Network forms of business-models of integrated economic systems

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Abstract. The paper considers the problems of systematization, analysis and modeling of various network forms of business organization in the form of transnational integrated economic systems operating in difficult Arctic conditions. The formation of a single organization in the form of network interaction of national economic systems allows to reduce the cost of activities, generate a synergistic effect of joint activities and consider the interests of different countries forming such structures. Network organization of activities is an important area of economic development which allows one to take into account climatic, organizational and structural difficulties. It also forms effective interactions of national participants in such an international business network. It coordinates the interests of those strategic zones (Arctic territories), to which the participants of the network organization apply their strategies. Such a network form of organization requires the formation of a structure with special management factors. The classification of network forms of organization of complexly structured economic systems is carried out, flat (linear) networks and spatial networks are determined. The definition of network structures is given, generalized models of network system forms are given.

1. Introduction

Strengthening of the integration processes in the global economy, production customizing, complicating the structure of economic systems, risks increase and economic processes differentiation, are the current trends in the development of economic processes in the world.

One of the effective tools for solving complex economic development problems is the mechanism of the network economy, which, in the modern economy, is presented in the form of large complex structured economic systems oriented both in spatial (economic territory) and industrial sectors.

The formation of a network concept reflects the important role of innovative forms in economic development and allows effectively transform development of the Arctic space, taking into account the existing network structures of countries such as Norway, the USA, Canada, Denmark and other Arctic countries [1,2].

The analysis of the economic space of the Arctic zone, the identification of the possibility of creating coordinated and balanced interactions of international, intersectoral economic systems on the spatial cluster of the Arctic, leads to the identification of a specific Arctic spatial-sectoral (network) integrated economic system, which involves not only intersectoral systems, but also international corporate alliances. Innovation in the processes of economic development involves the creation of new business
models for the effective management of cluster and network economic complexes, which concentrate competitive advantages and are drivers of economic growth.

All this makes it necessary to further expand and deepen studies of economic problems of economic development in the Arctic zone for the effective management of changes in the economic space of the Arctic for its development, considering the interests of all stakeholder countries [3,4,5]. Of course, the policy of economic development through network form of economic systems is very complex and ambiguous policy which requires coordination and achieving a balance of interests, including the participants themselves, and the base territories and the system as a whole.

The network interaction policy is an important area of economic development and should take into account the complexity of the structure and interactions in the network, the interests of those strategic zones (territories), to which the participants of the network organization are oriented.

The network form is a separate type of integrated economic systems and has some special factors: - the formation of a long-term system development policy; - localization and interaction of network participants in value chains; - the sustainability of strategic interactions across many types of economic and resource types of relations; - the presence of a coordination center for corporate governance of the development of such a system.

Combining these factors, you can get different types of network structures that are most effective in organizing business in difficult conditions, for example, for the development of the Arctic economic zone, within which the interests of many Arctic states are formed [6,7,8,9].

Given the interest of many countries in the Arctic economic zone, such network form in which companies of circumpolar countries participate, with their interests, technologies, and resources, can effectively manage the development of the Arctic cluster, its spatial organization and alignment of growth with the goals of national industry development strategies.

However, in difficult operating conditions (the Arctic zone), with strong economic convergence and significant economic risks, the appearance of a “backward wave” may occur, leading not to an increase in synergy but in development of risks. The ability to effectively manage the integration processes of corporate systems in business networks requires taking into account many parameters in the formation of their interactions, pooling interests and economic development potential.

The object of research in the paper is the organizational form of the business structures implementation in the difficult conditions of the Arctic economic zone. The subject of the study are the processes and models of the formation of network spatial forms, the participants of which are international economic systems. The aim of the study is to justify the network forms of organization of economic activity in the Arctic zone based on participation of international corporations and organizations requiring coordination of interests, balance of resources and interconnection for effective activities in difficult Arctic conditions.

2. Methods
The approaches to the formation of complex-structured economic systems of production and managerial types that generate in their structure the opportunities for joint effective activity of corporate participants, including a transnational type, are examined. A literature review on this problem involves the analysis and systematization of various types of corporate-type economic systems, including network organization forms. It is necessary to determine the structure of network forms and highlight the typology of the network type.

When analyzing the processes of economic integration, in [10] two types of integration are distinguished - integration from above (standard forms of mergers and acquisitions), and integration from below (networking). We will consider models of integrated economic systems in the form of a system (network) of value chains (business chains), whose participants are active elements with the highest priority (for the business chain) technologies and resources. Value chain according to [11] is the totality of the types of economic activity carried out by participants at all stages of the product's existence - from the development of a project idea to its final use and after-sales service. Although there is a clear hierarchy of relationships between active elements in the structure of such chains (business chains),
there is no hard management center here, although there is an anchor enterprise in whose interests’
chains are formed. Such a center forms the basic development tasks, defines and coordinates the
interests, resources, tasks and goals of the activity of each active element and essentially performs the
role of a network coordinator (creating policies and strategies of the entire system) of the business chain.

Relations on economic, resource and other interactions should be clearly balanced and defined in the
form of clear performance criteria. In this regard, it can be argued that modern and effective integration
processes can provide the formation of innovative network forms of economic systems (ES) that operate
in a certain economic space with a multidimensional composition of active elements (participants
representing business, scientific, government and public interests from the strategic economic zones,
which realize not only the private goals of the participants, but also the systemic development goals).
Such business chains can be formed according to the design and functional principle, reflecting
belonging to various administrative spaces and industries.

Similar trends are manifested today in building models of the national economies of countries, which
are based on the de-sovereignization of the world economy and the integration of countries into "... a
multidimensional network space without a relationship of hegemony and subordination" [10]. These
trends reflect the integration restructuring of large international corporations with the separation of
business chains during their disaggregation, redistribution of control functions and business functions
between participants in business chains. In [12], the integration process is described by the term
“shrinking of hierarchy” and reflects horizontal-network corporate business models.

Cluster models of economic development make it possible to formulate priority areas in countries
such as Denmark, the Netherlands, the Flemish region of Belgium, Quebec (Canada), Finland, France,
Italy, etc.

In [13], a typology of business organization models is disclosed according to the following criteria:
- organizational format (local or global), - level of cost reduction, - level of innovation in management
and production, a combination of which gives the following groups of integrated business models -
Multinational companies (MNCs), Transnational companies (TNCs), Multi-home-based companies
(MHbCs).

MNCs and TNCs represent the classic international corporations, typical to the industrial economy.
MNCs are oriented to the market of the country of origin (where the parent company is based), and build
a network of participants in other countries to reduce costs. TNCs operate in an open global market,
building a complex system of interactions, relationships, organizational structures, to ensure the effect
of cost reduction and innovative effect. They do not have a specific base region and in each country are
controlled by national management companies.

Multi-home-based companies (MHbCs) are the companies in which the main added value is brought
by network innovation effects. It is these companies that can be called cluster networks, as they distribute
their business functions among innovative clusters dispersed throughout the world. They can have
several business chains, where each stage of a separate chain is performed by a member of a specific
specialized cluster.

An overview of the characteristics and priorities of clusters and intercompany networks (business
organization networks) is given in [8,14,15,16,17].

Based on the analysis of the typology of network forms of business organization, we systematize and
generalize the types of network business models:
- flat (linear) networks, which include linear clusters and cluster linear networks. Linear clusters are
integrated economic systems in which:
  a) either the participants belong to a certain economic space, and which are territorial clusters,
  b) either the participants reflect the interests of one or related industries and represent industry
clusters,
  c) either the participants have priorities in one of the functional policies of strategic development
(innovative, industrial, financial, etc.), for example, innovative clusters.

Cluster linear networks - are networks consisting of interacting clusters of the same type.
- spatial networks in which participants reflect both territorial and sectoral interests and are organized in the form of cluster structures.

If territorial cluster systems and individual sectoral business units interact, then such economic systems will be called Spatial-Sectoral Economic Systems. At the same time, active elements that perform business functions in the value chain can relate to various industries and be distributed across different territories (including foreign ones).

Spatial networks in which the participants (nodes) of the network are individual clusters of various types that interact with each other and will be called cluster networks.

Depending on the type of network structure, the functions of participants, the types of interactions and the degree of authority of the managing center of the network, a different policy and strategy for the development of the economic system of the network form is formed. Using the above systematization of the network into flat and spatial networks, we define at least generalized models of such economic systems.

2.1. *The concept and categories of the economic systems.*

Based on the concept of ES given in [2,6,8,18], we define ES as a relatively isolated and stable in space and time part of the surrounding world, characterized by external integrity, internal diversity and systematicity. It realizes the processes of production, distribution, exchange and consumption of resources for the formation of consumer values.

Separating the hierarchy of concepts of an economic system through the allocation of analysis levels (macro-, meso- and micro-levels), we select as economic systems (ES) such systems that form:
- at the macro level - the global and transnational economy (in the form of a complex of TNCs, alliances, corporations, etc.),
- at the meso level - regional, territorial and other spatial types of economy (in the form of territorial clusters, spatial zones, regional enterprises, etc.),
- at the micro level - individual small, medium and large enterprises of a local type.

Considering the generalized structure of ES, it is usually believed that economic systems include the following elements:
- objects (structural elements) that are integrated into a single system and have a certain level of economic development potential (resources and opportunities for operational and strategic activities);
- a complex of functional and process interactions between elements within the system;
- interactions of an intersystem nature;
- processes and functional environments necessary for operational activities and development.

At the same time, we believe that value chains are implemented in the structure of the ES. The structure of value chains includes individual participants (within their operational capabilities), forming horizontal interactions among themselves and vertical interactions with other chains and other participants of the ES, as well as with the external environment [2,8,19,20]. In the process of interaction, participants generate some consumer value, within the framework of which the economic system carries out expanded reproduction and improves its economic condition and market position, ensuring functioning over time and spreading in the economic space within a certain period of time.

2.2. *Economic system model concept*

Based on the general concept of the economic system given in [2,8,19,20], we define the economic system as a relatively isolated and stable in space and time part of the global economic space, characterized by external integrity, internal diversity and consistency, realizing production processes, distribution, exchange and consumption of consumer values.

Such a system reflects the complex of business chains and participants interacting in its composition, the structure of which is determined by the system parameters: - set of participants (structure elements);
- a complex of relationships of participants;
- management and production structure (functions, tasks, powers);
- management resources;
- economic potential of development.
We believe that business chains are of a production and managerial type, the last of which (managerial) have structural (vertical and horizontal) and operational interactions, and the control parameters can be:

- \( \{A\} \) - a system of relationships between participants;
- \( \{B\} \) - policy management structure (functions, tasks, powers);
- \( \{PR\} \) - management resources;
- \( \{P\} \) - development potential;
- \( \{C\} \) - objective function;
- \( \{D\} \) - type of business chain or business network in the ES structure;
- \( \{T\} \) - period of management development;
- \( \{M\} \) - materials and components;
- \( \{OT\} \) - equipment and technologies;
- \( \{R\} \) - the system of interactions of participants.

With this in mind, the model of a generalized economic system is described by many business chains, each of which, in turn, is determined by a set of system-technological parameters [2,8]

\[
ES = \bigcup_{j=1}^{N} BC_j = \bigcup_{j=1}^{N} \bigcup_{k=1}^{M} (C_jk; A_jk; I_jk; B_jk; S_jk; T_jk; P_jk; D_jk; F_jk; R_jk; PR_jk; M_jk; OT_jk).
\] (1)

2.3. The concept of economic cluster.
The review and evolution of the concept of a cluster is described quite broadly, for example by [2,8,12,13,14,15,16].

We understand a cluster as a complex economic system, presented in the form of a flat-oriented network of participants with a dedicated control center, which are concentrated in a certain economic space. If this space is a territory, then such a cluster has the name of a territorial one, and if it is an industry is an industry cluster. Many participants (economic agents) are active elements of such a system and are interconnected by various types of relations (economic, resource, property, information, etc.). Such interaction makes it possible to generate a synergistic effect in the process of development of the entire economic system, but a “reverse wave of development” in the form of multiplicative risks is also possible.

Since all participants operate within the framework of a common goal, then in the cluster structure there can be one or more value chains of the cluster product.

We also believe that the cluster model, taking into account this definition, can be represented in the form of a value chain (business chain) as a flat (one-dimensional, linear) network structure, where either industry-specific or geographically concentrated economically independent organizations are the basic participants, closely interacting both among themselves and with external participants in the economic process. Given such a flat structure, a cluster, such as an economic system, can be represented as several possibly interconnected business chains defining the structure of a multi-level linear network.

Considering cluster systems as one of the types of economic systems oriented in a territorial or industrial dimension, we give some definitions and categories of a cluster. The term of active application of the cluster category in practice, although short, however, the application of this theory to manage the development of economic systems has many approaches, interpretations, definitions, characteristics and systematization of the category “cluster, cluster system”. Some overview of the definition of clusters and other related concepts can be found in [2,6,7,8,12,13,14,15,16,17].

2.4. Cluster systems.
The constant and effective interaction of individual clusters to achieve common interests can form a new class of ES, which we define as cluster systems.

Definition: a cluster system is a set of interacting clusters of various types integrated to achieve joint goals in a certain economic space.

These systems have their own characteristics and represent interests as possible effective drivers for the development of a territory or industry. They have advantages inherent in clusters, but have greater development potential and, if the growth conditions are met, can generate a greater level of development synergy.

3. Results

3.1. Spatial-industrial networks.
This type of network can be represented as a combination of industry and territorial clusters, where the economic territory (in the form of a cluster, cluster system) is of strategic interest to industry clusters. The advantages of such a system are the provision of significantly greater opportunities in the process of joint development due to: - greater synergy of development, - mutual influence of economic interests, resources and potential growth opportunities, - interactions of participants, - increased investment attractiveness, - increased competitive advantages, etc.

If spatial networks reflect the interactions and relationships between industry clusters and a separate economic territory, in which there is no organized cluster form, then such systems will be referred to as spatial industrial economic systems (SIES) [2,8]. In this case, the territory is a strategic management zone (SMZ) of the industry cluster. And there can be several such SMZ in the zone of interest of the cluster, for example, a zone of production priorities, a market zone, a zone of financial priorities, etc.

3.2. Cluster networks.

On the one hand, the territory wants to strengthen its economic attractiveness, competitiveness and standards of living, and on the other, the industry cluster considers the economic space of the territory as a zone of its strategic economic interests. With the coordination of these development interests, the growth task of the entire economic system can be solved more efficiently with minimal risks, ensuring sustainable development, balance and key growth areas. Thus, networks consisting of interconnected clusters of various types define a cluster network.

The main characteristics of spatial networks can be considered:
- concentration of economic interests of industry clusters in several strategic areas of management (territories or territorial clusters);
- coordination of sectoral and territorial interests to ensure common strategic priorities;
- ensuring operational specialization to participants in business chains in areas of certain areas of activity;
- coordinated interactions of participants within the framework of creating system-wide values, despite the presence of competition between them, which allows generating a higher level of value and competitive advantages from joint activities;
- the possibility of enhancing the economic potential of developing a network of economic agents (participants) and obtaining a synergistic effect;
- increasing the viability of the network system, strategic sustainability and ensuring the process of balanced development in the long term.

3.3. Form model of spatial networks.

In the network structure, it is possible to distinguish one- or diversified industrial segments, concentrating on one or several territories, forming a connected economic space.

It is these types of ES that we will consider further. We believe that a typical model with one basic business chain can be represented by a generalized structure of interconnected active elements (network participants), where participants can be territorial, integrated into territorial value chains, or industrial, where participants belong to the same industry. If the cluster \(U\) consists of \(n\) elements \(\{x_1, x_2, ..., x_n\}\) involved in the operational activities of a simple value chain, then the business chain can be represented as \(U_0 \to \{u_1 \to u_2 \to u_3 \to ... \to u_n\}\), where participant \(x_j\) performs \(u_j = f(x_j)\). In its simplest form, such a model reflects that each participant performs one operation. However, there may be structures when one participant performs several operations, \(\{u_1', u_2', ..., u_k'\} = f(x_j)\).

Then the cluster structure \(U_r\) with multiple operations for two participants can be like this. \(U_r \to \{u_1 \to \{u_1', u_2', ..., u_k'\} \to u_3 \to ... \to \{u_\ell', u_\ell''', ..., u_{\ell'''}\}\}\).

Spatial networks, in a generalized form, can also be represented by interconnected business chains, the participants of which can be both industry and territorial agents. The same participants can enter chains of various types and types.

The network structure consists of, i.e.:
- $K$ cluster of industrial type, $Y = (Y^1, Y^2, Y^3, \ldots, Y^K)$, where each cluster consists of $n$ participants, $Y_j = (y^1_j, y^2_j, \ldots, y^n_j)$.
- and $M$ cluster of spatial type, $X = (X^1, X^2, \ldots, X^M)$, where each cluster of this type includes $p$ participants, $X_j = (x^1_j, x^2_j, \ldots, x^p_j)$. Participant of an industrial cluster $(y_j)$ operates $w_j$, $w_j = f(y_j)$. When implementing several operations, we have $\{w^1_j, w^2_j, \ldots, w^k_j\} = f(y_j)$.

Then the spatial network model can be represented as the following system

$$
\begin{align*}
U^1_r & \rightarrow \{u^1_1 \rightarrow (u^2_1, u^2_2, \ldots, u^2_k) \rightarrow u^3_1 \rightarrow \ldots \rightarrow (u^n_1, u^n_2, \ldots, u^n_m)\},  \\
U^2_r & \rightarrow \{u_{21} \rightarrow (u^2_1, u^2_2, \ldots, u^2_k) \rightarrow u^3_3 \rightarrow \ldots \rightarrow (u^n_1, u^n_2, \ldots, u^n_m)\},  \\
\ldots
\end{align*}
(2)
$$

Each business chain of such a network system defines a separate network layer (level), within which members of various industries and territories operate, interacting both within the chain and with other chains and the external environment.

Given such a network structure of the economic system in the form of a multilevel network, its generalized development strategy can also be represented as a multidimensional network of functional growth strategies.

Considering network-type structures as one of the types of integrated economic systems, oriented in particular in space, we consider some of its definitions.

In the process of developing network systems, their important component is an adequate and effective policy for strategic growth of both the entire system and its participants, which allows you to formulate and implement strategic development processes and effectively manage them for the sustainable development of the system as a whole.

Moreover, such strategies should involve all participants in the business chain, both industrial and territorial, to strengthen competitive advantages and business activity, pursue an effective investment and innovation policy, provide benefits to economic territories, promote the growth of production specialization and strengthen the synergy of development.

3.4. Structural model of a network system.

Based on the concept of a network system in the form of a network of interconnected elements (value business chain), you can specify its model $(S)$ in the form of a systematized set of elements of a spatial industry system, in which territorial clusters participate $\{K_j\}$ and industrial networks $(y^1, y^2, \ldots, y^t)$, $S = (\{K_j\}, (y^1, y^2, \ldots, y^t))$ or,

$$
S = \bigcup_{j=1}^{m_1}(U_{j=1}^{l_1}(K^j)) \cup \bigcup_{b=1}^{l_2}(y^1_b, y^2_b, \ldots, y^t_b)  \big)
(3)
$$

The network development strategy is determined by the vector, where each of its components defines a functional growth strategy. And the parameters of the vector component are determined by the strategic objectives of growth that the participants have in this functional area. Thus, the development vector is a set of matrices, including: resource matrices, interaction matrices, target functional matrices of development trajectory states.

For example, the set (matrix) of relationships $R$ defines the flows of relationships of agents (participants) double (direct and inverse) and not equivalent to each other, moreover, the matrix element is determined by the following characteristics:
is the type of relationship (technological, material, informational, functional (financial, managerial, investment, etc.))

\( V \) is the level of interaction force for each participant, \( V = (v_{xi}, v_{xj}) \), specified on the pair \((y_i, y_j)\),

\( P \) is the level of potential of the participant, forming the needs of interactions,

\( D \) is an environmental pressure (competition, environmental policy, consumer pressure, etc.),

\( BS \) is the policy of managing the development of the economic system.

4. Discussion

The economic development policy of network forms of economic systems has its own characteristics and defines many procedures, tools and mechanisms for the formation and management of business chains and the network as a whole, providing balanced growth opportunities for the entire system as a whole and for each participant.

By defining the structure of a complex networked system, the following types of business chains can be distinguished: - production business chains; - business chains of auxiliary functions; - management business chains; - business chain of organization of services for management and production.

Naturally, the development strategy of such an ES is very complex and requires flexibility, synchronization, and a balance of interests and resources not only of individual participants, but also of cluster groups where participants in the business chain operate.

Strategic management of the development of complex integrated economic systems involves the formation and implementation of a set of measures and actions based on regular strategic tools and mechanisms that ensure the development of priority areas of corporate activity. The formation of a development strategy is one of the key tasks of the economic system of any organizational complexity, the success of which depends on many factors, including the structural complexity of the system itself.

Determining the parameters of the development strategy of the network economic system, we formulate some of them:

- a goal tree that takes into account the system development goals and the basic goals of each network member, taking into account possible alternatives;

- a matrix of strategies for the functional growth of participants, which defines a system of strategic opportunities for the development of the entire network and each participant and represents alternatives to strategic development (chains of interconnected functional strategies focused on the development of a particular participant);

- the budget of the development strategy (the totality of the budgets of the participants and the possibilities for reinvesting) in the form of forecast alternatives for the basic strategic target areas of development;

- a matrix of strategic resources (economic development potential) that are necessary for the implementation of functional strategies;

- matrix of interactions of participants in business chains in the form of pairwise interactions (by functional, resource (finance, investment, time, information, etc.), other network interactions, including with the external environment;

- matrix of possible risks and synergies in the development process;

Thus, the development strategy of a network-type economic system is a set of strategies for the functional growth and development of each network member, \( S \subseteq \{(S_f\beta, S_f\gamma, \ldots, S_f\eta), (S_y1, S_y2, \ldots, S_ym)\} \), where each strategy from \( S' = (S_f\beta, S_f\gamma, \ldots, S_f\eta) \ \subseteq S \), is a conglomeration of functional-specific strategies, for example, the development of financial activities, investment, innovation, marketing, production, distributed by participants \( S'_j = (S'_f\beta, S'_f\gamma, \ldots, S'_f\eta) \ \subseteq S \), taking into account the operations and functions performed, the level of development potential, the typology of business chains in the operations of which the active network element is involved.

Each participant’s development strategy, \( S'_j \), in turn, represents the totality of its inherent tasks for solving functional strategies. \( S'_j = \{S'_f\beta, S'_f\gamma, \ldots, S'_f\eta\} \).

Such a set of strategic elements can be represented in the form of the following strategic matrix

(Table 1)
Table 1. Matrix of development strategies for network participants

| Options for network member development strategies | Functional Types of Growth Strategies | Marketing |
|-----------------------------------------------|-------------------------------------|-----------|
|                                               | Financial                           | Productive| Marketing |
| SY₁                                           | S₁¹                                 | S₂¹       | Sₖ¹       |
| SY₂                                           | S₁²                                 | S₂²       | Sₖ²       |
| ...                                           | ...                                 | ...       | ...       |
| SYᵣ                                           | Sᵣ¹                                 | Sᵣ²       | Sᵣₖ       |
| ...                                           | ...                                 | ...       | ...       |
| SYₘ                                           | Sₘ¹                                 | Sₘ²       | Sₘₖ       |

And each strategic element Sᵢⱼ of this matrix is a set of strategic tasks of functional growth (action program or project impacts), leading the participant to a specific target functional state \(F_C\) in a specific direction of activity \(A_j\), and the entire system to the required target parameters.

However, the development strategy of network-type economic systems has a large degree of environmental uncertainty both at the time of the formation of target strategic states and in the process of controlled development. Reducing uncertainty in management requires coordination in the actions of participants in the business chain of the network. By determining the required level of balance of interests of participants and the degree of coordination of interests and resources, it is possible to obtain the effect of synergy of development, which multiplicatively enhances the operational efficiency of the entire economic system. With the wrong balance and diverging interests, development risk generation is possible.

Therefore, an important element of the strategy is the determination of many additional restrictions on the system of interactions and relationships of participants in the structure of business chains of the economic system [2,8]. The problems of interactions and relationships, within the framework of the economic opportunities of entrepreneurial networks, are considered in the works of G. Bagiyev [20], the methodology for reconciling the interests and resources of economic agents is considered in works on the theory of active systems [6,18].

5. Conclusions

The paper considers the problem of generalization and structuring of network forms of business organization, builds a typology of an entrepreneurial network and analyzes the structural model of a widely used spatial-branch network.

Such network systems are many value chains (business chains) that interact with each other and define the network structure of the economic system.

The model of the economic system is represented as a spatial network graph with groups of peaks, which are a network of clusters of a territorial type and an industry cluster of participants united by certain economic relations and interactions, in accordance with certain conditions.

As the basic layer (level) of such a system, the spatial organization of territorial business chains (with which industry participants in the economic system interact) is accepted. An important condition for the development process of such systems is the formation of an effective economic development policy.

References

[1] Didenko N I, Skripnuk D F, Kikkas K N, Merkulov V, Romashkina G and Kulik S 2018 The analysis of convergence — Divergence in the development of innovative and technological processes in the countries of the Arctic Council Int. Conference on Information Networking pp 626-631
[2] Afonichkina E A, Afonichkin A I, Stepanova M M and Tokareva E U 2019 The International Arctic Consortium Model IOP Conference Series: Earth and Environmental Science 302(1) 012019
[3] Antipov S 2018 Neural network model as a way of processing complex systems of econometric equations characterizing the interaction of the Russian Arctic MATEC WEB of Conference 170 01025
[4] Didenko N I, Kulik S V, Kikkas K N and Kudriavtceva R 2018 Models of the impact the global crisis has on the world economy *International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management* **18**(5.3) pp 585-592

[5] Didenko N I and Cherenkov V I 2018 Economic and geopolitical aspects of developing the Northern Sea Route *IOP Conference Series: Earth and Environmental Science* **180**(1) 012012

[6] Gerasimov K and Prosvirkin N 2015 System of control of effectiveness of enterprise cooperation in industrial cluster *European Research Studies Journal* **18**(3) pp 263-270

[7] Kikkas K 2018 Territorial-sectoral modelling of the automotive industry in the Russian Federation **180**(1) 012015

[8] Afonichkina E A and Afonichkin A I 2018 Synergies of the Economic Development of the Arctic Cluster System *IOP Conference Series: Earth and Environmental Science* **180**(1) 012011

[9] Dyatlov S A, Didenko N I, Lobanov O S and Kulik S V 2019 Digital transformation and convergence effect as factors of achieving sustainable development *IOP Conference Series: Earth and Environmental Science* **302**(1) 012102

[10] Smorodinskaya N and Katukov D 2017 The impact of global value chains on national economic systems and the challenges facing Russian economic policy *Social Sciences (Russian Federation)* **48**(4) pp 45-51

[11] OECD 2013 *Mapping Global Value Chains* Available from: http://www.oecd.org

[12] Powell W W and Smith-Doerr L 1994 Networks and economic life *The Handbook of Economic Sociology* Princeton Prinsrton University Press

[13] Solvell O, Ketels C and Lindqvist G 2008 Industrial specialization and regional clusters in the ten new EU member states *Competitiveness Review* **18**(1-2) pp 104-130

[14] Gradoselskaya G, Shcheglova T and Karpov I 2018 Information Waves on Social Networks: Problematization, Definition, Distribution Mechanisms *Proceedings of 2018 11th International Conference Management of Large-Scale System Development* 88551888

[15] Kharlamov A, Gradoselskaya G and Dokuka S 2018 Dynamic semantic network analysis of unstructured text corpora *Lecture Notes in Computer Science* **10716** pp 392-403

[16] Roth M S and Dakhli M 2000 Regional trade agreements as structural networks: implications for foreign direct investment decisions *Connections* **23**(1)

[17] Mathews M D 2007 General economics systems stability states and negative synergy *Int. Advances in Economic* **13**(2)

[18] Gerasimov B N and Gerasimov K B 2015 Modeling the development of organization management system. *Asian Social Science* **11**(20) pp 82-89

[19] Porter M E and Kramer M R 2006 Strategy and Society: The Link Between Competitive Advantage and Corporate Social Responsibility *Harvard Business Review*

[20] Bagiev G L, Pogrebova O A and Konnikov E A 2017 Marketing platform of organization of system-spatial complex "pSE" (Production - Science - Education) *Proceedings of the 2017 International Conference Quality Management, Transport and Information Security, Information Technologies* pp 466-470