DOI 10.29042/2018-2621-2625

Helix Vol. 8(1): 2621- 2625

Spatiotemporal Aspect of the Cluster Systems Evolution

Olga A. Lomovceva[1], Boris A. Tkhorikov[2], Olga A. Gerasimenko[3], Elena A. Gukova[4], Svetlana Y. Soboleva[5], Natalya A.Mamatova[6]

[1, 2, 3, 4, 6] Belgorod State University, Russia, 308015, Belgorod, Pobedy st., 85, [5]The Volgograd State Medical University, Russia, 400131, Volgograd, Fallen Fighters Square[1]

***Email:** lomovceva@bsu.edu.ru*

Received: 21st October 2017 Accepted: 16th November 2017, Published: 31st December 2017

Abstract

The article investigates the processes of regional clusters evolution in the space-time continuum. On the basis of spatial-temporal analysis methodology hypothesis of a permanent process of clustering is formulated, which is mediated by the transformation of biological, social, informational, holistic spaces in timeline. Spatial and temporal characteristics of each level create the preconditions to relevant cluster formations. Cluster transformation and deformation in different economic systems are latent, intermittent, their spatial boundaries and time frame can be determined using nonparametric clustering expertise factors. The novelty of the results is a matrix of recombination temporal and spatial processes, allowing us to obtain the profile of processes, indicating the possibility of a positive or negative outcome of the cluster. The field of application of such a matrix can be software-project activities to establish regional points of growth, production localization and cluster initiatives. Continued research is possible in the direction of determining the profile of a particular cluster in comparison with the reference, generating maximum number of positive effects.

Keywords: Spatial-Temporal Analysis, Cluster Patterns of Territorial Distribution, Continuum, Co-evolution, Externalities, Nonparametric Examination.

Introduction

The problem of the conjugation of the spatial and temporal aspects of the study of economic organization territorial forms is traditional for the regional economy as a science, its early theories of productive forces, the formation of spatial agglomeration and economic zoning. In this study the authors attempt to examine through the prism of the space-time continuum clusters, reveal inherent patterns and certain specific properties. For this let's pre-formulate the concept of the continuum and the context of its use in the article.

Historically and currently, there are two main concepts of "space - time": the substantial (ancient atomists Democritus, Newton) and the relational (Plato, Aristotle) [1, 2, 3]. The first is that space and time are independent of each other, from the material world and from the processes of activity [2]. Relational concept of considering space and time are not as distinct, independent of matter, the spirit, and as a form of existence of things. The space and time interact; their unity creates the form of material objects. A simple view of reality: the world is a set of (continuum) event, which has four dimensions - three spatial ones, and the fourth - time. So there is the concept of space-time continuum. Space and time are not only determined by the processes, events that occur in them and there, but the form and produce historical phenomena and nature. Modern understanding of the interaction of a continuum of products is: "Economic relations are a particular form of manifestation of space-time relations" [4]. With regard to the forms of the spatial organization of production should also say that they - the product space-time continuum.

In development there is no beginning and end, it is continuous, but the levels vary. The first level of spatial forms of organization of material objects is a biological space (biosphere), becoming the basis for the subsequent transformation [5]. Then the biological space creates society, the social space [6], with time - economic [7]. Going through the levels is carried out by "absorption" of one another space on the principle of "Russian dolls", where each higher level incorporates the previous space. Ultimately, all of them - "biological", "social", "economic" absorbed the entire space of "information." Authors venture to suggest that the next level of society development becomes the space of noosphere, which is the existence of the environment in the broadest sense, the environment, holistic form of our existence [8] (Figure 1).

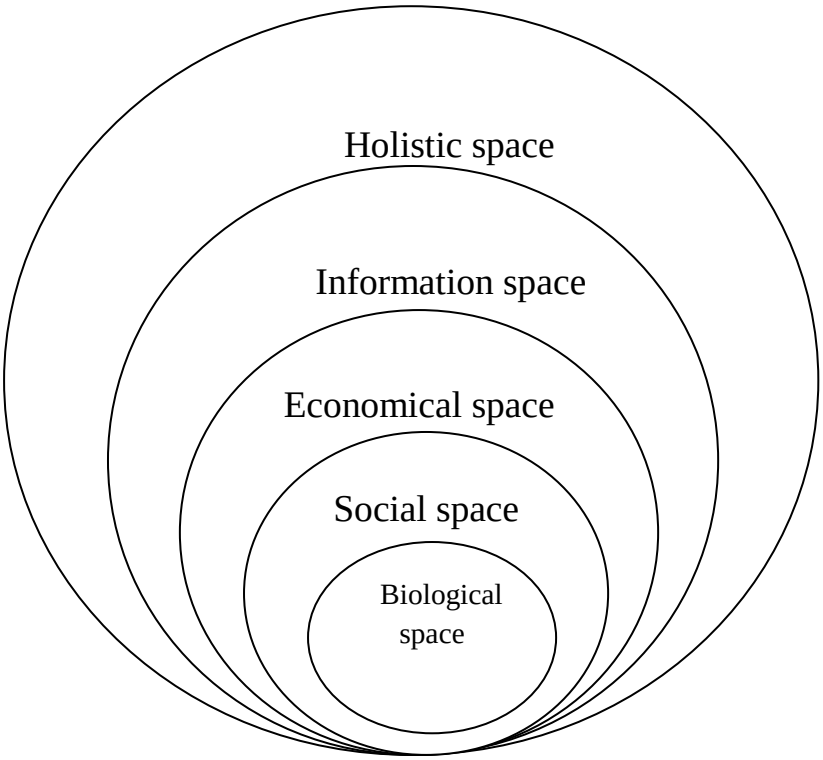

Figure 1: The Temporal Aspect of Spatial Forms Development

Metamorphosis continuum is not only the transition space phases from one state to another, where "social» (Ss) enters the "economical» (SE), and it, in turn, is - in "Information» (Si), and the appearance of the products of their transformation which are different in form and content. The basic form of the realization of the social space is the relationship and interaction (based on the desire and trust, or coercion, and formal institutions), allowing to reduce transaction costs. Economic space with its resource- marketing technologies and communications is superimposed on this field. Then follows the information space, the essence of which is determined by the exchange of the freedom, accessibility, even absolute information flows, and becoming a resource, and the result of existence.

Human labor and its results, on the one hand, organize and arrange the economic space of the local area in a certain sequence from the past to the future, and, on the other hand, are derived from this continuum, which results in different historical times depend on the spatial processes.

Problem Statement

Cluster system, like any social nature economic systems in general while functioning, transform the environment. As a result, the cluster produces a new consumer value to companies, industries, different stakeholder groups, and generates both positive and negative externalities [9].

In turn, the synergy of the companies' activities allows increasing customer value, giving it new properties, which is especially characteristic of cluster interactions. The more space the cluster covers the area of influence, the more consumer value and stronger externalities. Innovation and value created in this space, diffuse, transform the economic space, and develop the productive forces and the relations of production.

A cluster is "maturing" at each level of space - social, economic, and informational: "Relations cluster"; "Industrial cluster"; “Information cluster ". All these cluster formations have the appropriate product. In the cluster of relations such product is "relations» (R), in the industrial the product is product (service) (P), an information cluster generates information (I). Each product of the appropriate spatial level is the product of the increment of the prior level.

The product of the social space cluster are the relations of in the form of trust, networks synergies, organizational culture, that is, intangible assets, which are, basis for further development [10]. Full cluster does not arise till the time when relationships are not built. In economic cluster, the product already appears as a full commodity; the more stable and positive is the attitude, the more value gets this product. At the level of information space the deterministic range of products is as follows: relationship - Products - information. In the space of noosphere there is the possibility of forming a holistic cluster where the goods will be

the products of genetic engineering and biotechnology, associated with a new quality of life.

Spatio-temporal dimension of economic development is associated with differing intensity, time-consuming process that generates positive or negative externalities that lead to the development or abandonment, prosperity or territories degradation. The examples of such approaches in development areas has been the development and transformation of territorial production complexes (TPC) and production units (PU), which are partially combined the spatial and sectoral components of the functioning of the local development. The largest TPC- in the Soviet Union was West Siberian (oil and gas industry of the Tyumen region), the Kansk-Achinsk (the coal industry of the Krasnoyarsk Territory), South Yakutia (coal Yakutia Industry), the Kursk Magnetic Anomaly (fine iron and steel industry of Kursk and Belgorod regions) and others. However, due to the scale and weak integration ties and providing basic facilities TPC failed to become full-fledged establishments in the USSR. The planned nature of the economy of that period did not contribute to this process, as well as the centralized decisions on the placement of the productive forces and the nomenclature of products.

Some facts of existence quasi cluster formations suggest possible cluster transformations and deformations in different economic systems. They are latent, intermittent, their spatial boundaries and timeframe is difficult to determine without the use of adequate diagnostic tools. One possible instrument could be nonparametric clustering expertise factors [11, 12], in which the mathematical processing via software [13] shall be subject to peer review and ranking of factors. Author mathematical model allows to objectify and to identify the most relevant in relation to the phenomenon under study expert opinions [11 - 13].

Research and Practice Analysis

The study of clusters in the space-time continuum it possible to identify patterns of territorial distribution taking place in time, grouped into positive and negative in terms of the effect they produce.

In our opinion, the permanent development of cluster structures, overt and covert, described the eight aspects: four - time (T), four - space (S). In the interim, we have identified two positive (continuous and infinite), and two negative (discrete and finite):

- Continuous aspect (C - continuous) - is characterized by the continuity of what is happening in time;
- A discrete aspect (D - discrete) - is characterized by discontinuity happening in time;
- Infinite dimension (P - perpetual) - has unlimited of what is happening in time;
- Final aspect (F - finite) - is characterized by a limited time.

The spatial aspects as there are two positive and two negative. Positive - local and negentropic negative - dislocal and entropy:

- A local dimension (L - local) - structured elements occupy certain location in the territory;
- Dislocal aspect (NI - dislocal) - unstructured elements take unspecified location in the territory;
- Negentropic aspect (N - negentropy) - provides the elements striving for orderly interaction of elements in a certain area;
- Entropic aspect (E - entropy) - demonstrates our commitment to the chaotic elements interact in a certain area.

We group all aspects of using the space-time matrix of possible combinations (Table 1).

Table 1: Possible Spatial and Temporal Aspects of the Clustering Combination

Dislocal / Entropy	**CPNIE**	**DPNIE**	**CFNIE**	**DFNIE**
Local / Entropy	**CPLE**	**DPLE**	**CFLE**	**DFLE**
Dislocal / Negentropic	**CPNIN**	**DPNIN**	**CFNIN**	**DFNIN**
Local / Negentropic	**CPLN**	**DPLN**	**CFLN**	**DFLN**
	continuous / infinite	Discrete / infinite	Continuous / finite	Discrete / finite

Recombination of the temporal and spatial aspects of the process provides a profile, indicating the possibility of a positive or negative outcome of the cluster. In our opinion, the combination of CPLN gives the "ideal" profile, where all aspects - local, negentropic, continuous, endless - contribute to the formation of clusters, the cluster is able to form and evolve. Positive are also:

- DPLN – “subideal" clustering profile where discontinuity has a limited effect, without canceling the positive trend;
- CFLN - profile, suggesting the development of artificial clusters, but not evolutionary, since in the absence of an endless process of ending the temporary criterion can only be targeted;
- CPNIN - profile of latent cross-border clustering;
- DPNIN - Profile conditional temporary cross-border clustering.

Of all the possible combinations of temporal and spatial dimensions we could only mark five positive profiles which can lead to the formation of clusters. Two of the five profiles are strongly positive, and

three of them - relatively positive. For all other possible profiles of the emergence of clusters is not possible, since the entropy (E) process prevents the orderly interaction of the elements, which is so important for clustering.

There is reason to assume that clustering processes inherent in different time periods to countries with developing, transition and developed economies and even countries with non-market mechanisms of management. For example, the imposition on the matrix signs such form, as the RIC (quasi-focused cluster), gives the following possible clustering profiles: CFLN and CPLN.

Production unit, unlike TPC, can develop spontaneously and purposefully, so for him to assume other recombination and thus obtain the following profiles: CFLN - to purposefully formed PU; CPLN and DPLN - for spontaneously forming PU. Endless time process (P) and the process of spatial localization (L) defines a continuous clustering in any recombination of profile TPC and PU and involve permanent through transformational clustering.

The development of the cluster goes due to synergies and adaptive mechanisms that entail a change in themselves spatio-temporal processes within the cluster. Thus, with a positive effect may be discrete continuous process or entropy - negentropic, with a negative effect and - vice versa. Profile cluster can be associated with a specific spatial economic system, which occurs gradually in the process of clustering (TPK, PU, quasi cluster, pre cluster, cluster, etc.) [14, 15]. Economic effects in the transformation will occur in increments of territorial or system assets, or lack thereof, as well as to increase the competitiveness of enterprises or cluster area. On a positive or negative impact of adaptation as a process of self-organization, are inherent in all systems we can judge according to its current effects.

Summary

The hypothesis of a permanent cluster process requires evidence-the evidence base for a long historical period of observation. On each selected time interval may need different diagnostic tools, ranging from field research and the collection of primary data from sources to the analysis of historical and archival data. We believe that the continuity of the process provided by cluster interference, i.e. superposition of varieties of clusters in different historical periods on certain space. Each new historical level carries the development of cooperation networks, enabling them to any extension or transformation or diversification. Increment of spatial formation upon application of clustering levels promotes a positive economic effect in market systems or political decisions of expediency in the non-market systems. This does not mean that the process must be definitely infinite and cannot lead to degradation of the territory. The development of old industrial clusters in the Ruhr area (Germany) [16, 17, 18], Birmingham (USA) and Manchester (England) [19], their crisis, transformation and diversification suggest the development of interoperability throughout the XX and XXI centuries.

The authors proposed the hypothesis of the influence of the space-time continuum, the results of which are different forms of agglomerate, it is universal. In the short time interval the special cases are modeled and presented as sets of recombined spatial and temporal profiles, positive and negative, revealing the possibility of designing a cluster policy in the region and the state.

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