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Management and Modeling Technologies of Sustainable Development of Russian Regions

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Abstract*: The aim of the article is to develop approaches to the management and modeling of sustainable development of the regions of the Russian Federation. Analysis of the approaches used in the theoretical studies and practice of management and modeling of sustainable development of the Russian Federation regions has shown that it is most advisable to develop a comprehensive methodology, which includes a comparison (analogy) method as well as normative, balance, and modeling methods. The cascading method was employed to determine the element-by-element potentials of sustainable development of regions for further perspective. The proposed set of sustainable development indicators of territories allowed assessing the degree of achievement of strategic goals, as well as served the basis for planning and adjusting activities in those areas, which required special development. The calculated sustainable development indicators made it possible to reflect the cause-and-effect relationship between the goals at all management levels. It is proved that sustainable development indicators and indices should be consistent with each other and available for decision-making at all levels, i.e. global, national, regional, and local. In this context, methodological approaches to modeling allowed bringing strategic goals and indicators at all management levels in line with each other, and building a set of regional indicators.

***Index Terms*: management, modeling, strategy, region, policy, sustainable development, efficiency, indicator.**

I. INTRODUCTION

Currently, the state policy of regional development of the Russian Federation is aimed at ensuring sustainable socio-economic development of the Russian Federation entities. In many regions, attempts are being made to integrate environmental and social aspects into the strategic management system. Sustainable development of the Arctic zone of the Russian Federation is the main priority of the state policy of regional development due to the specific geopolitical and geo-economic characteristics of the region.

The concept of future sustainable development for the period up to 2030 is reflected in detail in the UN resolution of September 25, 2015. According to this document, sustainable development is based on the green economy, which is complex in nature, involving among other things increase in energy efficiency, for example, through the implementation of renewable energy sources. According to the UN resolution, the goals and objectives of the global sustainable development are complex and indivisible, being global in nature and universally applicable. The 17 goals among 169 targets of sustainable development highlight the scale and relevance of this new agenda, which foresees the continuation of work already underway towards protecting and restoring terrestrial ecosystems, ensuring the rational use of water resources, providing universal access to reliable and modern energy sources, promoting sustainable infrastructure, industrialization, and innovation.

II. LITERATURE REVIEW

The study of issues related to the development of the Russian Federation regions was reflected in the works of E.A. Bondarev [1], Yu.E. Danik [2], A.G. Osipov [3], I.B. Petrov [4], V.A. Skripnichenko [5], V.S. Timchenko [6], and others. Literature review on the concerned research topic allows identifying contradictions that prove the need to justify the management and modeling of sustainable development of regions, especially the regions of the Arctic zone of the Russian Federation. Scientists note that the development of the Arctic zone of the Russian Federation is of particular interest both domestically and abroad [7-9]. This is a huge area, where environmental management needs particularly careful planning and even modeling. To this end, project offices have been created in Russia, which represent an original form of project work on various topics. In particular, the Project Office for Arctic Development has been operating in Russia for several years on an initiative basis. There are statutory documents regulating the work of project offices in the country. Modeling of the project office operation to develop possible scenarios of environmental management in the Arctic zone of the Russian Federation was applied in youth practice for the first time. The teams of six Russian universities worked on a triple task.

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They carried out a strategic analysis of the territory development (the selected region of the Arctic zone of the Russian Federation); formulated regional aspects of indicators reflecting sustainable development goals; adapted the roadmaps of the national technology initiative.

The work technology was based on the participation of students of different training areas from the involved universities in the model.

Within the team, several working groups (2-3 people) most close in terms of their professional focus to the certain research area were selected. The study was carried out in several stages: conducting an inventory of the existing situation in each of the areas (three vectors of the task); selecting the existing best possible practices to implement in the regions; adapting roadmaps into the economic activities of the Arctic regions of Russia. Also, the entrance and final testing of experts and participants were carried out separately.

III. METHODS

A. General description

Analysis of the approaches used in the theoretical studies and practice of management and modeling of sustainable development of the Russian Federation regions has shown that it is most advisable to develop a comprehensive methodology, which includes a comparison (analogy) method as well as normative, balance, and modeling methods. The cascading method was employed to determine the element-by-element potentials of sustainable development of regions for further perspective.

The comparison method is based on the determination of the natural resources utilization efficiency depending on their purpose in the base region. In the balance method, the effectiveness of sustainable development of the region is assessed based on the importance of regional natural resources and the structure of the regional environmental balance, as well as survey data. The information base of the article includes the statistical data of state bodies, legislative and statutory documents regulating the sustainable development of the Russian Federation regions [10-12].

B. Algorithm

In the course of the study, it is planned to systematize management and modeling aspects of sustainable development of the Russian Federation regions, to develop measures aimed at coordinating activities among the main entities of the regions that ensure regional development, and to justify the provision on the rational use of economic potential in the Arctic zone.

C. Process flow diagram

It is planned to carry out study according to the following scheme, in which the management and modeling of sustainable development of the Russian Federation regions are considered as a dynamic process arising from a set of factors of the economic environment (Fig. 1).

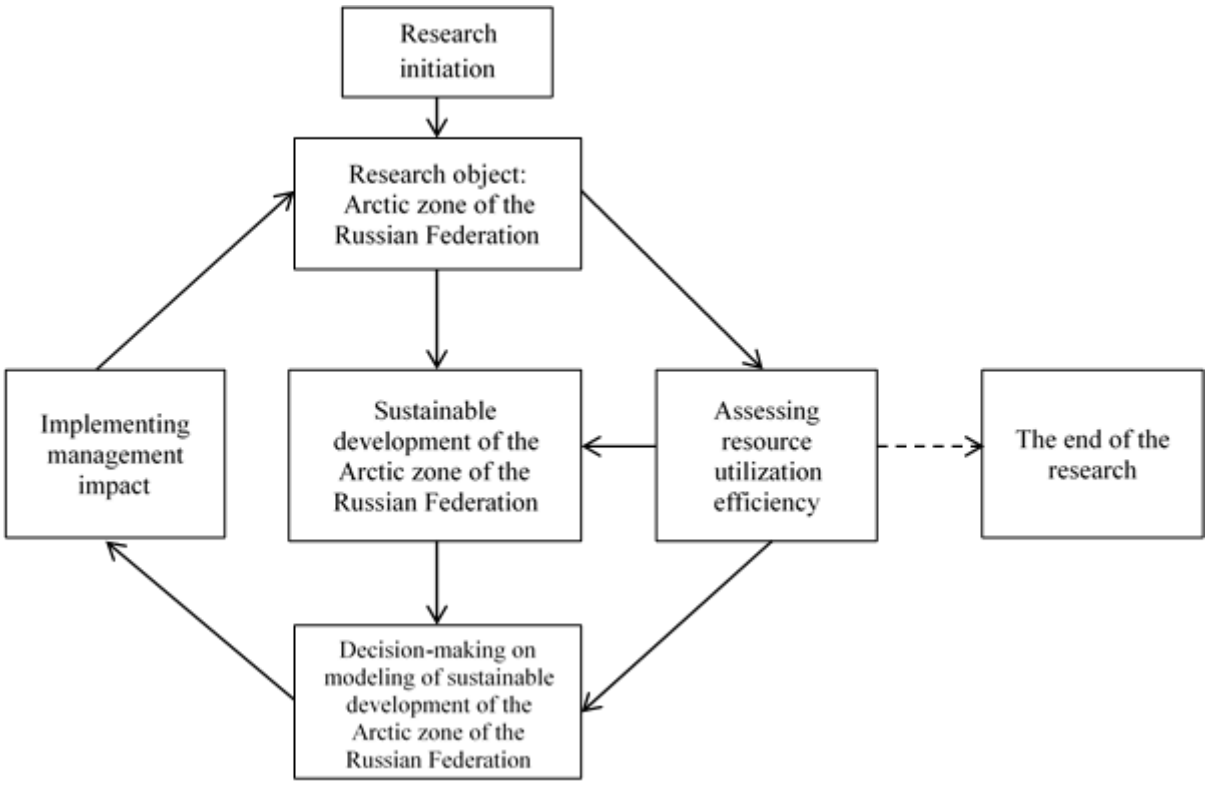

Fig. 1: Flow diagram reflecting research on management system and sustainable development modeling of the regions

IV. RESULTS AND DISCUSSION

The achievement of the sustainable development goal is understood as the creation of a global partnership. At the same time, sustainable development goals can be considered as an additional tool to international conventions, international law, and treaties, encouraging the interaction of countries and mobilizing stakeholders for action.

In this aspect, the UN has identified six mandatory elements for the successful achievement of sustainable development goals:

– People. Creating conditions for a healthy life, education, and involvement of women and children.

– Decent life. Eradicating poverty and combating inequality.

– Prosperity. Building a strong, inclusive, and transparent economy.

– Planet. Preserving ecosystems to the benefit of all societies and our children.

– Partnership. Encouraging global solidarity for sustainable development.

– Justice. Promoting safe and peaceful human coexistence and building strong institutions.

At the same time, addressing global challenges to achieve sustainable development of the regions should be based on the strategy. The principal line of such strategies is taking into account the fact that for future generations the main priorities should be indicators of human dignity and social value, i.e. indicators of intellectual and spiritual perfection, rather than the possession of wealth and overuse of material goods. All this will require changes in political systems, international relations, and machinery of states.

Therefore, the region's sustainability can be characterized by a system of indicators, because any region within the state under consideration is a natural and socio-economic system. The sustainability of the region's development should be considered as a certain dependence of the final indicator on the economic, social, and environmental sustainability of the region. In this case, for all sustainability indicators, there is a single vector of optimal orientation towards the state of absolute stability.

When choosing the method of aggregated indicators, a problem arises, which is characterized by the difficulty of determining the weights of the initial indicators without losing their significance. The increase in the level of aggregation of information leads to the subjective importance of indicators and the complexity of weighing values. Nevertheless, methods for determining integrated indicators are actively used to define the success of economic development and well-being, regardless of the complexity of the calculations.

In consequence of the study it has been revealed that the environment and the economy in the real world are integrated, while in practice, economic decisions are made without special attention to natural resources and other environmental constraints. Despite the fact that the issues of sustainable development are constantly in the focus of the UN, which promotes comprehensive proposals to achieve sustainable development, the sustainable development principles proclaimed by the UN are supported neither by theoretical and scientific grounds, nor complemented by technologies, scientific methods, and systems.

The practical solution to the implementation of the sustainable development strategy lies through science. In order to move comprehensively to sustainable development in the system of ecology-society-economy, it is necessary to thoroughly study, understand, and describe all the links among different natural structures, social institutions, and structures of human activity. Therefore, achieving the status of sustainable development is possible by developing a scientific method based on the general laws in the system of nature-society-man, linking together natural, social, and spiritual processes.

The study revealed a large number of indicators and methods for determining integrated indices. Using all the indicators at once will not allow achieving the desired result. Therefore, the authors propose to use the balanced scorecard as a mechanism that will streamline the set of existing indicators and bring the system in line with the goals and strategy of sustainable development of the Arctic zone of the Russian Federation. Such a system is one of the most effective tools of the development strategy to achieve the goals.

However, even such an effective system must be adapted to the conditions in which it is intended to be used. A balanced scorecard is an effective tool, which will allow selecting and organizing indicators based on the cause-and-effect relationships of internal processes of any economic system of any scale.

At the same time, a complex model of cause-and-effect relationships can be built using the cascading method, which allows harmonizing the lower-level indicators system with the high-level indicators one based on the definition of strategic objectives and indicators. The cascading method is based on the principle of harmonizing the goals at all levels of economic systems and the successful implementation of sustainable development strategy.

At that, analyzing the dynamics of sustainable development indicators of various economic systems, it is possible to identify problem areas and opportunities for the development of certain territories, timely prevent the occurrence of risk situations, and develop strategies for change management. Therefore, in the present study, the balanced scorecard, which is adapted to regional peculiarities, serves a tool to form indicators for assessing the sustainable development of territories for each of the four projections: financial, internal and external market, infrastructure and innovation, as well as development and modernization.

Depending on the changes in the indicators in the system, it will be possible to assess the development trends of territories and identify factors that contribute to or hinder sustainable development. To identify development trends of different territories and factors affecting or hindering sustainable development, one should analyze the dynamic pattern in the selected indicators for the four projections as is presented on the example of the Arkhangelsk, Murmansk, and Vologda regions in 2014-2018. As can be seen from Table 1, the Arkhangelsk and Murmansk regions are similar in terms of GDP per capita, and this figure tends to increase in all three regions.

Table 1. The dynamic pattern in the development of individual territories based on selected indicators

Territory	2014	2015	2016	2017	2018
Financial component					
The index of labor productivity, %					
Arkhangelsk region	101.9	101.1	101.8	102.6	103.8
Vologda region	106.2	104.3	96.5	103.7	101.2
Murmansk region	101.3	101.0	101.6	103.5	103.7
GDP per capita, thousand rubles/year					
Arkhangelsk region	360.1	391.0	417.7	456.9	523.5
Vologda region	269.1	296.6	289.6	324.6	394.1
Murmansk region	333.4	361.9	395.1	427.0	510.7
Amount of investment per capita, thousand rubles/year					
Arkhangelsk region	110.4	134.4	131.2	132.7	146.0
Vologda region	95.7	126.0	63.0	66.7	73.1
Murmansk region	70.6	92.3	90.8	111.5	131.3
Internal and external market					
Environmental protection costs, % of regional GDP					
Arkhangelsk region	1.84	1.71	1.36	1.46	1.28
Vologda region	0.31	0.37	0.49	0.38	0.40
Murmansk region	1.24	2.50	2.16	1.93	1.35
Russia	0.79	0.69	0.69	0.69	0.69
The proportion of imports in the turnover of the region, %					
Arkhangelsk region	3.8	8.6	10.3	8.0	5.7
Vologda region	13.5	12.2	13.1	15.3	16.7
Murmansk region	16.7	26.3	25.1	16.3	14.1
The proportion of exports in the turnover of the region, %					
Arkhangelsk region	96.1	91.3	89.6	91.9	94.2
Vologda region	86.4	87.7	86.8	84.6	83.2
Murmansk region	83.1	73.5	75.1	83.5	85.7
Infrastructure and innovation					
Fee for permissible and excess emissions (discharges) of pollutants, % of regional GDP					
Arkhangelsk region	0.08	0.08	0.06	0.10	0.05
Vologda region	0.04	0.04	0.03	0.03	0.03
Murmansk region	0.18	0.17	0.21	0.18	0.12
Number of innovation infrastructure objects and subjects, %					
Arkhangelsk region	9.2	8.1	5.3	5.1	5.7
Vologda region	9.2	7.2	7.7	5.5	5.4
Murmansk region	8.4	9.1	13.4	10.1	9.3
The proportion of the employed population in mid-year population, %					
Arkhangelsk region	49.5	50.1	50.2	50.1	50.2
Vologda region	49.1	48.5	48.1	48.1	48.2
Murmansk region	53.6	54.1	54.1	53.3	52.4
Unemployment rate, %					
Arkhangelsk region	5.8	5.3	6.0	7.1	6.7
Vologda region	7.2	5.7	6.0	5.5	6.7
Murmansk region	8.5	7.6	7.1	6.6	7.7

The highest investment activity is in the Arkhangelsk Region. In the Murmansk and Vologda regions, despite the decline in per capita investment in 2016, there was growth in 2017 and 2018. Environmental costs account for a small share of regional costs. The lowest rate is in the Vologda Region (0.31-0.49%), in the Arkhangelsk region it amounts to 1.28-1.84%, while in the Murmansk region – to 1.24-2.50%.

V. CONCLUSION

Summing up, it can be noted that the proposed set of indicators characterizing sustainable development of territories will allow assessing the degree of achievement of strategic goals, as well as can be a basis for planning and adjusting activities in those areas which require special development in this field. The calculated sustainable development indicators will allow reflecting the cause-and-effect relationship between the objectives at all levels of management.

It should be noted that sustainable development indicators and indices must be consistent with each other and available for decision-making at all levels, namely, global, national, regional, and local. In this context, methodological approaches to cascading will allow bringing strategic goals and indicators at all levels of management in line with each other, and building a set of regional indicators which will be used to monitor the contribution of all participants to the achievement of the common goal of sustainable development.

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