IRSTI 06.56.31

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THE INFRASTRUCTURE OF THE NATIONAL INNOVATION SYSTEM

The article is devoted to one of the most urgent problems of Kazakhstan's economy – innovation infrastructure. In the presented work approaches to the definition of the concept of «innovative infrastructure» of various authors, legal sources, including Kazakhstan ones, are considered. The institutes that form the innovative infrastructure in the Republic of Kazakhstan are determined. Key trends in the development of innovative infrastructure are identified at the present stage of its formation in our country. The article gives different views on the components of the innovation infrastructure and considers it necessary to introduce additional elements such as the commercialization of intellectual property and state regulation of innovation and its infrastructure. The text refers to the total number of elements of the innovation infrastructure, the number of its individual elements.

Key words: innovations, innovative infrastructure, commercialization of intellectual property, components of infrastructure.

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Инфраструктура национальной инновационной системы

Статья посвящена одной из актуальнейших проблем экономики Казахстана – инновационной инфраструктуре. В представленной работе рассмотрены подходы к определению понятия «инновационная инфраструктура» различных авторов, из правовых источников, в т. ч. и казахстанских. Определены институты, образующие инновационную инфраструктуру в РК. Выделены ключевые тенденции развития инновационной инфраструктуры на современном этапе её формирования в нашей стране. В статье приведены различные взгляды на составляющие элементы инфраструктуры инновации и считают необходимым дополнительно ввести такие элементы, как коммерциализация интеллектуальной собственности и государственное регулирование инновации, её инфраструктуры. В тексте названы общее количество элементов инновационной инфраструктуры, численность отдельных её элементов.

Ключевые слова: инновации, инновационная инфраструктура, коммерциализация интеллектуальной собственности, составляющие элементы инфраструктуры.

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Ұлттық инновациялық жүйенің инфрақұрылымы

Аталмыш мақалада Қазақстан экономикасының ең өзекті мәселелерінің бірі – инновациялық инфрақұрылымға арналған. Зерттеу барысында түрлі авторлардың «инновациялық инфрақұрылым» ұғымына байланысты берген анықтамалары сараланды, Қазақстан Республикасында инновациялық инфрақұрылымды қалыптастыратын институттар анықталды. Инновациялық инфрақұрылымды қалыптастырудың негізгі бағыттары сарапталып, қазіргі таңдағы Қазақстан Республикасындағы инновациялық инфрақұрылымның даму деңгейі анықталды. Сонымен қатар,

инновациялық инфрақұрылымның құрамдас элементтері туралы әр түрлі пікір ұсынылды әрі аталмыш ұғымның толыққандылығы үшін инновациялық зияткерлік меншік, мемлекеттік реттеу, оның инфрақұрылымын коммерцияландыру секілді қосымша элементтерін енгізу жайлы ұсыныс жасалды. Мақалада инновациялық инфрақұрылымның элементтерінің жалпы саны, оның жеке элементтерінің саны көрсетілген.

Түйін сөздер: инновациялар, инновациялық инфрақұрылым, зияткерлік меншікті коммерциализациялау, инфрақұрылымның компоненттері.

Introduction

Foundation and development of a new type of economy is impossible without adequate infrastructure support, therefore, so simultaneously with the development of an innovative economy, an innovative infrastructure should be formed. In 1987 K. Freeman's work «Technology, Politics and Economic Efficiency» the notion of a national innovation system is introduced, which is defined as «a network of public and private sector institutions whose action and interaction allow the initiation, adaptation, modification and transfer of new technologies» 1, p. 16]. Consequently, science, technique and technology, in a modern market economy, without the support of a «network of institutions of the public and private sectors,» is now impossible to promote, even more so to integrate their development into practice. For modern Kazakhstan, the problem of detachment of science from production is very acute, which objectively raises the issue of creating an efficiently operating innovation infrastructure.

Materials and methods

During the preparation of this material, more than a hundred different scientific articles, monographs, materials of scientific conferences, various electronic resources were studied. The literature listed in the references was used while writing. Among the materials are the works of domestic economists, Russian, Ukrainian, Belarusian authors of textbooks, study tutorials, scientific articles and monographs, as well as authors of foreign countries. In addition, the formulation of the problem under investigation follows from the content of the Laws of the Republic of Kazakhstan «On Innovative Activity», «On the Commercialization of Scientific and / or Scientific Results», «On State Support for Industrial Innovative Activities». Many actual data on the innovation infrastructure were collected from electronic resources and scientific research of Kazakhstani authors

The mechanism for managing innovation processes requires the formation of an integrated innovation infrastructure, the commercialization of innovative products and services, including institutions for the protection of intellectual property rights and insurance of risks, financial, information and personnel support of innovation activities [2, p. 28].

Continuous improvement of the innovation infrastructure will stimulate the activity of high technology and high-tech entrepreneurship [3, p.23], which in turn is a key factor in the development of the country's innovative potential. Accordingly, the main direction of development of the national innovation system is the creation of such an innovative infrastructure that will allow integrating the resources and directions of the action of science, technology and technology, the state and business.

The effectiveness of innovative activity is determined by the development of the country's innovative infrastructure, thus, the innovation infrastructure is the basic component of the innovation economy, the innovative potential of society. It is also the main tool and mechanism of an innovative economy that can raise the country's economy to a high level of development [4, p.124].

In the process of researching the essence and specifics of the innovation infrastructure functioning, we will consider it as a complex, multifactorial economic category. The term «infrastructure» is formed from the Latin words «infra» – below and «structura» – the structure, the lower part, which can be interpreted as a basement or foundation. The study of questions on the essence of infrastructure in the writings of Western scholars and economists [5; 6; 7; 8; 9; 10; 11] leads to the conclusion that they define the infrastructure as a set of general conditions that ensure the development of entrepreneurship and are aimed at meeting the basic needs of the population.

The term «infrastructure» was first applied in the studies of Western economists. So, the problem of the interrelation of production with its servicing branches arose long before the appearance of the term «infrastructure», which was addressed in due time by R.Nurks, P.Rosenshtein-Rodan, A.Hirshman and others. In the economic literature of the former USSR, the study of infrastructure

problems began only in the 1970s. Researchers recognize that infrastructure is an indispensable component of any integral economic system, while emphasizing its multidimensionality and breadth of the range of fundamental services that they provide at different stages of the innovation process [12, p.71].

In turn, the innovation infrastructure is a subsystem of market infrastructure. As an independent subsystem, an infrastructure is a set of organizational and legal forms that facilitate the movement of goods and services, acts of sale or purchase, or a set of institutions, systems, services, enterprises that serve the market and implement a certain purpose in ensuring a normal regime for its functioning. [13].

The content of the concept of «infrastructure» is extremely wide, the main types and organizational forms depend on the purpose. In general, the infrastructure is a set of structures, buildings, systems and services that are necessary for the functioning of the branches of material production and ensuring the conditions for the life of society. Sometimes the term «infrastructure» refers to a complex of infrastructure sectors of the economy (transport, communications, education, health, etc.).

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Infrastructure in a market economy is a specific system of interconnected institutions, the objective function of which is to create common conditions for the functioning of economic entities in different markets. This understanding of the infrastructure allows us to consider it as a whole as a complex of institutional, innovative, credit, financial, industrial, commercial, information, environmental and social infrastructures. Summarizing the approaches to determining the economic essence and content of the infrastructure, it can be concluded that there are methods for an expanded and limited interpretation of infrastructure as an economic category. The national innovation system consists of an inherent unique set of elements, each of which implement its function. The analysis of a number of works (14, 15, 16, 17,) devoted to the problems of national innovation systems made it possible to single out the following elements:

• state policy aimed at the creation and functioning of a national innovation system;

• the legal framework regulating relations arising in the framework of innovation activity in general.

Infrastructure in a market economy is a specific system of interconnected institutions, the objective function of which is to create common conditions for the functioning of economic entities in different markets. This understanding of the infrastructure allows us to consider it as a whole as a complex of institutional, innovative, credit, financial, industrial, commercial, information, environmental and social infrastructures. Summarizing the approaches to determining the economic essence and content of the infrastructure, it can be concluded that there are methods for an expanded and limited interpretation of infrastructure as an economic category. The national innovation system consists of an inherent unique set of elements, each of which fulfills its function. The analysis of a number of works (14, 15, 16, 17,) devoted to the problems of national innovation systems made it possible to single out the following elements:

• state policy aimed at the creation and functioning of a national innovation system;

• the legal framework regulating relations arising in the framework of innovation activity in general;

• Innovation infrastructure;

• financial system;

• human resources;

• information (knowledge, innovations, innovations).

It is obvious that innovation infrastructure plays a key role in the national innovation system [18]. The function of the innovative infrastructure is to organize the transfer of scientific developments and achievements into the sphere of economic relations. It is this role of the commercialization of innovations that determines the importance of this element of the system. In Kazakhstan, the problem of detachment of science from production is very acute, therefore, the creation of an efficiently operating innovation infrastructure is, to date, a priority.

To disclose the economic content of the concept of «innovation infrastructure», we give sev-

eral definitions. According to the scientists of the Kazakh State Scientific and Research Institute of Scientific and Technical Information, the innovation infrastructure is «... enterprises, organizations, institutions that promote and carry out innovative activities» [19, p. 12]. In this definition, the organizational, legal, informational and economic components of the phenomenon under consideration are missed.

The essence and content of the concept of innovative infrastructure to some extent reflects the definition proposed by S.T. Kupeshova, according to which «innovation infrastructure is usually understood as a set of organizations that promote innovation, providing favorable conditions for the innovation process, including technological Parks, business incubators, consulting and engineering firms, innovation and venture funds, research centers and other specialties organizations «[20, p. 102].

Another definition of innovation infrastructure is as follows: «... organizations, firms, associations covering the entire cycle of innovation, starting with the generation of new scientific and technical ideas and their development and ending with the release and sale of science-intensive products, which are a set of interrelated and complementary each other systems and corresponding organizational elements necessary and sufficient for the implementation of these activities «[21, p. 27].

The following definition is also represents interest: «Innovation infrastructure, functionally linked to innovation. It ensures the functioning and updating of the innovation sphere, the focus on the needs of the market and the effectiveness of innovation. The basic elements of the project include information infrastructure and organizational support infrastructure. The first provides necessary information for beginning innovators (consulting firms, independent expert firms) and possible consumers of innovations (centers for demonstrating advanced technologies). The second one accompanies the innovation process with services – consulting on management, marketing, leasing, taxation, legal advice, assistance in finding and renting premises, equipment, etc. «[22, p. 12].

Innovation infrastructure, like any other system, consists of many elements acting in accordance with its laws and hierarchical structure. The basis of the innovation infrastructure is the production and technical structures (technology parks, technological business incubators, etc.). The objects of the information system include analytical and statistical centers, information networks and bases, scientific libraries, training and retraining organizations in innovation management, financial institutions (innovation and venture funds, insurance companies), examination systems, patenting, certification, standardization, accreditation, etc. [23, p. 48]. The largest and most widespread elements of the innovation infrastructure are technoparks and technopolises.

In the above definitions, the most important element of the innovation infrastructure in a market economy has been missed: the commercialization of scientific and scientific and technical products. This element is especially important for post-Soviet countries, because in the Soviet economy there could be no question of this. Moreover, none of the above interpretations refers to the role of state regulation in the creation of an effectively functioning national innovation system and the transition to an innovative development path. Although many scientific approaches speak of the role and significance of the state and politics, few of them show the mechanism for their implementation. The real mechanism for introducing state policy into practice is state regulation, which is implemented through plans, programs, public funding, etc. These points emphasize that in order to provide an innovative «breakthrough» in economic and social relations, it is necessary to change the methodological approach to the formation and functioning of an innovation infrastructure [24, p.163].

The given spectrum of interpretations of the essence of the concept under consideration testifies to the lack of unanimity in views and clarity in its definition. The essence of the concept of «infrastructure» is extremely broad, the main types and organizational forms depend on its functional purpose. Thus, clarity in the content of the economic category «innovation infrastructure» can be brought about by studying its epistemology. First, the innovation infrastructure is an artificially created environment that is designed to stimulate innovation. Secondly, the innovation infrastructure is a dynamic self-regulating system of markets and actors operating in it that enter these markets in certain economic relations within the limits stipulated by the laws and regulations of the country and ensure the creation of the necessary conditions for the expanded reproduction and marketing of innovative products, technologies, services.

The main goal of the formation and functioning of the country's innovation infrastructure is to provide both integrated innovative activities and the preservation and development of the scientific and technical potential of the country in the public interest, including overcoming the decline in

production, restructuring its structure, changing the product range, creating new products, processes.

Complex, complex nature of innovative processes, high level of technical, industrial, commercial and other risks of innovation make it impossible for successful functioning of innovative organizations without the formation of a special supporting infrastructure, creating an enabling environment for innovation actors. In the absence of elements of such infrastructure, the successful implementation of innovative projects becomes an accidental exception, which most unfavorably affects the innovative climate [25, p.27]. The innovative infrastructure determines the pace of development of the country's economy and the growth of the well-being of the population. The experience of developed countries shows that in the conditions of global competition in the world market, the one who has developed infrastructure for creating and implementing innovations, an effective mechanism of innovation, wins [26, p.125].

The process of forming an innovative infrastructure is implemented with the aim of providing active support to innovative enterprises and assisting in the creation and practical implementation of new scientific, technical, production, managerial and social-organizational proposals to better meet the economic, social and economic needs of society. The market essence of the innovation infrastructure is revealed in the system of specific features of its constituent elements and their influence on innovation processes.

A large number of organizations, subjects of innovation, performing the functions of servicing and promoting innovative processes, form an innovative infrastructure. That is, an innovative infrastructure is an organization that facilitates the implementation of innovation activities [16, p.27]. Innovative infrastructure unites organizations of various types: firms, investors, intermediaries, scientific and government institutions that cover the entire innovation cycle from the generation of a scientific and technical i to its implementation in the form of a new product, new technology, new services, and a new management organization. Today there are 133 research institutes, 17 development institutes, 19 laboratories of various profiles, 11 techno parks, 147 universities, 10 free economic zones, 4 research bureaus, 8 venture capital funds, 1 autonomous cluster fund, 1 center scientific and technical information, 1 center of state scientific and technical expertise, science fund, national institute of intellectual property, national library, national academic library, central scientific library, republican scientific and pedagogical library, republican scientific and technical library, a number of regional scientific libraries, about 20 business incubators (BI), about 15 coworking centers (KC) and information-analytical publications.

The prerequisite for the creation of an innovative infrastructure in independent Kazakhstan is the regulatory and legal framework on the basis of which new elements of infrastructure support for innovation were created. Thus, the Law «On Innovation Activity» of July 3, 2002, for the first time uses the concept of «innovation infrastructure» as «a set of organizations that perform work and provide services necessary for the implementation of innovation activities». In 2017, the current legislative acts regulating innovation activity in the Republic of Kazakhstan are the Entrepreneurship Code of the Republic of Kazakhstan, the State Program of Industrial and Innovative Development of the Republic of Kazakhstan for 2015 – 2019, the Law «On the Commercialization of Scientific and / or Scientific Results» On Science «, a number of legislative acts on the protection of intellectual property and a nu A large number of organizations, subjects of innovation, performing the functions of servicing and promoting innovative processes, form an innovative infrastructure. That is, an innovative infrastructure is an organization that facilitates the implementation of innovation activities [16, p.27]. Innovative infrastructure unites organizations of various types: firms, investors, intermediaries, scientific and government institutions that cover the entire innovation cycle from the generation of a scientific and technical idea to its implementation in the form of a new product, new technology, new services, and a new management organization. Today there are 133 research institutes, 17 development institutes, 19 laboratories of various profiles, 11 techno parks, 147 universities, 10 free economic zones, 4 research bureaus, 8 venture capital funds, 1 autonomous cluster fund, 1 center scientific and technical information, 1 center of state scientific and technical expertise, science fund, national institute of intellectual property, national library, national academic library, central scientific library, republican scientific and pedagogical library, republican scientific and technical library, a number of regional scientific libraries, about 20 business incubators (BI), about 15 coworking centers (KC) and information-analytical publications.mber of normative legal acts.

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The implementation of innovative ideas, directly implementation of the innovation process, is a sequence of performed, rather complex, often risky operations. Given the formation of a set of favorable environmental factors for innovative enterprises, at various stages of the innovation process, it is possible to hope for the successful implementation of certain innovative projects. Innovative infrastructure is a chain of various auxiliary services, the action of which covers all stages of the innovation process from the emergence of a scientific idea, a proposal for its practical implementation in the form of new production products, goods or services.

Theoretical and methodological approaches to research of the processes of functioning of subjects and objects of innovation infrastructure should take into account their specific features:

high level of uncertainty and riskiness of innovation results;

commercial interest of all subjects of innovation infrastructure and, as a result, the possibility of using market mechanisms to enhance their activities;

a wide range of services offered by infrastructure entities at all stages of the innovation process;

accessibility of services provided by subjects of innovation infrastructure;

the systemic nature of the functioning of subjects of innovation infrastructure, which is determined by the combination of their activities in the process of consistent provision of services at all stages of the innovation process, from the origin of the innovative idea to the receipt of a finished product or product;

dynamism, constant development, improvement of forms and methods of activity of subjects of innovative infrastructure;

the creativity of innovative processes, requiring creative approaches to the supply and realization of services;

professionalism of services, narrow specialization in individual phases, stages of the innovation process;

the need to provide a special legal status to the subjects of the innovation infrastructure, the recognition of the priority of their activities at the legislative level;

social responsibility and corporate ethics of subjects of innovation infrastructure [13, c.38]

Despite the multifaceted nature of the research of infrastructure support for innovative development, there are still a lot of unsolved problems in this area, such as the lack of systematization of the directions that determine the conditions for the formation and functioning of certain infrastructure elements, the lack of an integrated approach to the formation of an institutional environment for the infrastructural support of innovative development, P. The need to intensify innovation is an axiom of the present in the development of the economy, increasing its competitiveness.

It should be noted that innovative infrastructure is the engine of innovative development. It provides horizontal and vertical links between the subjects of innovation activity. The experience of developed countries shows that innovative structures create favorable conditions for the effective operation and development of small innovative enterprises that implement original scientific and technical ideas by providing them with temporary use of production areas, material and technical facilities, information networks, provision of research instruments and equipment, rendering advisory assistance on a wide range of scientific, technological, economic and legal issues.

The conclusion

It is important that the innovation infrastructure should be comprehensive, provide services at all stages of the innovation process and work as a single mechanism – according to a certain logical chain and have a certain algorithm of action. In the course of the research, a holistic understanding of the structural elements of the innovative infrastructure of the Republic of Kazakhstan was created. State regulation, political and legal protection of innovation activities and normative acts that determine the organizational and administrative activities of the innovation infrastructure are also needed. This approach will ensure interaction with those organizations that are not directly related to the creation of innovation, but will significantly affect its further development.

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