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Methodology for designing and implementing spatial innovations in the system of multi-level economic development management

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ABSTRACT

Objective. To innovate processes associated with the formation, development, use and evaluation of spatial resources. **Methodology.** Works are analyzed scholars examining the concepts of “space,” “spatial resource,” “spatial potential,” and “spatial innovation”; textbooks

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and articles characterizing past and present processes of rational use of space at the meso- and micro-levels (including those based on logistics systems); regulatory documents governing the activities of self-regulatory organizations. **Results.** Existing theoretical approaches to innovation types based on different types of resources have been systematized and expanded. Resource management functions have been specified as they apply to spatial resources. Principles for diagnosing the innovative component of spatial potential at the meso- and micro-levels have been developed. A spatial innovation management toolkit aimed at achieving a synergistic effect has been developed. A set of performance indicators for the socio-economic effectiveness of micro-level spatial innovations has been formulated. **Conclusions.** The scientific novelty of the work lies in the theoretical justification and methodological support for the processes of identification, design, and subsequent implementation of spatial innovations aimed at the efficient use of spatial resources in all dimensions and at all levels of management (macro-, meso-, micro-level).

KEY WORDS: Spatial resources, Spatial potential, Spatial innovation, Resource management, Logistics systems, Innovation diagnostics.

Introduction

The current stage of Ukrainian economic development is associated with the optimization of resource potential. The existing structure of resource provision for innovation processes at all levels of economic activity requires change and development. The economic mentality of socialist economic management, which developed during the 20th century, was largely linked to the peculiarities of the geopolitical situation, the system of economic entity distribution, the virtual free availability of land and energy resources, and a lack of understanding of the limitations of space at both the geographic and economic levels.

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A quarter of a century of market economy development has gradually shaped the conscious need for all economic entities (from territorial market entities (regions and municipalities) to micro-level economic entities (enterprises and organizations of all types and sizes)) to take concrete steps to improve their competitive status by rationalizing the structure of resource use. In the context of limited material resources and the fee-based nature of their use in innovation processes, which form the basis of the anti-crisis development of the economy, the attraction and/or optimization of resources, the limited nature of which was previously never questioned, is intensifying. This type of resource includes intellectual, institutional, temporal, and spatial resources.

Algorithms for implementing various types of innovations to develop and rationally utilize the comprehensive resource potential of countries, regions, and companies are developed ad hoc and are not assessed against the backdrop of the need for innovation at various scales and levels. One area of focus is the development of innovative approaches to assessing and utilizing space as a resource for economic development at the macro, meso, and micro levels. Therefore, the theoretical justification and systemic analysis of spatial innovations as methods for rationally utilizing spatial resources to achieve socioeconomic benefits at various levels are a relevant research topic aimed at solving specific national economic challenges. Partially, the issues of assessing the efficiency of using spatial resources and their impact on the innovative development of economic entities at different levels are addressed in the works: Dumitriu, D., Militaru, G., Deselnicu, D. C., Niculescu, A., & Popescu, M. A.-M., 2019), (Jung, S.-U., & Shegai, V., 2023), (Biloshkurska, N., Harnyk, O., Biloshkurskyi, M., Liannoi, M., Kudrina, O., & Omelyanenko, V., 2019), (Danyliuk, M., Babenko, V., Krykhivska, N., & Oryshchyn, T., 2019), (Esmanov, O. M., Shtyka, Yu. M., & Linnyk, M. A., 2024).

The concept of spatial distribution of economic entities and infrastructure is considered in the works of such authors as: (Gutiérrez, M. M., Páez, J. J. P., & Gutiérrez Bonilla, F. d. P. , 2024), (Witek-Hajduk, M. K., & Zaborek, P., 2022), (Cioppi, M., Curina, I., Francioni, B., & Savelli, E., 2023), (Vărzaru, A. A., & Vărzaru, R., 2024).

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However, the process of identifying, designing, and subsequently implementing spatial innovations as an effective way of using spatial resources in all dimensions and at all levels of management (macro, meso, micro) requires theoretical justification and methodological support.

The **aim** of the study is to develop tools for identifying, substantiating, implementing and assessing the socio-economic efficiency of innovations created on the basis of rational use of spatial resources by different types of economic entities.

The **object** of the study is innovative processes associated with the formation, development, use and evaluation of spatial resources.

The **subject** of the research is the organizational and managerial relations arising during innovative processes to optimize the use of spatial resources at the macro-, meso- and micro-levels.

Methodology

The theoretical and methodological basis of this work includes the works of scholars examining the concepts of "space," "spatial resource," "spatial potential," and "spatial innovation"; textbooks and articles describing past and present processes of rational use of space at the meso- and micro-levels (including those based on logistics systems); and regulatory documents governing the activities of self-regulatory organizations. The author utilized the following general scientific research methods: scientific approbation, a systems approach, comparative analysis, economic-statistical methods, graphical and tabular methods of presenting information, and others.

Results and discussion

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An analysis of the scientific literature revealed that, in the genesis of the concept of "space" and throughout its research, no common understanding of the term has emerged. This category has primarily been considered from philosophical, mathematical, and geographical perspectives. In this regard, various perspectives on the concept of "space" have been systematized (Table 1).

Table 1: Existing points of view regarding the concept of “space”

APPROACH	POINT OF VIEW
Philosophical	A system of connections and relationships formed through the interaction of coexisting states of the material world (length, width, height, mutual arrangement of objects).
Physico-philosophical	A set of objects between which relationships are established that are structurally similar to ordinary spatial relations.
Mathematical	A logically conceivable form (or structure) that serves as a medium where other forms and constructions are carried out.
Geographical	Space is based on factors such as three-dimensionality, order, arrangement, structure, extent, measurability, and others.
Economic	Space reflects various types of relations, primarily concerning at the macro- and meso-levels the development of a territory in all dimensions, and at the micro-level the relations between economic entities in a market economy, which, as in mathematics, are similar in formal properties to ordinary spatial relations.

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Based on the data in Table 1 and the fact that the term "space" is currently not used independently in various contexts, the author advances the thesis that space is multifaceted. A large number of abstract categories and concepts, including those used in economics, readily accept the expressions "solution space," "possibility space," and so on.

In modern conditions, "space" is very closely tied to the borders of a country or a specific municipality. Therefore, in this paper, the author distinguishes between the categories of "territory" and "space." For the purposes of this study, "territory" refers to an administrative unit (while being a spatial resource, territory is also a collection of many other resources), while "space" refers to a resource whose effective use of 3D volume makes it possible to generate fundamentally new sources of development.

This distinction is made because the nature of Ukrainian space clashes with established stereotypes enshrined in concepts such as "administrative-territorial division," "settlement pattern," "location of productive forces in the Gosplan sense," and "powers of government bodies." Furthermore, since one of the fundamental goals of the economy as a whole is to ensure a resource distribution that maximizes their marginal productivity, solving this problem requires taking spatial factors into account. Space can be a paid resource, in the case of land and the space above it, and can be a free resource when developing in 3D. In turn, the author understands space as a resource of volume within which specific economic activities are carried out by entities at various levels (Kovtun, O., Paniotto, V., Sakhno, Y., & Dumchev, K., 2024).

In their study, the authors emphasize that new approaches to the use of spatial resources can form the basis of spatial innovation. By spatial innovation, the authors define technologies for the use of spatial resources in all dimensions that create fundamentally new economic, social, or socioeconomic effects at the macro, meso, and micro levels of economic development.

Spatial innovations, in this case, can arise when the configuration of an economic entity in M-dimensional space changes. M-dimensional space, in turn, is a space that can be modified in a three-dimensional coordinate system, which involves expanding or contracting space in width, length, or height. Moreover, vertical expansion is possible not only upwards but also downwards

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(underground). Configuration changes are also possible when optimizing the use of existing space using new innovative technologies.

Thus, spatial innovations at the macro level will encompass the country as a whole; at the meso level, the object will be a region; at the micro level, a municipality or economic entity (Piccolo, R., Romeo, E. F., & Zarić, S., 2024).

In the study, the author also defines the concept of "spatial potential" as a promising economic effect that can be achieved by changing the approach to using a territory's spatial resources to better meet the socioeconomic needs of the population and economic entities.

The authors note that the role of efficient use of spatial resources is economically underestimated. Given Ukraine's innovative development, spatial innovations require due attention, as the rational implementation and use of innovations can improve a region's position at both the macro, meso, and micro levels of economic development.

Based on general management functions (planning, organizing, motivating, and controlling), the author identifies four areas of management activity related to the issue under consideration:

1. Planning and forecasting spatial resources;
2. Organizing the use of spatial resources;
3. Motivating and influencing factors;
4. Monitoring the use of spatial resources.

Thus, at the macro- and meso-levels, spatial resources are typically territories. The micro-level is more multifaceted, where, according to the author, management functions were established "historically" (Biemans, W., & others, 2024).

A business entity's management system involves the formation of the enterprise's organizational structure, the management process, the ergonomics of production and work execution, as well as other organizational management methods.

Spatial innovation management should be built on the interconnectedness of all stakeholders. In this regard, the author proposes a self-regulatory organization as a form of social contract

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for the development and rational use of spatial resources in macro- and micro-logistics systems, involving the following participants:

— Business entities;

— Ukrainian government bodies and local governments;

— Public organizations in Ukraine;

— Public self-government committees.

In this case, business entities and government bodies interact through public-private or public-private partnerships. Individual entities are included in the self-regulatory organization to achieve the best possible results, which were previously impossible. Thus, the self-regulatory organization is created precisely for the purpose of achieving a positive synergistic effect.

Spatial innovation at the micro level involves more than just territorial development within a municipality. Such a conglomeration, within the framework of the provisions, should be expressed in the creation of a complex at the municipal level, defined as an innovative spatial socio-economic complex.

With an increase in social impact, an economic effect will also occur, increasing revenues for meso- and micro-level budgets and, as a result, significantly improving the quality of life of the population and satisfying their social needs.

It is noted that in the formation and use of the presented innovative spatial socio-economic complex, differences in the level of socio-economic development of territories will only contribute to the achievement of socio-economic benefits for each of them individually and as a whole.

The scientific novelty of this work lies in its theoretical justification and methodological support for the processes of identifying, designing, and subsequently implementing spatial interventions aimed at the efficient use of spatial resources in all dimensions and at all levels of management (macro, meso, and micro). This is confirmed by the following findings:

1. The current approaches to the concepts of "space," "spatial resources," "spatial potential," and "spatial innovation" in economic and management literature have been systematized and expanded. The author defines spatial innovation as technologies for utilizing spatial resources

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in all dimensions, creating fundamentally new economic, social, or socioeconomic effects at the macro, meso, and micro levels of economic development. This allows for a reconsideration of existing approaches to the use of space as a measurable, limited economic resource.

2. The functions of resource management are specified in relation to spatial resources, which are formed as a specific innovative process, in which the management activities of economic entities consist of implementing innovative methods of planning, organization, motivation, and control at the meso and micro levels, with maximum reliance on spatial factors. The author's proposed approach to determining spatial resources of varying scale and vectors makes it possible to develop options for their use at the meso- and micro-levels to achieve additional socio-economic benefits.

3. A methodology for diagnosing the innovative component of spatial potential has been developed. At the meso-level, this methodology represents an analysis of the current state of urban development policy, allowing for the identification of five main blocks of spatial components, which, among other things, can be used to trace the basis of spatial innovation at the meso-level: changes in transport infrastructure (road construction), construction of an economically efficient large enterprise (the prospect of creating new jobs), the transition from centralized energy, water, and heat supply systems to local systems (reducing costs and increasing the reliability of engineering infrastructure), expansion of administrative boundaries (creation of additional conditions for population living and doing business), and the creation of a cluster on the territory (industrial, scientific, educational, and others). at the micro level - analysis of the macro-logistics and micro-logistics levels of economic entities, which, in contrast to municipal management methods, has a tendency towards logistics induction (that is, economic growth is generated from below, from small spaces - from the micro-level of small and medium-sized enterprises).

4. A set of performance indicators for the socio-economic impact of micro-level spatial innovations (increase in the number of jobs; expansion of social recreational areas; increase in profits and, consequently, budget revenues from service sector development; reduction in transportation costs; development of industrial and social infrastructure facilities) is presented.

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These indicators are combined into a single innovative spatial socio-economic complex. This approach allows us to propose an algorithm for spatial resource conservation.

Theoretical and practical significance of the work. The key provisions, recommendations, and conclusions of this dissertation allow us to propose a new conceptual approach to utilizing spatial resources of three dimensions for the development of economic entities at the meso- and micro-levels. The theoretical substantiation of the concepts examined in the study allows us to develop and expand existing approaches to space as a complex concept and its perception as a limited resource. Practical recommendations regarding the implementation of spatial innovations and the use of the author's proposals regarding an inter-regional territorial cluster can be used by state, regional executive authorities, local governments, and economic entities to rationally utilize spatial potential to achieve additional socioeconomic benefits.

Conclusions

As a result of the conducted research, the authors formulated a number of conclusions:

- An analysis of the scientific literature revealed a limited number of opinions regarding the concept of "spatial innovation." The authors formulated a definition of spatial innovation as a technology for using spatial resources in all dimensions, which create a fundamentally new economic, social, or socio-economic effect at the macro-, meso-, and micro-levels of economic development. In the theoretical part of the dissertation research, approaches to the concepts of "space," "spatial resources," and "spatial potential" were supplemented; four areas of management activity in relation to the issue under consideration were identified: planning and forecasting spatial resources; organizing the use of spatial resources; motivation and influencing factors; monitoring the use of spatial resources;
- The study formulated the directions of the influence of spatial innovation on the development of various levels of the economy:

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• at the macro level - the implementation of scientific national projects on infrastructure, communications, and other facilities, which allows for a change in the configuration of economic ties;

• at the meso level - changing regional boundaries, creating regional clusters. Currently, the implementation of strategies at the level of mesoeconomic systems requires consideration of modern development conditions: economic globalization and the resulting need to account for spatial components;

• at the micro level – production and qualitative changes, and the technical use of 3D space by economic entities.

Thus, the recommendations proposed in the study allow for the optimization of territorial spatial resources; the strengthening of the rational use of spatial potential, which will, consequently, promote the interests of all stakeholders; the development of appropriate social and production infrastructure; and the strengthening of cooperation between business and government structures at a given level of economic development in order to increase socioeconomic impact. The synergistic effect arising from the effective management of spatial innovations is reflected in an improved quality of life for all categories of the population by optimizing costs associated with the rational spatial placement of social, production, and service facilities.

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