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# INNOVATION INFRASTRUCTURE AND ITS ROLE IN THE NATIONAL INNOVATION SYSTEM

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**Abstract:**

The article analyzed the main approaches to defining the concepts of innovation and innovation infrastructure. The subject of the study is innovation infrastructure, which is an important factor in innovation activity. The author proposed the main components of innovation activity within which there is a complex interaction of economic, social and organizational factors that determine the creation of innovations.

**Keywords:** innovation, economics, innovation infrastructure, innovation activity, national innovation system

Today innovation is an active link in all spheres of society. It is impossible to imagine the modern world without existing innovations, those that have already become familiar, and without future ones. Most scientists agree that innovation has become the main driving force of economic and social development. Innovative activities have led the world community to a new, higher stage of development. The concept of "innovation" is used almost everywhere and is a topic of conversation at both the everyday and professional levels, incl. at the level of heads of state, international organizations, etc. Innovation can be understood as the final result of innovative activity, embodied in the form of a new or improved product introduced on the market, a new or improved technological process used in practical activities, a new approach to social problems [1].

The innovative technologies in the world have become the most important effective means and condition for the development of modern production and the economic potential of the state. They combine advanced scientific achievements, the possibility of implementing the latest engineering and technical solutions and modernization of production, mastering the production of new types of products, their mass distribution and market sales.

Most countries in the world are setting themselves the task of transitioning to an innovative economy based on knowledge, and in which the creation, transfer and use of the results of scientific and technical activities are the main conditions for sustainable economic growth. Therefore, in sovereign Uzbekistan, from the first days of independence, much attention is paid to the development of domestic science, leading scientific schools and innovative research. These processes are regulated at the legislative level, which can be seen in the example of a number of decrees and relevant Government resolutions adopted in the field of innovative development.

The basis of the system of state regulation of innovation activity, support and development of scientific and technical activities, increasing the competitiveness of scientific potential in Uzbekistan is the legislative framework based on regulations and decrees adopted in the country.

President of Uzbekistan Shavkat Mirziyoyev approved the strategy for innovative development for 2022–2026. According to the document, the strategy is designed to accelerate the development of innovations and ensure their widespread implementation in all sectors of the economy. For this purpose, a network of innovation infrastructure entities will be formed - technology parks, clusters, technology transfer centers, accelerators and incubators. By 2026, it is planned to increase their number threefold. It is also planned to increase the number of manufacturing enterprises active in the field of innovation to 2250. The volume of commercialization of innovative developments will be increased by 2 times, and the jobs created as a result of innovative entrepreneurship will be increased by 4 times [2].

Innovation benefits the state, since innovative activity at various levels makes a direct contribution to increasing GDP (as a result of increased productivity, disposable income and tax revenues) and contributes to the development of individual industries. Components of the effect for private business, for society, for the state as a whole from the development of innovations:

–improving the quality of life;
–GDP growth;

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- growth of income and profit;
– growth in income of the population;
– diversification of the economy;
–development of new sectors of the economy;
–new employment opportunities;
–reducing inequality;
– accelerating the growth rate of small and medium-sized businesses.

Uzbekistan is consistently moving to an innovative path of development, which is impossible without the widespread introduction into production of new technologies and high-tech products, developed, among other things, by our scientists. A powerful incentive for the further development of innovative activities in the republic was the document "On improving the public administration system in the field of development of scientific and innovative activities" [3].

Innovative infrastructure is the main element and mechanism for the functioning of an innovative economy; it can provide a high level of economic development, and can also cause a severe lag in the rate of economic growth.

Therefore Innovation infrastructure is one of the main elements of the national innovation system. The latter includes a set of legal, financial, socio-economic and information institutions that are characteristic of a given state and influence the conditions for the flow of innovation processes.

The ultimate goal of forming an innovation infrastructure is to create a system of economic entities capable of ensuring the effective implementation of innovation activities in the interests of the entire society.

The objectives of the formation and development of innovation infrastructure are: overcoming the decline in production by restructuring the economy and changing the range of products, increasing the competitiveness of domestic products and the attractiveness of the national economy, preserving and developing scientific and technical potential. The functions of the subjects of innovation infrastructure are different; they depend on the direction of activity, the properties of a specific innovation, the stage of the innovation process, and the goals of state innovation policy [4].

Innovation infrastructure is a basic component of the innovation economy, the innovation potential of society, it is a tool and mechanism of the innovation economy, a set of interconnected, complementary production and technical systems, organizations, firms and relevant organizational and management systems, necessary and sufficient for the effective implementation of innovation activities and the implementation of innovations, to accelerate the pace of development of the country's economy and the growth of the well-being of its population. Innovation infrastructure is a kind of bridge between the results of scientific research and the market, government and business.

The innovation infrastructure in the form of a diagram can be decomposed into the following components which are shown in the table below (Table 1).

Table 1 – General scheme of innovation infrastructure

| Components of innovation infrastructure | Type of organization |
|---|---|
| Production and Technology | Technology Park, center for collective use of equipment, etc. |
| Consulting | Technology transfer center, business incubator, consulting in the field of economics and finance, technology, marketing, foreign economic activity |
| Finance | Budgetary organization, extra-budgetary funds, venture funds |
| Personnel training | System for training specialists in the field of technological and scientific management; personnel development system in the field of innovation |
| Information | State system of scientific and technical information, regional information networks, Internet |
| Sales | Foreign trade association, specialized intermediary company, Internet, exhibition |

It should be noted that innovation infrastructure objects can solve only part of the problems, and the successful development of innovation activities cannot be made solely dependent on the availability or quantity of corresponding infrastructure objects. To function successfully, an innovation system must also have a favorable regulatory framework.

The more detailed description of the role of infrastructure elements and the problems of their development:

1. The production and technological infrastructure is designed to create conditions for small

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enterprises to access production resources. This includes technology parks, innovation and technology centers, technology clusters, etc. Technology Park located on university territory, a complex designed for the development of high technologies. The Technology Park rents out its space to innovative enterprises on better terms than just commercial rent. In addition to rent, a set of general services (fax, telephone, Internet access, duplication, secretarial, accounting and legal services, etc.) are also provided here on preferential terms. The experience of the Technology Park shows the correctness of the strategy and its high efficiency. In addition, here, through the exchange of information and experience between various enterprises, new projects, new solutions, sales schemes, etc. are born. It is also important that in the Technology Park there are no conditions for conducting shadow activities.

The organization of these structures is implemented through the development of a territory equipped with the necessary communications and production infrastructure where small enterprises could first rent and, if they have the financial capacity to buy production space. Another option is to organize Technology Park on the basis of empty or idle enterprises of which there are quite a lot in almost all regions. Such projects are already beginning to be implemented in a number of regions.

The organization of clusters has become recently popular: a collection of enterprises located in one limited area and more or less closely connected by production ties.

It is obvious that providing all small enterprises with modern production equipment is impossible due to the fact that the relatively small volumes of their production do not allow the effective use of modern production equipment. Only a fairly large enterprise can afford to purchase a modern and expensive machine and effectively operate it when producing its own products. For this reason, a huge number of small and medium-sized enterprises are cut off from the use of new technologies in production. A way out of this situation is possible through the collective use of equipment in service centers.

The organization of collective use centers makes it economically feasible to provide a large number of enterprises with access to modern technologies and provides many positive side effects that contribute to the transfer of the Uzbek economy to an innovative path of development.

2. Consulting infrastructure is a set of consulting organizations. Innovative activity has many specific features, knowledge of which can only be acquired through practical experience. The creation of small innovative enterprises (SIEs) by non professional management leads to the fact that the survival rate of such enterprises is usually low. Therefore, providing access to professional advice (financial, economic, marketing, as well as on foreign economic activity) seems to be one of the means of increasing the efficiency of using funds allocated for innovative development.

Technology transfer centers should provide a comprehensive solution to many of these issues. Technology centers are created usually at large universities and academic institutes because they have the most significant potential in the development of new technologies. Technology transfer centers are created either as structural division of organizations with innovative developments or as independent legal entities.

The main problems that began to emerge with the beginning of the development of the network of centers were the lack of qualified personnel. With the solving the personnel the centers can become one of the important structural elements stimulating the development of innovation activities in the regions.

3. Personnel training infrastructure, if we consider in more detail the problems of personnel training a whole range of problems can be found in this area. As noted above, problems with personnel providing research and development are growing. There is an acute problem of a shortage of mid-level technical personnel and skilled workers. The problem of enterprises producing innovative products has recently been the aging of personnel who are carriers of key technologies. Without the entry of young workers, the technologies used may be partially lost.

In developing the training system, it is necessary to provide balanced training in all areas of innovation. However, it should be noted that at present, most enterprises (both large and small) do not have specialists who can competently ensure the promotion of new products to the market. The problem can be solved only by organizing targeted training of such personnel with a planning horizon of 5-10 years (basic training time and practical skills acquisition).

4. Information infrastructure relates to access to information. In this area, there is a fairly extensive network of organizations, including a regional system of public centers for scientific and technical information, structures supporting small businesses, regional information networks. A great deal of information on innovation is available on the Internet.

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The current system quite effectively solves a number of problems. Thus, technical information is currently available in large volumes in almost all areas of science and technology. Access to patent information is not particularly problematic. The main information that can influence the solution of innovative development problems and for which there is a significant deficit is related to information about markets.

Another group of issues related to the information support of innovation activities is related to the communication of new developments to potential users, organization of consultations on their use.

This problem can be partially solved by creating a network of information and analytical centers in priority areas of development of science and technology, as well as on innovation topics. Work is needed to organize the collection, analysis and systematization of information on completed R&D in the regions and in the republic as a whole. Significant efforts should be directed toward communicating information about completed R&D to interested consumers.

5. Financial infrastructure includes structures that provide access to innovative enterprises (both large and small) to financial resources. Currently, there are quite a few financial instruments, but the main source of financing for the development of innovative industrial enterprises is their own funds. Bank loans still remain too expensive for the development of innovative activities. State budget resources are available mainly to large enterprises. Venture capital investment is still low.

Another source of funding for innovation is the involvement of enterprises in international projects. The development of a network of technology transfer centers with the participation of foreign partners will enhance the flow of finance from this source.

6. Sales infrastructure is one of the key factors of competitiveness of modern enterprise. Due to objective reasons related to the history of development of Kazakh enterprises, most of them do not have the personnel and skills in the field of marketing innovative products. As a result, there is no active promotion of innovative products to markets by producers.

The conducted analysis showed that in general it is possible to note a positive trend in the development of innovation infrastructure in the Republic of Uzbekistan over the last decade. The government has made considerable efforts to build and maintain infrastructure.

As a result of the Global Innovation Index 2022 Uzbekistan improved its position by 4 points, taking 82 places out of 132 countries [5]. At the same time, according to a number of key indicators, the country is among the top ten countries in the world. This applies primarily to economic development: in terms of gross capital formation, Uzbekistan ranked 6th in the global ranking, and in terms of labor productivity growth 7th. However, by the current positions of Uzbekistan in the world rating of innovation activity of countries the efforts made by the state are clearly not enough.

At the same time, the organizations themselves related to the objects of innovation infrastructure are not able to fully solve all the problems associated with the development of the national innovation economy of the country. The activities of these organizations should be integrated into the national innovation system. This fact will stimulate business interest in innovation, expressed in the financing of R&D, since a huge share of the costs of financing innovative detail at the initial stage is borne by the state. At the same time, the activities of innovation infrastructure facilities are currently focused on the implementation of priority areas country's policy in the field of education. At the same time, the integration of innovation infrastructure organizations into the national innovation system will stimulate demand for the results of innovation activities within the country.

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