Strategic digital model for sustainable spatial regional development

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Abstract. The key task of model development is to improve the modern paradigm of sustainable development. The main factors for improving the efficiency of the model include the spatial nature of the development of the territories, their regional dimension and the emergence of digitization. The article revealed that strategic forecasting is the base of managing the model of sustainable spatial regional development. In the era of digital technology, strategic forecasting forms the environment for managing the development of the region based on land resources and environmental principles. The social pressure of modern society brought environmental issues, rational nature management and the effectiveness of regional management decisions for long-term planning to the top of the agenda. The authors proposed a strategy for the sustainable development of the region, recommended regional programs as a combination of economic, social and environmental problems of the region’s development.

1. Introduction
At the moment, we can achieve new social challenges of a temporary nature such as a viral pandemic, and permanent nature as digitalization of society, the prospects for sustainable socio-economic development, the necessary quality of life and health only through the design and implementation of a creative multifactorial model that includes a scientifically-based environmental agenda specific to the region. All these factors increase social tension in many regions of Russia, which in turn strengthens the importance of effective management of natural resources, environmental protection and rational land use.

Our study proved the low efficiency of state policy in the field of territorial and sustainable development. It requires an integrated project approach to address the spatial development of the region: land use, organization and environmental management economies, an effective environmental strategy [1–3]. The anthropogenic nature of the impact on the processes of reproduction of natural resources and the state of the environment needs the non-standard way of solving environmental problems [4, 5]. The actual and unexpected nature of the phenomena determined the topics of our developments.

The purpose of the study was to develop recommendations for the formation of a flexible digital model of sustainable spatial regional development. We have identified the basic scientific tasks: to
justify the important role of the model of sustainable spatial development as a unifying tool for solving economic, social and environmental problems of territorial development; to determine the role of the ecological subsystem in the structure of the socio-economic development programs of the region; to justify the scientific basis of choosing a spatial development project, and its strategic directions in the region guaranteeing a tendency to improve the quality of human life, the ecological environment considering the rationalization of nature and land use.

2. Materials and methods

Strategic planning is one of the most essential tools for managing the region’s sustainable development and forecasting its condition. In the context of the development of the digital economy, the strategic planning process provides the basis for managing the region as a whole and its areas, including the environment.

The authors studied this process using a variety of methodological tools, including calculation and analytical method, economic and statistical method and others [6–8]. They have focused on a systematic approach while developing an effective strategic model for sustainable spatial regional development.

This model gives the opportunity to lay down such parameters and characteristics of the quality and level of human life support and will consider environmental, biological, and socio-economic norms. The current extraordinary challenge to the global economy, Russia and its regions is the coronavirus pandemic. In responding to such challenges, we need to foresee and model, for example, new health and epidemiological standards, the consequences of possible local and global technological disasters.

Unfortunately, at this stage, regional economic development programs poorly consider these factors, especially environmental problems [9, 10]. We should use synthetic algorithms, multifactorial analysis of the various relationships that arise in the design of spatial development projects.

We have already proposed a mechanism for a program-targeted approach to solving environmental problems in the territory of one or another region of Russia.

There are three main areas of regional programming: spatial-production, socio-economic and resource-ecological. These areas require the following tasks: the formation of regional programs for the creation of industrial, agricultural, transport and other complexes; programming of various forms of production or social infrastructure; economic incentives for individual regions and types of economic activity to create favourable conditions for the location of production; carrying out comprehensive measures to streamline the concentration of production and the population, including environmental programs.

3. Results and Discussion

Currently, the lack of an integrated approach to nature management and environmental protection is a weak link in regional economic development programs [11, 12]. Strategic planning is an essential management function at various levels, including regional. The spatial development project is based on the choice of development objectives of the territory and ways to achieve them. Its most important component is the rational use of natural resources and environmental protection measures that ensure the sustainable character to this project. We suggest that one of the most important functions in state strategic planning and governance of Russia should be a multifactorial model that considers the country's socio-economic development and regional policy priorities, as well as proposing a set of specific actions to achieve its goals.

We understand the digital economy as automated management based on information technology. We believe that the current model of sustainable spatial development should be designed precisely through the implementation of the latest developments in telecommunications and computer technology. More specifically, this will require the use of artificial intelligence to construct a very multifactorial model. The factors should include all relevant and available data: characteristics of the land and natural resources of the region, human potential, both numerical, intellectual and ethnic, current socio-economic development of the region in all aspects, as well as prospects for road
transport and industrial policy, considering the key factor of our time: sustainability, environmental safety. With the designed model and multivariate solutions to the goals and objectives set, managerial personnel will develop not only quickly, but also highly adaptively a project for the spatial development of the region. The automated process will make it possible not only to realize scientific and technological progress but also to calculate the necessary investment volumes and to ensure the transparency and efficiency of their investments, to monitor the use of financial resources and the environment permanently. In our opinion, today one of the problems of the state is that the digital economy is just a kind of virtual environment for storing and exchanging information resources, while information technology and artificial intelligence can already really design and manage economic processes.

To ensure the sustainability of spatial development models, we offer the following key activities:

- consideration of environmental standards when placing production facilities and concentration of production in specific areas of the region;
- introduction and use of environmentally oriented technologies;
- monitoring and identification of environmentally hazardous facilities and parts of the region affected by technogenic pollution;
- prediction of possible environmental pollution (land and water resources, air) over the established limits;
- introduction of a mechanism for assessing the state of the environment through calculating the amount of economic damage from air and water pollution in this region;
- consideration of possible environmental consequences of the functioning and development in the region of the most environmentally significant sector of the economy and various types of economic activity;
- selection of the composition of production and the scale of their development within individual parts of the region, considering environmental requirements;
- introduction of a specific set of legal, economic, organizational and other measures necessary for the implementation of the environmental strategy of the Russian region.

The main directions of the formation of a mechanism for implementing regional environmental protection programs in the context of the development of the digital economy at both the national and regional levels should, in our opinion, include the following measures:

- developing an economic mechanism to stimulate rational environmental management and environmental protection, stimulating and supporting environmentally responsible business and rational land use. Restoration of economic regulators in the environmental sphere, primarily the regulation and improvement of the system of environmental payments, the introduction of rental payments for the use of natural resources;
- strengthening environmental authorities, expanding the capabilities and powers of regional authorities and local authorities in the field of environmental protection and rational use of natural resources. Optimization of the environmental management quality management system aimed primarily at minimizing air and water pollution;
- increasing environmental protection costs from all possible sources of financing (primarily costing own funds of enterprises and organizations);
- regulating and improving the system of environmental payments;
- improving the legal framework, creating a legal framework that is adequate to the current economic and environmental situation in the country;
- restoring the obligation of state environmental review of new construction projects as virtually the only legitimate tool for enterprises to demonstrate their environmental viability to society;
- forming a system for informing the public about the state of the environment;
- developing a system of specially protected natural territories;
- ecological upbringing and educating the population, increasing the level of environmental awareness and environmental culture as the basis of the ecological well-being of Russia.
4. Conclusion
The authors justified the choice of a model of sustainable spatial development as one of the most effective means of linking the economic, social and environmental goals of the development of the region and revealed the place of the ecological subsystem in the structure of programs for the socio-economic development of the territory. They proposed the main methodological and procedural foundations for the formation of an environmental protection strategy in the region, including determining the ecological mission of the region and its ecological image of the future, setting priority goals and objectives and choosing possible ways to solve them, detailing tasks in specific projects and programs, developing a mechanism for their implementation, analysis and evaluation of the results and consequences of the implementation of programs. In the context of the development of the digital economy, such programs are based on the program-targeted approach to comprehensively cover the main problems of the development of the territorial production system, realize the ideas of sustainable development of the region, which provides the balance of the economic and social development of the region with environmental capabilities and, as a prerequisite, ensure the environmental safety of the development of the relevant territory.

The study identified a range of problems associated with the implementation of regional environmental programs. It substantiates the choice of strategic directions for the sustainable development of the region, ensuring the formation of a real trend of gradual improvement of the environmental situation. There is also a justification for recommendations on improving the management mechanism of the regional environmental and economic system. The authors proposed specific ways to prepare projects for sustainable spatial development and their subsequent management based on innovative technologies with environmental safety of the development of the national economy.

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