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DEVELOPMENT OF A SYSTEM FOR COMPREHENSIVE ASSESSMENT OF THE QUALITY OF REGIONAL DEVELOPMENT MANAGEMENT BASED ON FUZZY LOGIC

Speciality: 5.2.3 «Regional and sectoral economics»

Abstract of the dissertation for the degree of candidate in economic

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Relevance of the study. Modern conditions of socio-economic development require new approaches to regional management. The quality of regional development management can be defined as the ability of government and administration bodies to effectively use available resources to achieve the goals and objectives of the socio-economic development of the territory. However, in the framework of the study of the quality of regional development management, there are a number of unresolved issues that can be considered "blank spots" in the research field.

In most existing studies and practices, the assessment of regional development management is based on individual indicators (for example, investment attractiveness ratings, governor ratings, regional competitiveness, level of socio-economic development, etc.). Among the many assessments, there is no single methodology that takes into account not only the management results, but also the decision-making process itself, the adaptability of strategies, and the efficiency of resource use.

An analysis of the consolidated ratings of socio-economic development of Russian regions reveals a significant polarization between the leading and lagging entities. According to RIA Novosti data for 2023, the leaders are Moscow (94.4 points) and St. Petersburg (89 points). At the same time, the regions at the bottom of the rating, such as the Republic of Kalmykia, the Karachay-Cherkess Republic, the Republic of Ingushetia, the Jewish Autonomous Region and the Republic of Tyva, showed low results of socio-economic development.

Such polarization is due not only to differences in the initial conditions, but also to the quality of regional development management. The gap in management approaches leads to heterogeneity in the development of territories, increases disproportions and reduces the effectiveness of state regional policy. In this regard, the development of a system for a comprehensive assessment of the quality of regional development management, taking into account the specifics of individual territories and allowing for the development of more balanced management strategies, is becoming relevant.

The use of fuzzy logic in such a system will make it possible to more adequately assess the quality of management, since it is influenced by many subjective and

insufficiently formalized factors, the importance of which increases in conditions of high variability of regional management, where traditional assessment methods do not always reflect the real situation. The development and implementation of a system for comprehensive assessment of the quality of regional development management based on fuzzy logic directly corresponds to the strategic guidelines of the Russian Federation, enshrined in current strategic planning documents.

The priorities for ensuring, for example, a sustainable and dynamic economy, digital transformation of state and municipal administration, the economy and the social sphere, defined in the Decree of the President of the Russian Federation of May 7, 2024 No. 309 "On the national development goals of the Russian Federation for the period up to 2030 and for the future up to 2036" correspond to the goals of forming a system for comprehensive assessment of the quality of regional development management, since they allow identifying and eliminating management imbalances and increasing the accuracy of decisions made in conditions of uncertainty. The use of fuzzy logic methods in the system for assessing the quality of regional development management ensures that factors influencing socio-economic processes are taken into account, as well as multi-level and incomplete data when changing management decisions. The assessment system based on big data analysis and the use of fuzzy logic is in line with the goals of the National Project "Data Economy" launched in 2025, which is aimed at developing digital technologies and efficient use of data in regional management.

The Strategy for Spatial Development of the Russian Federation for the period up to 2025 sets the tasks of increasing the competitiveness of the economies of the constituent entities of the Russian Federation and reducing imbalances in their development. The proposed management quality assessment system provides a mechanism for identifying hidden patterns in the regions, more objective diagnostics of problem areas, flexibility in modeling forecasts and scenarios for the development of the economy and social sphere, compliance with strategic decisions taking into account the specialization of each constituent entity of the Russian Federation, ensuring a balance between economic growth, sustainable development and efficient use of

resources.

Thus, the development and implementation of a comprehensive assessment system for the quality of regional development management based on fuzzy logic is a fairly relevant, justified and timely research topic.

The degree of scientific development of the topic. A significant volume of research devoted to various aspects of regional development management has been accumulated in the world and domestic literature. The region is considered as a part of the national economy with economic specialization by Baburin V.A., Korchagin Yu.A., Fominykh S.B., Sharygin M.D., Shchemelin S.A., Nikulina N.I., H.V. Chung Yeung, Christian Heffner, Brygida Solga, Potapov M.G.; such authors as Gutman G.V., Barbakov O.M., Barzilov S.I., Nekrasov N.N., Pokazanyeva T.V., Skopin A.Yu., Marshalova A.S., Fedorenko N.P., Samarina V.P., Gonar Yu.A. focus on the region as an administrative unit. Josep A. Ivars Baydal, George J. Miringay, Marco M. Burra, Nelly J. Babere; consider the region through the prism of natural and geographical conditions Alaev E.B., Rodoman B.B., Starodubtseva E.E., Tishkov V.A., Van den Berghe P., Krylov M.P., Zyryanov A.I., Giertz K., Shils E., Monica Noviello, J. Entrikin, Nuzhina I.P., Yudakhina O.B., Sulpovar L.B., Mihurinskaya E.A. Melnikova N.V., Litovka O.P.; identify the region as a socio-economic system Chepurnykh N.P., Yakobson A.Ya., Kruglikova O.V., Dolyatovsky V.A., Kuzin B.I., Francois-Olivier Seys, Inayati R., Saiful N. Bugayev V.K., Lapaeva M.G., Laptev S.P.; integrate heterogeneous elements inherent in the region as an economic category into a complex multi-component system Khomchenko I.V., Chepurnykh N.V., Novoselov A.L., Lemeshev M.Ya., Mednikov M.D., Sokolitsyn A.S., Tanle A., Ogunleye-Adetona S.I., Artor G. Kuchinskaya T.N., Lazicheva E.A., Lugovskikh N.I., Kleiner G.B. Research in the field of regional management conducted by such authors as Baransky N.N., Avanesova G.A., Astafieva O.N., Mitroshenkov O.A., Bocharnikova I.S., Kalyuzhnaya N.A., Kulibaba S.I., Panasyuk M.V., Trapeznikova V.A., Gruzdev G.V., Afanasyev V.G., Lapin N.N., Brekhov A.G., Chupina I.P., Kovalenko E., Zinchuk G., Kochetkova S., Maslova S., Polushkina T., Ryabova S., Yakimova O., Gorodilov A.A., Collier P., Tackett D., Lorain A., Christine P.V. Wong, G. Gudjin, K. Mayer, D.

Rodrik, S. Stancheva, F. Cook, D. Bella, T. Vantillo, J. Beckers, A. Verhetzell, R. Leonardi, cover a wide range of issues related to the theory and practice of regional management. In their works, the authors analyze territorial and economic zoning, methods and instruments of regional policy, as well as issues of decentralization and efficient resource allocation, combining theoretical approaches and practical recommendations. The quality of management is studied in the works of such authors as S. Bratchenko, R. R. Schmidt, L. I. Tatarnikova, A. V. Parvoz, who consider management as a complex system, where the key factors of quality are institutional stability, transparency, adaptability of management decisions and orientation to the interests of society. Management efficiency is studied in detail by such researchers as Atamanchuk G.V., Shakhmalov F.I., Bartsits I.N., Kurakov L.P., Kurakov V.L., Leksin V.N., Azriliyan A.N., Grice J., Helm D., Smith S., McCann F., Ortega-Argiles R., Herrell E., whose attention is focused mainly on the analysis of factors influencing the effectiveness of management processes, including administrative reforms, rational distribution of resources, decentralization of power and the introduction of modern management technologies. Some authors pay special attention to balance as an important indicator of the effectiveness of regional management. Thus, Alferova T.Yu., Adzhikova A.S., Kancerov R.A., Shkolnikova N.N., Alfimenko S.S., Akindinova N.V., Chernyavsky A.V., Chepel A.A., Bushinskaya T.V., Arapov S.V., Petrova E.E. and Pereslegin S. consider the balanced development of territories as the main factor of the stability of regional economic systems. At the same time, Kuklin A.A., Naslunga K.S., Kachanova E.A., Matochkin R.V., Chevtaeva N.G., Kolesov R.V. and Afanasyev R.S. come to the conclusion that one of the most reasonable indicators of financial stability and efficiency of financial resources is the solvency ratio of the region. Their approach confirms the importance of financial balance in assessing regional management and complements the concept of balanced economic processes, providing a comprehensive view of the stability and efficiency of territorial development. Features of the implementation of the new paradigm of the client-centric approach were considered in their works by the following authors: Bachurinskaya A.I., Nuzhnova S.L., Mamaev M.S., Yuzhakov V.N., Maslov D.V., Barabashev A.G.,

Yakobson L.I., Kalinin A.M., Kakoho T.G., Udalykh S.K., Roslyakova M.V., Bogatyreva T.G., Martynova S.E., Smirnova V.V., Leontyeva L.S., Orlova L.N., Galeeva A.R., Kozhanova I.V., Voronina N.A., Getman A.N., Mikhailova S.A., Romanova D.E., Polshina K.O., Kharchenko V.A., Alieva S.V., Zhamborov A.A., Bozhko E.A., Lipina O.O., Antonovsky A.V., Istomina I.A., Dolinin A.Yu., Tsarkova E.G. and many others. Among foreign researchers of the client-centric approach at various levels of public administration, one can mark Aunt E., Corea T., Sachang O., Ndu M., Ariba O., Ohuruogu A., Garcia-Alvarez S., Lopez-Fernandez A.M., Janssen K., Chunying S., etc.

The theory of fuzzy logic was developed by Lotfi Zadeh in 1965 and has received wide recognition as a tool for dealing with uncertainty and subjectivity. In relation to regional development, fuzzy logic was used in their studies by Averchenkova E.E., Makhmudov M.K., Gadzhialiev R.K., Kovalenko A.V., Kalaydina G.V., Akinshina V.A., Anokhina E.A., Kravets E.V., Solodova O.S., Kramarov S.O., Sakharova L.V., Khramov V.V., Dli M.I., Bischokov R.M., Adzhieva A.A., Thaytsukhova S.R., Nizamutdinov M.M., Oreshnikov V.V., Karpova A., Grineva N., Kosov D.L. Erlin Vindya Ambarsari, Nurfida Dwitiyanti, Noni Selvia, Wahyu Nur Cholifah and Putri Dina Mardika, Subhashini L., Michele Caprio and Yusuf Sale and other authors.

In the works of modern authors such as Gadzhiev M.M., Magomedova M.A., Generalov I.G., Fokina N.A., Oborin M.S., Abramova M.A., Maslov M.P., Petrov S.P., Abramov V.I., Andreev V.D., Prokopyev E.A., Bessonova E.A., Babichev A.O. Oborin M.S. Gadzhimetov B.E., Shchukin O.S., Yakovleva I.K. Bondareva Ya.Yu., Legalis P., Plakhin A.E., Selezneva M.V. and others. the region is perceived as a dynamic digital ecosystem, where the key features are network interaction, digitalization of management and economy, innovative cluster connections, interregional cooperation, as well as continuous development of infrastructure and inclusiveness.

An analysis of scientific papers has shown that most domestic publications that have appeared in recent years, in a generalized form, convey foreign experience in assessing the effectiveness of the management system, projecting regulatory methods

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onto the Russian economy without taking into account regional specifics. Insufficient attention is paid to such issues as studying the influence of socio-economic factors and conditions on the transformation of the regional economy and on the Territory Development Strategy.

In addition, classical methods of analysis and decision-making do not reveal the deep relationship between the factors influencing socio-economic development, and do not provide an opportunity to find such management decisions that could ensure the most effective development of the region. At the same time, there is no approach to the formation of a system for comprehensive assessment of the quality of regional development management using fuzzy logic.

It is necessary to study methods for adapting fuzzy logic to the specifics of various regions, taking into account their unique conditions. In addition, there is a need to develop models that can flexibly respond to changes in regional development conditions and provide an up-to-date assessment of the quality of governance.

The purpose and objectives of the study. The purpose of the study is to develop theoretical and methodological approaches and to develop practical recommendations for the formation of a system for a comprehensive assessment of the quality of management of the socio-economic development of a region, functioning on the basis of fuzzy logic.

Research objectives:

- based on a critical analysis of Russian and foreign scientific literature, to develop theoretical provisions of the essence of a region as an object of management;

- to develop conceptual provisions of regional management in terms of developing a scheme for the interaction of the main elements of the system for achieving a sustainable level of socio-economic development of regions;

- to form a system for a comprehensive assessment of the quality of regional management based on the principle of client-centricity, structured by the main domains of socio-economic development and including detailed criteria, indicators and metrics;

- to develop an algorithm for using fuzzy logic in assessing the quality of regional management, allowing for uncertainty and complex relationships between

various indicators of socio-economic development; - to present an original author's methodology, including groups of criteria and indicators for assessing the quality of regional governance, reflecting public satisfaction, management efficiency, transparency and openness, innovation and public involvement; - to develop an algorithm for adapting the system for assessing the quality of regional governance to the institutional conditions of the socio-economic development of new Russian territories, taking into account their specifics and development conditions.

The object of the study is the socio-economic system of the region. **The subject** of the research is a system of comprehensive assessment of the quality of regional development management based on the use of fuzzy logic.

The theoretical and methodological basis of the study was formed by fundamental theoretical provisions and approaches to the study of problems of socio-economic development of the region, presented in the works of domestic and foreign authors, as well as works devoted to the specifics of assessing the quality of regional development management in conditions of uncertainty. The study is based on general scientific, general economic and special methods, including methods of scientific abstraction, process methods, methods of historical-logical and economic-statistical analysis, structural analysis and synthesis, methods of system, comparative and logical analysis, graphical interpretations, modeling of economic processes, fuzzy logic.

The instrumental and methodological apparatus of the study includes a set of methods, models and approaches necessary for the development and implementation of a system for comprehensive assessment of the quality of regional development management. The methodological basis of the study is based on the principles of system analysis, fuzzy logic, as well as modern methods of modeling and managing socio-economic systems. The use of system analysis allows structuring and detailing the problem under study, identifying key factors and parameters influencing regional development management, and determining their interrelations. The use of fuzzy logic makes it possible to work with uncertain and incomplete data on the activities of socio-economic systems. To build and test the models, mathematical modeling methods were used, including fuzzy sets, which made it possible to formalize

and analyze complex cause-and-effect relationships.

The information and empirical base of the study includes federal and regional regulatory documents governing issues of regional development and management; strategic documents, programs for socio-economic development of regions, national projects reflecting the results and directions of territorial development; materials of state statistical bodies; scientific papers devoted to issues of regional development and management, the use of fuzzy logic in economics and management; candidate and doctoral dissertations on related topics; reports and presentations at scientific conferences on issues of regional development and management; databases and information systems containing statistical and analytical information on regions, providing a comprehensive and multifaceted study that allows substantiating methodological approaches and demonstrating the practical applicability of the developed integrated system for assessing the quality of management.

Conformity of the dissertation to the Passport of the scientific specialty. The research in the dissertation was carried out in accordance with the areas corresponding to the Passport of the specialty of the Higher Attestation Commission - 5.2.3 "Regional and Sectoral Economy" in the following areas: 1.3. Regional economic development and its factors. Problems of balanced regional development. Balance of regional socio-economic complexes; 1.6. Monitoring of socio-economic development of regions. Regional economic dynamics; 1.7. Factors of sustainability of regional economic systems; 1.15. Evaluation of the effectiveness of regional economic policy in the Russian Federation, federal districts, constituent entities of the federation and municipalities.

The working hypothesis of the study is that traditional assessment methods that do not fully take into account the uncertainty and complexity of the relationship between various factors cannot provide an adequate assessment of the quality of management. The use of a comprehensive assessment system for the quality of regional development management based on fuzzy logic will significantly improve the quality of management decisions in the field of regional management by formalizing uncertainty factors and calculating their impact on socio-economic development

processes.

Thesis to be defended:

1. Existing definitions often consider a region as a set of individual economic, social, institutional, political and geographical characteristics without taking into account their interaction and mutual influence, which leads to a fragmented understanding and simplification of its nature. The lack of emphasis on emergence ignores the synergy effect, when the interaction of various elements of a region leads to the emergence of new qualities and characteristics that cannot be explained only by analyzing these elements in isolation. According to the author, taking into account emergence allows us to consider a region as an integral system in which the interaction of economic, social, environmental and institutional factors leads to the emergence of new, unique qualities and contributes to a deeper and more complete justification of the essence of the region.

2. A region has many factors, such as environmental sustainability, natural resource potential, human capital and social and economic conditions, which interact with each other and directly influence each other. To achieve a sustainable level of development, a management system is needed that can take into account these complex relationships and ensure their systematization. An integrated approach will allow for the effective formulation of strategic goals, identification of priority tasks, establishment of evaluation criteria and performance indicators, as well as monitoring and adjustment in the process of implementing management functions.

3. Modern approaches used in regional management practice often do not take into account the interests and needs of various stakeholders in the sustainable socio-economic development of the region, which leads to insufficient efficiency in management and irrational use of resources. The absence of a system focused on regular and comprehensive measurement of the results of management decisions makes it difficult to assess the impact of events on regional development and complicates the adoption of informed strategic decisions. As a result, many programs and projects may remain underestimated or unclaimed, despite their potential significance for the region. Insufficient integration of opinions and needs of various population groups can also

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lead to a decrease in the level of public trust in management decisions and their perception, which, in turn, negatively affects social cohesion and stability, being a critical factor for long-term sustainable development. The lack of adequate methods and tools for monitoring and analyzing the quality of management actions creates additional risks for the region, since management decisions are made without sufficient information on their real impact on socio-economic development.

4. The methods used today to assess the quality of regional management do not provide a mechanism for assessing subjective factors; there is no system for formalizing and accounting for them, which hinders a full-fledged analysis and assessment of the effectiveness and quality of management based on a program-targeted approach, reducing the objectivity and reliability of conclusions about the degree of implementation of strategies and programs. As a result, the assessment of the quality of management is based on insufficiently accurate data, which reduces its effectiveness and reduces the potential for achieving the set goals.

5. Insufficient clarity in defining such key aspects as public satisfaction, management effectiveness, transparency and openness, innovation and development, as well as the level of public involvement, complicates the systematic analysis and assessment of the real impact of management practices on the socio-economic development of regions, which limits the possibility of comparing different regions and objectively measuring their success in achieving strategic development goals. Moreover, the lack of clearly formulated criteria complicates not only the assessment of the current state, but also the planning of future management actions and resources aimed at improving the quality of management in the regions.

6. In the "new Russian territories" there is a lack of formalized systematic assessment of the quality of management, which complicates the effective management of the socio-economic development of the regions, but their conditions are in many ways similar to Russian regions. Adaptation of management experience and quality assessment to new territorial conditions, based on the idea of management aimed at achieving long-term sustainability and increasing competitiveness, will allow taking into account the specific features of the new Russian regions and their basic needs.

The scientific novelty of the dissertation research is manifested in the development and implementation of a system for comprehensive assessment of the quality of regional development management based on fuzzy logic.

The main elements of scientific novelty are reflected in the results of the dissertation research, namely:

1. The concept of «region» has been substantially expanded from the standpoint of the emergent nature of internal and external relationships, manifested in the synergetic effect of the interaction of territorial-geographical, natural-ecological, socio-economic and cultural-historical factors, which leads to the emergence of new unique qualities and contributes to a more complete disclosure of its essence (clause 1.3 of the passport of scientific specialty 5.2.3 Regional and Sectoral Economy).

2. A scheme for achieving sustainable socio-economic development of the region has been developed, including a comprehensive accounting of human capital, environmental, natural resource, social and economic factors, differing from existing ones in the use of an iterative approach, which allows for the creation of a scientifically sound model for managing regional development through a system of testing, cyclical operations, and feedback in order to obtain a positive result. This allows for changes to be made to strategic planning documents in real time based on incoming data (clause 1.7 of the passport of scientific specialty 5.2.3 Regional and Sectoral Economy).

3. A system for a comprehensive assessment of the quality of regional governance based on the principles of client-centricity has been developed. It differs from those currently used by the presence of key domains ("Public Satisfaction", "Managerial Efficiency", "Transparency and Openness", "Innovation and Development", "Public Involvement") structured by detailed subcategories, according to which indicators and metrics of the socio-economic development of the region have been developed, which provide an objective basis for assessing the quality of regional governance. The system is based on the methods of expert assessments and fuzzy logic and includes tools for statistical data analysis, modeling and forecasting for calculating, analyzing and interpreting indicators used for systematic assessment and monitoring of the level of regional development. (clause 1.15 of the passport of scientific specialty

5.2.3 Regional and Sectoral Economics).

4. An algorithm has been developed for using fuzzy logic operations for a generalized assessment of the quality of regional governance, the main stages of which are the collection and processing of information; development of a model for assessing the quality of regional governance; empirical research and application of the model; sensitivity analysis (definition of the indicators that have the greatest impact on the overall assessment of the quality of management); forecasting based on the use of fuzzy logic methods to assess possible scenarios for the future development of the region under the influence of changes in the management doctrine; validation of the results and analysis of the accuracy of the model, a distinctive feature of which is the ability to take into account uncertainties and subjective factors affecting management processes, which is very important for more accurate and adaptive modeling of complex relationships between various indicators of the socio-economic development of the region and increasing the objectivity and reliability of assessments (clause 1.6 of the passport of the scientific specialty 5.2.3 Regional and Sectoral Economics).

5. An original author's methodology for assessing the quality of regional management is presented, including groups of indicators and criteria taking into account the principles of client-centricity, as well as public satisfaction, management efficiency, transparency and openness, innovation and development, public involvement. Each of these groups is a comprehensive set of key aspects subject to systematic study and assessment. The proposed criteria and indicators are the basis for applying a universal methodology aimed at objectively assessing and comparing the effectiveness of management strategies and their impact on various aspects of life and development of a region (clause 1.15 of the passport of scientific specialty 5.2.3 Regional and Sectoral Economics).

6. An algorithm has been developed for adapting a comprehensive system for assessing the quality of regional management to the institutional conditions of the socio-economic development of new Russian territories, including the following stages: identification of the main functions of public administration of the socio-economic development of the territory with the definition of key domains and

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corresponding indicators and metrics taking into account the specifics of socio-economic development; preparation of adapted indicators, development of a methodology taking into account the specifics of regional development; testing and approbation; implementation and monitoring; feedback and correction. Their consistent implementation will allow for modification of the main evaluation indicators and methodological approaches within the framework of the author's methodology for assessing the effectiveness of regional management, taking into account the specifics of Russian regions, their capabilities and problems (clause 1.15 of the passport of scientific specialty 5.2.3 Regional and sectoral economics).

Theoretical and practical significance of the study. From a theoretical point of view, the study expands the methodological boundaries in the field of management, integrating fuzzy logic to analyze multi-criteria aspects of regional development management. Theoretical materials and practical developments of the dissertation research can be used by regional authorities as the main tool in assessing the quality of regional management, as well as in the educational process.

From a practical point of view, the study offers specific tools and methods for management practice in the regions. The developed system of comprehensive assessment of the quality of management allows state and municipal authorities to better understand the effectiveness of their actions, identify weaknesses in management and make informed decisions to improve development strategies, which is especially important in the context of today's dynamic economic and social environment, where the need for a prompt response to changes and adaptation to new challenges is becoming a key task for ensuring sustainable development of regions.

Validation of the research results. The research results and main scientific provisions were presented at international, all-Russian and regional conferences, in particular, at the All-Russian scientific and practical conference of young scientists «Digital consciousness and artificial intelligence: transformation of approaches to management decisions in the AI-NATIVE era» (Rostov-on-Don, February 20-21, 2025); IV International scientific and practical conference «Strategies for the development of society and economy in the new reality» (Rostov-on-Don, October 20-

21, 2022); III International scientific and practical conference «Modern strategies for sustainable development of the state and society in the context of global challenges» (Rostov-on-Don, October 21, 2021); XV International scientific and practical conference «Digital transformations in the development of the economy and society» (Lipetsk, April 21, 2021); V International Scientific and Practical Conference «Ways to Improve the Efficiency of Management Activities of Public Authorities in the Context of Socio-Economic Development of Territories» (Donetsk, June 3-4, 2021), etc.

Some of the main results of theoretical research and practical developments were published in 41 printed works, the volume of the author's text of which was 11.4 pp.

The structure of the dissertation corresponds to the logic of the research and contains an introduction, three chapters, a conclusion, a list of references, and appendices.