

UDC 334.7

**MANAGEMENT OF INTER-SUBJECT INTERACTION
OF INDUSTRIAL ECOSYSTEM PARTICIPANTS**

**УПРАВЛЕНИЕ МЕЖСУБЪЕКТНЫМ
ВЗАИМОДЕЙСТВИЕМ УЧАСТНИКОВ
ПРОМЫШЛЕННОЙ ЭКОСИСТЕМЫ**

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Keywords: inter-subject interaction, industrial ecosystem, management, specific organizational forms, ecosystem effects.

Ключевые слова: межсубъектное взаимодействие, промышленная экосистема, управление, специфические организационные формы, экосистемные эффекты.

Abstract. The relevance of the study is due to the fact that in the field of industrial production, the implementation of integration processes for the design and deployment of scientific and technological chains that produce finished competitive products is often carried out within the framework of ecosystems representing specific organizational forms, the task of which is to streamline the interaction of independent entities in order to obtain positive synergistic effects. The subject of the study was the organizational and economic relations that arise in the process of forming an organizational mechanism for managing the inter-subject interaction of ecosystem participants.

Аннотация. Актуальность исследования обусловлена тем, что в сфере промышленного производства реализация интеграционных процессов проектирования и развертывания научно-технологических цепочек, производящих готовую конкурентоспособную продукцию, зачастую осуществляется в рамках экосистем, представляющих конкретные организационные формы, задачей которых является упорядочение взаимодействия независимых субъектов с целью получения положительных синергетических эффектов. Предметом исследования стали организационно-экономические отношения, возникающие в процессе формирования организационного механизма управления межсубъектным взаимодействием участников экосистемы.

An ecosystem could be clarified as an organizational form of coordination of complementary resources and competencies of legally independent economic entities in order to ensure positive synergy from their interaction. The development of ecosystem is possible due to the motive for increasing the profits of participants, but at

the same time it is limited by the possibilities of obtaining this profit due to the effects generated by a new form of interaction.

Based on this approach, we can distinguish three types of coordination related to the use of the resources of the participants in the industrial ecosystem [1]:

- Firstly, coordination of relations concerning the use of non-specific resources. The absence of the resource rarity property makes it possible to use the market exchange mechanism;

- Secondly, coordination of relations associated with the use of specific resources is based on the principles of hierarchy;

- Thirdly, the use of the hybrid coordination mechanism, which involves the formation of stable network relationships.

The essential characteristics of an ecosystem as a special organizational superstructure should include not only mechanisms for coordinating economic entities, but also iterative procedures for selecting these coordination mechanisms. At the same time, the criterion for the selecting one or another coordination mechanism within the ecosystem is the possibility of achieving positive synergy and the cumulative economic effectiveness of the interaction of ecosystem participants.

Within the framework of the research goals, we have developed a methodology for assessing the partnerships of ecosystem participants, which allows to obtain a comprehensive understanding of the specificity of the connectedness of partners, the forms of coordination of interaction and the formation of additional synergistic effects of the ecosystem.

The methodology we propose allows to determine the specificity of relations between ecosystem participants, which determines their interdependence, taking into account the resource potential of each partner.

The structural elements of the model are of a qualitative nature, therefore, to ensure their comparability when calculating integrated indicators, it is necessary to use the method of expert assessments, which is used to reduce uncertainty and is able to ensure the objectivity, complexity and reliability of management decisions.

Based on the data obtained, characterizing the existing ways of organizing interaction between ecosystem participants, such possible forms of coordination are determined as: market exchange; hybrid form; hierarchy.

In hierarchical structures, a fundamentally different control mechanism is used, based on a vertical power pyramid built on the principle of subordination. The main tool that binds this structure and makes it sustainable is the ownership of assets. Mixed coordination mechanisms are based on a symbiosis to varying degrees of market and hierarchical mechanisms. Organizations using a mixed mechanism of coordination are the result of the transformation of two extreme types of organization of interaction, arising in two diametrically opposite directions [2].

In the works of most authors, the ecosystem, as a specific form of network interaction, occupies an intermediate position between market and hierarchical coordination [3]. In addition, Walter A., Ritter T., Gumedon H. consider partnerships

as an effective mechanism for coordinating work and adapting the economic system to constant changes [4].

Further, the forms of coordination must be analyzed from the standpoint of the formation of additional synergistic effects by calculating the relevant indicators before and after the interaction.

The main indicators of ecosystem effects achieved include: increase in the output of quality products; increase in profits of ecosystem participants; increasing the quality of products; reducing the labor intensity of products; reducing of risks in the implementation of joint activities; growth of qualification of employees with high qualification and some others.

When developing indicators for assessing additional effects, not only infrastructural effects and economies of scale are taken into account through the indicators of output and profits of ecosystem entities, but also the growth of innovation, qualifications, competitiveness, investment attractiveness and risk reduction is assessed [5].

At the next stage of the proposed model, the correspondence between the form of coordination of interaction between ecosystem participants and the interdependence is determined. When the results obtained for all participants of the ecosystem are combined, a complete picture of intersubjective interaction is formed and it becomes possible to manage such a complex object of management as an ecosystem that has a polysubjective structure.

In accordance with the developed methodology, an assessment was made of the interdependence between the participants in the studied industrial ecosystem of NLMK Ural. Most of the relationships that have developed within the NLMK Ural ecosystem are characterized as relationships of a specific nature. Critical relationships, which are characterized by a high level of interdependence between ecosystem participants, are observed only for three partners.

In order to assess ecosystem effects, the indicators of the studied ecosystem proposed within the framework of the author's methodology were calculated for the period from 2010 to 2021, with the allocation of 4 main stages of ecosystem development in accordance with the year the partnership was established.

The results of the study confirm that the NLMK Ural ecosystem needs to modify the ecosystem coordination system in the following areas:

- attraction of partners, the establishment of stable relations with which would allow solving the issues of increasing competitiveness, qualification, innovative activity, risk reduction;
- changing the form of coordination of ecosystem participants from hybrid tools to hierarchical tools related to the value chain and generating significant additional synergistic effects;
- changing the form of coordination of ecosystem participants related to infrastructure service organizations from hybrid instruments to market instruments.

It is important to emphasize that the organization of the ecosystem involves a partial reorganization of the management systems of business partners. Often this problem is

solved empirically, that is, through trial and error, which may lead to the premature termination of cooperation. We propose to solve this problem by creating a coordinating council for managing inter-firm interaction between ecosystem participants, consisting of representatives of partner enterprises. Its main functions should be: development and coordination of goals, objectives and projects of intercompany interaction; organization and control over the implementation of science-intensive projects; assessment with a group of experts of inter-subject relations of ecosystem participants, acting as an initiator, as well as its business partners; development of recommendations for improving the adaptive system of partnerships.

Thus, the recommendations presented above make it possible not only to assess the effectiveness of the organizational mechanism for managing inter-subject interaction of ecosystem participants, but also serve as a tool for timely adjustment, building and maintaining inter-subject relations of ecosystem participants, strengthening the protection of the competitive position of the initiating enterprise.

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