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TERMINOLOGICAL ASPECTS OF VISUALIZATION IN SOCIO-ECONOMIC STUDIES OF HETEROGENEOUS SPATIAL SYSTEMS

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Abstract

The article discusses the terminological aspects of the study of heterogeneous spatial systems. The specificity of this object of socio-economic research is multidimensional, which manifests itself in significant specificity for each separately considered case. Multivariance is expressed in the degree of heterogeneity, in the nature of the manifestation of heterogeneity and its combinations. In fact, we are dealing with completely different objects of study. Currently, there is a terminological confusion caused by the unsystematic use of the terminological apparatus, as well as its insufficient clarification in each specific situation. In particular, in socio-economic studies of heterogeneous spatial systems use logistic or legal terms, the concept of "transport corridor" means completely different things in the understanding of different authors (from the route of movement of the cargo, to the socio-economic community). In our article, a systematization of the conceptual apparatus of some elements of a heterogeneous spatial system from the point of view of socio-economic research is proposed. Author's definitions for the selected terms are proposed and methodological limitations of their use are determined. Conceptually new is the use of visualization tools (in our case, geoinformatics tools) in order to overcome terminological confusion and most correctly determine the object of study in each individual case. The use of the proposed terminology and methodology in the article was tested on the example of the structure of the interregional socio-economic zone of the transport corridor Ural - Northern Kazakhstan, including the agglomerations and agglomeration processes located in the transboundary zone.

Keywords: Spatial socio-economic development, complex system, visualization, analysis terminology, transport corridor.

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1. Introduction

In modern conditions, there are many non-standard management tasks that require individual statement. This is due to the need for a deeper study of the specific problems of promising development. The tasks of long-term spatial socio-economic development are largely interdisciplinary and require updating approaches, starting with studies of basic concepts and terms. It is the effectiveness of the study of specific moments that often determines the possibilities of formulating qualitatively new more complex problems.

Individual tasks imply geographical specificity and other factors that determine the heterogeneity and uneven development of various territorial entities.

Recently associated with two important aspects of spatial development. The first aspect is related to the study of agglomeration processes and the development of agglomerations, as well as the development of communications and the formation of transport corridors. A joint examination of these aspects raises a wide range of issues, starting with the definition of a common terminology.

2. Problem Statement

The development of transport corridors, as specific spatial objects on the routes of movement of the flow of goods and services between agglomerations, has a significant impact on the socio-economic transformation of all surrounding territories. A joint consideration of the two directions is inevitably associated with deeper socio-economic studies of the development of complex heterogeneous spatial systems. An interdisciplinary study of issues is inevitable here:

- development of complex multi-level spatial systems, economic geography and regional economy;
- urbanization, agglomeration processes and agglomerations;
- communications, logistics and transport corridors.

Here the problem of creating a single base of concepts and terms for the three previously separate areas of research needs to be addressed.

3. Research Questions

The heterogeneous spatial socio-economic system in this study is the set of territorial objects of a certain geographical space, formed on the basis of the commonality of their properties and, accordingly, having common classification rules and terminology. In the general case, a variety of concepts and their corresponding terms in applied socio-economic studies of heterogeneous spatial systems is formed by combining the components. The considered example of research on the joint development of agglomerations and transport corridors is characterized by a variety of territorial objects of the most varied scale, degree of detail and specificity. Such a variety automatically raises the question of the formation of a certain basic median set of terms and concepts. The key concepts defined in this case become some basis for their refinement, adaptation and development in further research. In real conditions, with the subsequent adaptation of the base set to the requirements of the particular situation in

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question, specialized, information-adapted approaches to organizing research, based on the principles of "soft systems methodology" (Checkland, 1990, p. 11), benefit. They allow you to refine the definition of tasks directly in the search for solutions. Clarifications of the provisions and concepts in this case are integrated into one of the stages of the search for solutions.

In a real information situation, the study of the socio-economic aspect of the development of transport corridors and agglomerations (if any) is associated with the analysis of systems with a large number of uncertain factors. To reflect all the specifics, the general symmetric ordered multilevel hierarchical model (for example: the model of the concept of systemic stability of the economy (Kleiner, 2015a,b), is superimposed on a heterogeneous network structure - the spatial framework for the placement of territorial objects. In turn, a number of components can be distinguished in the spatial framework:

- natural-ecological framework,
- socio-settlement framework,
- transport - logistic framework.

Of particular importance are the definition of basic concepts and terms, as well as their detail and refinement.

4. Purpose of the Study

Such an expansion of the range of issues addressed determines the basic requirements for updating the methodological foundations of the search for solutions. Further, it predetermines the requirements for the formation of common terminology for such an integrated research area. The fundamentals of the formation of a problem-oriented set of concepts and terms open for further development are considered in this paper. The openness of such a set, necessary when expanding the range of tasks to be solved, inevitably affects a number of other related research issues related to the use of information technologies (IT).

In this case, the studies are considered on the example of rather complex heterogeneous spatial systems, designated as - the zone of the transport corridor. This study is devoted to determining the most correct terminology that is directly oriented to solving the problems of managing the development of complex spatial systems.

5. Research Methods

With a large heterogeneity of the spatial framework, the variety of concepts and terms characterizing the specifics of socio-economic development will be quite large. In such conditions, it is advisable to consider the formation of a basic set of concepts and terms in stages, as the specificity of the problems being considered is determined. Their correction is possible as soon as the intermediate results of the study are obtained and the grounds for further refinement and detail appear. The initial defining the basic setting of tasks in this example are the most general basic concepts in terms appropriate to them (regional economy, urbanists, logistics).

Here, the most general concepts and terms should be highlighted:

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- system-wide studies of the regional economy - the region (lat. Regio - country, region) in the general case determines the totality of territories;
- urban planning - agglomeration (from Latin agglomero - I connect, accumulate) as the concentration of settlements around large cities, in cases of a poorly structured form of integration of urban settlements, considered as conurbation - (from Latin con - together - and urbs - city).
- transport corridor (logistic) - part of the transport system in general transportation directions.

Further, these three concepts are considered in many aspects. Zones are considered for regions, agglomeration components (large city center - core cities of the agglomeration, edge cities - cities on the outskirts of the agglomerations, urban area - cities within the real built-up space, and not within the administrative boundaries, metropolitain area - clots of settlements around large cities etc.), in transport corridors their function (transit corridor, trade corridor, development corridor).

The subsequent update of the concepts is associated with a multidimensional interdisciplinary analysis of significant amounts of information on a large number of objects of heterogeneous socio-economic spatial systems. Visualization (as one of the areas of IT) - in this case, represents the process of presenting information (both numerical and graphic) in an image that most fully reflects the characteristics of the object of study in the study - “problem-oriented analysis” (Gordeev, 2016, p. 38). The graphical representation not only greatly simplifies the perception of information, but also opens up the possibility for more detailed studies, within the framework of the capabilities of visualization tools (visualization tools). Further, due to additional information (images of the object of study), a graphical study allows you to give clearer definitions of the elements of systems that are difficult to formalize at initial consideration. In the context of the spread of IT, many sections of spatial development are considered in the geoinformatics environment, touching on key issues, starting with the conceptual apparatus and ending with applied tools.

Thus, providing a more detailed formalization and reflecting reality as correctly as possible, visualization makes it possible to formulate and solve qualitatively new, significantly more complex problems of spatial development.

In this case, the transport corridor zones become such specific objects of spatial development. Their definition and classification affect many basic terms, starting with the concept of the classic logistic definition of a transport corridor (Gadzhinsky, 1999). This is complicated by the existing differences in terminology, which is expressed in the fact that the definitions of the transport corridor differ markedly depending on the object of study (Shcherbanin, 2006). A number of EU documents address the “transport axis”, and in some cases use the logistic term “multimodal route” (Huang, Bucher, Kissling, Weibe, & Rauba, 2018, p. 3). In a broad sense, the transport corridor is interpreted as a path for movement along a specific route and it eliminates the need for transit transportation.

A generalization of many international studies is presented in a rather detailed methodological review of the economic impact of the transport corridor on the adjacent zone. It is based on 78 studies (to 2017) and contains a consolidation of several hundred findings (Roberts, Melecky, Bougna, & Xu, 2019, p. 15). However, the examples considered there are very heterogeneous, starting with the construction of railway networks in the United States, China and colonial India. In particular, Ghani, Goswami, and Kerr,

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(2017) wrote about India, Revoltella, Brutscher, Tsiotras, and Weiss, (2016) wrote about the USA, and Berg, Deichmann, Liu, and Selod (2017) about China.

The term "transport corridor" is also often used in the sciences of the earth and the world, but in completely different meanings. For example, the transport corridor in the Arctic zone is understood as the transport route of the icebreaker fleet, that is, a new route created for the transport of goods and passengers (Skripnuk, Kikkas, Safonova, & Volodarskaya, 2019). Also, the term “the green transport corridor” is used, which means a sustainable transport system including five components: sustainability, stakeholders, industry and entrepreneurship, qualifications and personnel, financial resources and budget (Teslya & Gutman, 2020). Often, studies examine only cross-border transport corridors, losing sight of the possibility of a different interpretation of the term (Fedorenko & Pokrovskaya, 2020). Politico-military discourse uses the term “safe transport corridor” or simply “safe-corridor”, which means a safe travel route for humanitarian aid and civilians (Kang, Xu, Tao, & Zhongzhen, 2020).

A more interesting example of the modern highly developed zone of the transport corridor is the Las Vegas Strip which connects Las Vegas and Los Angeles (366 km long). Its main center in Las Vegas, approximately 7 km long, is referred to as “linear agglomeration”. The rest of the path is referred to as the “linear form of neighborhood retail areas” (Wang, Fan, Zhao, & Myint, 2020, p. 2).

The complex structure of the settlement framework associated with the uneven distribution of the population determines the prerequisites for the heterogeneity of the spatial structure of the zones of the transport corridor (Popov & Puzanov, 2008). In a number of cases, zones of socio-economic influence of various settlements, primarily those associated with agglomeration processes, are superimposed on the traditional linear zone of the transport corridor (Laird & Venables, 2017, p. 2). As a result, a much more complex heterogeneous spatial structure is formed. Inside such a zone (heterogeneous structure), points of additional attraction arise (Barkhatov, Pletnev, & Kapkaev, 2019, p. 68). Here there can be both agglomerations and large cities, as well as smaller settlements.

Thus, the concept of the transport corridor zone receives a different definition. They act as a set of territories of high transport accessibility that have competitive advantages through the use of a transit transport component (trunk) to solve local territorial problems. The term zone of the transport corridor in the general case applies to a heterogeneous set of spatial objects and in each case requires additions. At the same time, the formation of a group of clarifying terms that reflect the diversity of the specific features of spatial objects is determined mainly within the framework of problem-oriented analysis and visualization.

6. Findings

The considered author’s definition of transport corridor zones with their subsequent classification creates the prerequisites for updating the methodological apparatus of the spatial studies under consideration. Further, the use of the advantages of visualization technologies here creates the prerequisites for further research in the framework of problem-oriented zoning. A similar approach to updating the methodological apparatus taking into account the whole variety of objects in an expanded set of concepts and terms has been tested in studies of the development of the heterogeneous macro-regional and transboundary transport corridor Ural - Northern Kazakhstan (Gordeev, 2019).

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The general structure of a specific interregional socio-economic zone - the transport corridor Ural - Northern Kazakhstan, as an example of visualization of the spatial system is shown in Figure. 01. It presents a lot of objects: agglomerations of Yekaterinburg and Chelyabinsk (agglomeration zones are indicated by a dotted line, the size of cities in the diagram is proportional to the population). A specific transboundary zone (marked by a solid line in Figure 01) with the border center of the city of Troitsk and other nearby municipal centers is noted. The location of small centers of social development as potential growth points in the transport corridor zone on the Chelyabinsk - Kostanay section, and the surrounding zones for centers of 15-minute transport accessibility are given.

Only the main objects of the transport corridor zone are considered above. With more detailed visualization, in further studies, the number and variety of objects will be significantly larger, with appropriate reflection in terminology.

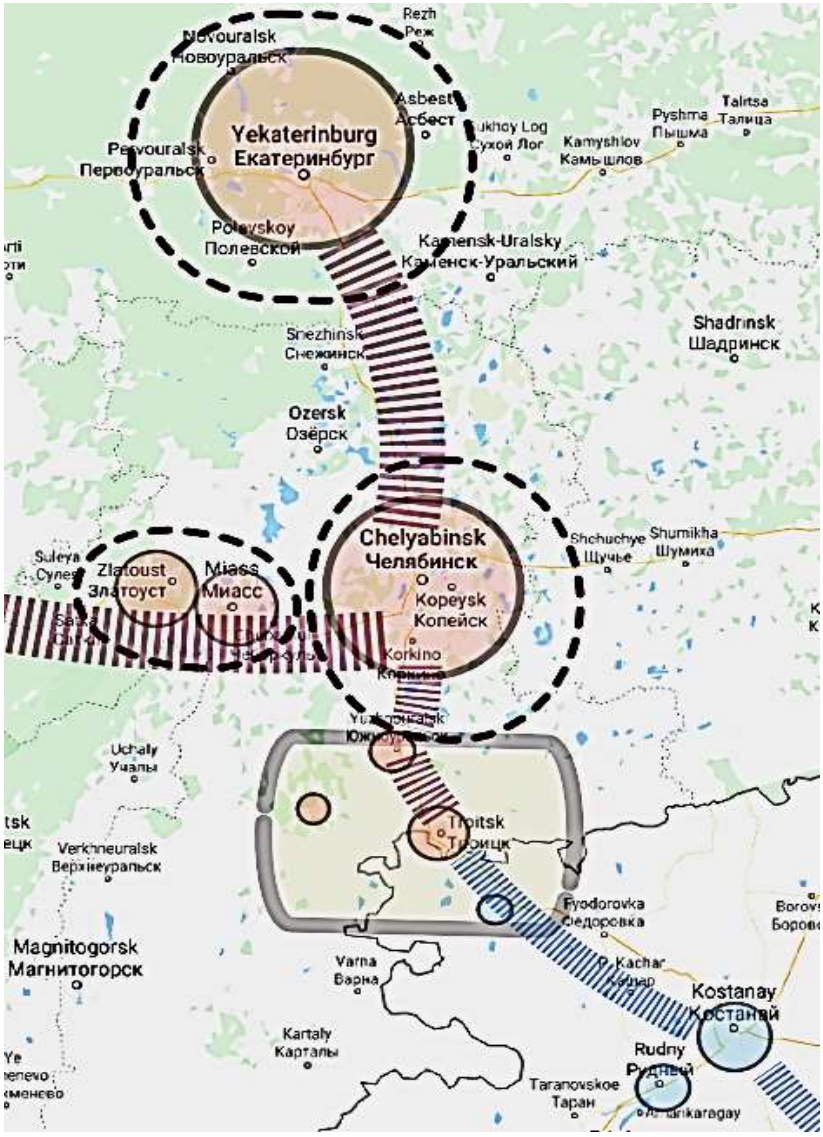

Figure 01. The structure of the interregional socio-economic zone of the transport corridor Ural - Northern Kazakhstan, including the agglomeration and agglomeration processes, the transboundary zone

7. Conclusion

The considered updating of the fundamentals of the terminology and methodology of spatial development, starting with the definition of concepts and terminology, using the example of studying the zones of the spatial corridor, creates the prerequisites for further more detailed classification and systematization of the factors of territorial development. In this case, the new objects under study are considered as elements of complex socio-economic systems and important drivers of promising development. Further development of such a terminological direction of interdisciplinary research is largely based on the improvement of multidimensional analysis and visualization technologies. The terminology formed at the same time becomes one of the factors in the development of the language of international professional communication.

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