of the macroregion in the national economy

As can be seen from Figure 1, the interpretation of the parameters and indicators of the study of the role of the macroregion in the national economy is based on the use of a comparative approach, that is, it involves comparing the achieved results of the macroregion with the average levels in the country.

The developed methodological apparatus in the form of a set of parameters and indicators can be used as an adaptive system for analyzing and managing the development of a macroregional socio-economic system.

Based on the testing of the proposed methodology, we will present an interpretation of the parameters of the study of the role of the Central Chernozem macroregion in the national economy in 2015-2019. (Table 3).

Table 3. Interpretation of the parameters of the study of the role of the central chernozem macroregion in the national economy in 2015-2019

Estimation parameters	Interpretation of parameters in the context of their comparative analysis with the average values for the macroregions of the Russian Federation
The level of connectivity of territories (conditions for resource mobility)	at the level of the average level in the country (deviations of no more than 10%)
The level of intensity of cooperation	at the level of the average level in the country (deviations of no more than 10%)
The effectiveness of cooperation (interaction) of participants of the macroregional industrial and economic complex (PCC)	at the level of the average level in the country (deviations of no more than 10%)
The infrastructure of socio-economic spatial data	is below the national average
The effectiveness of spatial development policy	is above the national average
The effectiveness of the macroregion	at the level of the national average (deviations of no more than 10%)
of the zone of the role of the macroregion in the national economy	**the average significance of the macroregion in the national economy**

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The interpretation of the parameters of the study of the role of the Central Chernozem macroregion in the national economy in 2015-2019 allows us to state the average level of significance of the studied macroregion in the national economy.

4. CONCLUSION

In the economic literature, the authors most often use well-known indicators to assess the impact of a macroregion on the national economy, which can be calculated for socio-economic systems of different levels, that is, for municipalities, regions, macroregions and the country as a whole. However, the role of macroregional systems is the emergence of specific positive effects, which, in our opinion, will most significantly reflect the contribution of these territories to the country's results.

The author's approach to measuring the impact of macroregions on the effectiveness of the national economy is based on a combination of analysis of diverse indicators that take place only in territorial structures.

The presented algorithm and a set of estimated parameters make it possible to illustrate the influence of the macroregion on the effectiveness of the country's economy. Most of the indicators characterize the level, degree and intensity of interaction between actors of the macroregional economic and industrial complex.

The choice of indicators is determined by their functionality, that is, it reflects the possibility of objectively measuring the degree of influence of the territorial economy on the national system, reveals the effectiveness of existing measures of government support for specific territories.

The developed methodological apparatus in the form of a set of parameters and indicators can be used as an adaptive system for analyzing and managing the development of a macroregional socio-economic system.

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