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28 April 2023

Online at <https://mpra.ub.uni-muenchen.de/119340/>  
MPRA Paper No. 119340, posted 11 Dec 2023 13:25 UTC

# **Characteristics of markets for the creation of innovative products and their impact on the mechanisms of interaction between the subjects of the innovation infrastructure**

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**Abstract.** The article presents the results of a study of the main characteristics of modern markets for the production and sale of innovative products (services, technologies). They made it possible to identify new organizational and economic mechanisms of interaction between the subjects of the innovation infrastructure. As a methodological tool, authors used the main provisions of the theories of interconnections and value chains, cooperation and competition, as well as the Henderson-Clark innovation model. Authors carried out the analysis of the main characteristics of existing and new markets for the production and sale of innovative products (services, technologies). Based on the research, authors concluded that at present there is no universal organizational and economic mechanism for the interaction of subjects of innovation infrastructure in the markets for the production and sale of innovative products (services, technologies). For the successful development of innovation activity, usage of a specific mechanism is subject to a comprehensive justification from the standpoint of each subject of the innovation infrastructure.

**Key words:** innovations, new types of products (services, technologies), innovation infrastructure, interactions between subjects, value chains, innovation clusters, hubs, technological platforms.

## **Introduction**

The internationalization of R&D and innovation is the dominant trend in today's economy. Thanks to the development of informatization in almost all areas of production activity, the system of interactions between many economic entities began to function in an interactive mode.

It based not on market signals, but on direct interactions of all market participants through websites and the Internet ([1], [16]). Given this circumstance, most advanced companies have

already moved to the path of internationalization of R&D and innovative developments. To obtain additional competitive advantages and increase profits, they transfer their production to foreign markets, thereby bringing the results obtained in the course of scientific research in the form of innovative products (services, technologies) to their potential consumers. At the same time, advanced companies guided by two main strategic principles: 1) exploitation of assets to obtain information about new markets in order to adapt goods (services) and apply previously developed technologies; 2) search and acquisition of assets through which companies gain new knowledge and access to resources abroad. The implementation of these principles is possible based on taking into account the main characteristics of modern markets for the production and sale of innovative products.

### **Main part**

In modern conditions, for many markets for the creation of innovative products (services, technologies), the following characteristics become predominant.

#### 1. Modularity of many types of modern innovative products (services, technologies).

Modularity predetermines the existence of a situation where the producers of several complementary components of one product are different production structures (companies). At the same time, the interaction of components is a necessary condition for using the product.

In many cases, its creation and marketing requires the combination of several patents and other intellectual property rights [11]. The modularity of many types of modern innovative products (services, technologies) determines the dominance of incremental (gradual) innovations over radical (breakthrough) innovations. The formation of incremental innovations mainly occurs based on already existing technologies and based on well-known areas and systems of knowledge, while radical innovations arise because of the development and implementation of fundamentally new "breakthrough technological solutions" and, in the vast majority of cases, based on newly formed areas and knowledge systems.

American scientists R. Henderson and C. Clark first developed this approach to the classification of innovations in 1990 [15]. The model of innovation management proposed by them is very popular in modern conditions. It based on the allocation of two dimensions in the field of knowledge necessary for the development of new types of products (services, technologies) and the introduction of innovations. These are: 1) measurements of areas and systems of knowledge of the components from which innovative products (services, technologies) created; 2) measurement of knowledge of connections between components, or areas and systems of knowledge into which these components combined to create innovative products (services, technologies).

The Henderson-Clark innovation model shown in Figure 1.

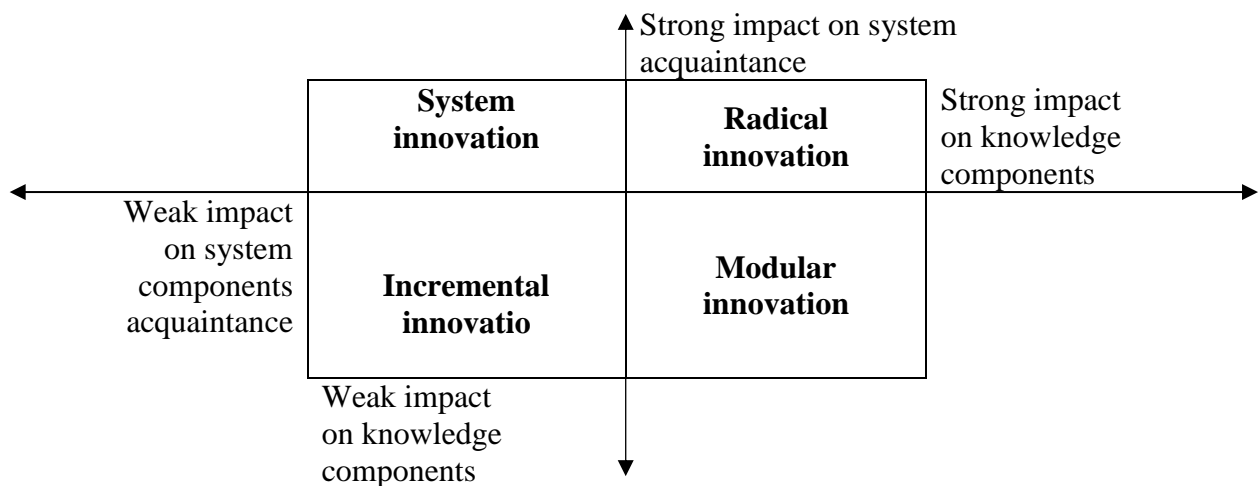


Figure 1. The Henderson-Clark innovation model.

Let us briefly explain the essence of its main components below.

Incremental innovations arise, as a rule, based on small modifications of areas and systems of knowledge about the components of innovative products (services, technologies).

Modular innovations for their creation require the emergence of new areas and systems of knowledge related to one or more components from which innovative products (services, technologies) created, but knowledge of system relationships between components does not require updating.

Systemic innovations occur when serious changes needed in the representation of knowledge areas and systems to form new systemic relationships between the components of innovative products (services, technologies), but knowledge about the components themselves remains the same.

Radical (breakthrough) innovation involves the emergence of new areas and systems of knowledge both about the main components of innovative products (services, technologies) and about the systemic relationships between them.

As you can see, in the Henderson-Clark innovation model, there is already a need to implement various kinds of interactions to combine individual components of innovative products (services, technologies) into a new product based on systemic relationships between them.

During the period of the emergence of innovations, these issues were in the field of activity, as a rule, of one company engaged in the production of innovative products (services, technologies). However, in the context of the globalization of the world economy, individual companies, regions and countries cannot develop the entire range of innovative developments [2]. On the contrary, they strive for a certain specialization in various types of innovations and the development of those that best suit their competencies, economic and other interests. This circumstance predetermines the emergence of the second characteristic of modern markets for the production and sale of innovative products (services, technologies).

2. Development of inter-network interactions at the level of independent producers of innovative products (services, technologies) and economic entities of innovative infrastructure, the presence of which predetermines the growing complexity of value chains in many markets.

A significant contribution to the development of the theory of interconnections made by well-known Russian scientists, Academician of the Russian Academy of Sciences Makarov V.L. and Corresponding Member of the Russian Academy of Sciences Kleiner G.B., Popov E.V. and a number of others. Thus, they argue that humanity can exist only in the form of a society based on the collective consumption of goods ([9], [11]). In addition, noting the importance of strengthening the interconnections of market participants, they emphasize that any independent economic entity that operates within the framework of a network structure is essentially located inside a kind of web of various kinds of interconnections with other economic entities [12]. The joint introduction of innovations under such conditions gives great advantages, given the unity of research topics of scientists and business goals, as well as turning the process of managing value chains into an effective competitive management tool.

The fundamental role of value chains used to identify the sources of competitive advantages and specialized professional competencies of individual companies and cluster structures [5]. Today, traditional value chains have essentially become global. As a result, scientific research, design, development and production of innovative products (services, technologies) no longer represent a single intellectual product owned by one company. Thus, the emergence of global value chains leads to the stratification of the economy of many countries, segmenting it into small niches with fierce competition. At the same time, large corporations forced to restructure their activities, developing it mainly in the field of functions of integrators and providers of access to the strategic investment market.

The desire to achieve sustainable competitive advantages forces manufacturers of innovative products (services, technologies) to enter into closer interactions both among themselves and with economic entities of the innovation infrastructure in order to increase the competitiveness of their products in comparison with other economic entities. This process based on the development of cooperative relationships and interactions between independent producers of innovative products (services, technologies) with economic entities of the innovation infrastructure for the joint creation of additional added value with its subsequent distribution among all interested participants [8].

At the same time, cooperation becomes one of the defining organizational and economic mechanisms for the production of innovative products (services, technologies), and the division of the production cycle into separate operations and specialization in the performance of their individual types contributes to improving the quality of both the operations themselves and the

production of innovative products (services, technology) in general. In this case, the trends of cooperation and competition do not contradict each other, but form additional prerequisites for effective interaction between producers of innovative products (services, technologies) and institutional economic entities of the innovation infrastructure to manage value chains.

For the practical realization of the benefits of developing cooperative relationships and interactions, it is necessary to create innovative technological platforms (TP) as part of the formation of an innovative infrastructure of the regional economy ([6], [10]). They can help at the regional level to concretize existing and develop new organizational and economic mechanisms of competition in the process of interaction between producers of innovative products (services, technologies) and economic entities of innovative infrastructure within the framework of cluster structures, network structures of special economic zones, projects for creating public-private partnerships and others [4]. Consequently, in the processes of development and production of innovative products (services, technologies), there is a transition from linear innovative models to integrated innovative structures - the so-called ecosystems, the results of which are determined by a set of interactions between key participants with specific competencies [14].

In this case, the term "ecosystem" used not exclusively in relation to biological communities. The similarity of the functions and structural features of many economic systems make it appropriate to use this term in the economic sphere. Under the ecosystem in the economic sphere, we mean a system of new organizational and economic mechanisms that promote R&D developers, manufacturers of innovative products (services, technologies), and founders of start-ups from an innovative idea to the creation of a production structure that works on this idea. Thus, the innovation ecosystem is an open system that can independently organize, regulate and develop, as well as produce input flows of ideas, value, knowledge, intellectual property and information resources. Specific subjects of economic and social relations operate in the innovation ecosystem [13].

Key components of a successful innovation ecosystem include the following:

- attracting intellectual and financial capital to generate innovations;
- possession of key competencies and the ability to benefit from them;
- ability to produce new components of products (services, technologies) based on new knowledge and breakthrough innovations;
- knowledge of the main trends in the development of the market and the ability to widely disseminate their entrepreneurial opportunities on it;
- balanced attitude to risky innovations;
- concentration of R&D results and organization of information exchange between all institutional economic agents of the innovation infrastructure of the regional economy.

At the global level, each participant in the innovation ecosystem has new functions and new requests, namely:

- educational structures with traditional missions of excellence in teaching and research, moving into the category of “entrepreneurial universities”, should maximize the accumulation of new knowledge designed to generate innovations and bring them to the market;

- public administration at all levels becomes the center of association, stimulation and support of new organizational and economic mechanisms of interaction between institutional economic agents of the innovative infrastructure of the regional economy;

- within the framework of joint network structures, interaction is coordinated and differentiated key competencies are integrated between institutional economic agents of the innovation infrastructure of the regional economy, taking into account their economic interests, goals and capabilities;

- the possibilities of the financial system are used for effective insurance of strategic economic resources;

- in order to successfully solve the problem of competitiveness, it is advisable to use corporate investments in innovations, which make it possible to transfer the quantitative volume of resources and knowledge into qualitatively new innovative products (services, technologies).

Thus, in the context of increasing competition, the interaction of producers of innovative products (services, technologies) with each other and with the institutional economic agents of the innovation infrastructure enhanced through the cooperation of efforts to create additional value added and the competitive bases for its subsequent distribution among them.

3. Complexity and (or) convergence, the presence of which is predetermined by the need to solve the problem of combining inventions and technological solutions developed for previously unrelated sectors in many markets.

Ideally, we can solve this task by the cluster structures of the future by combining the knowledge and professional skills developed by various institutional economic agents of the innovation infrastructure and product manufacturers specializing in different sectors of the economy and having different regional affiliations. The consequences of the changing nature of clusters have revealed the potential of the innovation policy of developed countries, which ensures the economic development of cluster structures through the concept of TA to create joint innovations and exchange information on priority tasks and technological solutions between industrial enterprises, consumers, academia, government agencies and other stakeholders. This new organizational and economic mechanism of interaction should ensure the development of more innovative solutions both in the production sectors of the economy and in the socio-economic problems of society and the state [3].

Today, the participation of research organizations in strategic partnerships as part of territorial clusters is due to the high level of their high-tech industry competencies. That is why in the education sectors of innovative clusters associated with high-tech industrial production, research organizations act as key partners, turning, in essence, from traditional educational structures into entrepreneurial structures of R&D commercialization.

In many industries, the formation of network cluster structures has become the main method of innovative development in both our country and abroad [9]. At the same time, creativity and cooperation as factors of innovative development are more important than capital markets and the level of competition. At the same time, against the background of informatization of all spheres of life of the modern world community, the concept of clusters is gradually giving way to a more progressive model based on the formation of network cluster structures that exchange part of the R&D results, use the network effect and economies of scale for the marketing promotion of innovative products (services, technologies) to sales markets. Therefore, the principle of forming clusters based on geographic proximity is gradually giving way to the principle of community of economic interests, which is the basis for building modern network cluster structures.

In such organizational structures of innovative development, cooperation mechanisms and R&D transferred to on-lain technologies. The importance of initiatives implemented on the principle of joint innovation, which involves the use of the potential for mutually beneficial cooperation between different organizations across networks, is increasing. The concept of "co-innovation" arose as a result of the desire to expand the scope and scope of external partnerships and alliances to gain access to new technologies, knowledge and markets. Recently, this term also used to denote the participation of institutional economic agents and product manufacturers in the development and implementation of innovations, informing about their needs and specific requests for their consideration at the initial stages of R&D. This circumstance is the most important confirmation of the high potential of cooperation mechanisms within the framework of online interactions in the on-lain mode in the era of information technology [16].

The transfer of innovative technologies as part of their commercialization has traditionally been one of the main factors in the development of innovation in industrialized countries that have a highly developed education system and in which university science, based on basic and applied research, generates many innovative solutions. This is necessary for the development of major breakthrough technologies that used in industry, such as photonics, nanotechnology, and a number of others, where university science has accumulated fundamental knowledge. Technology transfer is not only about the exchange of intellectual property and information between universities and industries. Establishment of new companies based on university research and licensing of R&D results by newly created innovative companies on their own behalf requires an ecosystem that



promotes the development of venture capital and the emergence of intermediaries for open innovation [13]. They act on behalf of organizations that develop innovative solutions in collaboration with other companies. Their task is to establish contacts between knowledge centers that not interconnected due to structural reasons, which caused by insufficient diversification of the company. These intermediaries offer one or more open innovation methods, such as idea contests, broadcast searches, co-creation toolkits, and value-added services for the innovation process ([2], [7]). At the same time, technological innovation centers become a kind of strategic nodes for the national innovation system (NIS) of any country. Initially conceived as geographic hubs for manufacturing and supplying companies, service providers, brokerage firms (including finance) and research and development organizations, these centers became the innovation catalysts and stimulators of competitiveness growth, as well as global producers of new knowledge, both from the point of view of countries and regions of their location, and from the standpoint of managing global value chains.

### **Conclusion**

As a result of the analysis of the main characteristics of modern markets for the production and sale of innovative products (services, technologies), authors identified new organizational and economic mechanisms for the interaction of subjects of the innovation infrastructure. Authors established that there is no universal mechanism, method or model, the use of which could ensure success in the development of innovative activity. In this regard, it seems obvious that the successful development of innovation activity ensured to a comprehensive justification for the integrated use of one or another mechanism in relation to the real conditions of the economy and the practice of interaction between production structures and economic entities of the innovation infrastructure.

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