e-ISSN **3041-2498**

Public Management and Policy

https://www.eu-scientists.com/index.php/pmap

Development of innovation infrastructure in countries worldwide

Liliia Oleksenko [1] *

[1] *LLC "Institute of Innovative Bioeconomy" (Ukraine). Senior Researcher, PhD in Economics, Associate Professor.*

*** *Corresponding Author,*** e-mail: liliyaolek@ukr.net

ARTICLE INFO

Research Article

Received:
3 November 2024
Revised:
10 December 2024
Accepted:
12 December 2024
Published online:
26 December 2024

DOI:
10.70651/3041-2498/2024.3-4.03

ABSTRACT

The article examines current trends in the development of innovation infrastructure in different countries of the world. Innovation infrastructure plays a key role in stimulating economic growth and ensuring the competitiveness of national economies. The purpose of the study is to analyse the functioning of innovation infrastructure, its main elements and models, and to identify best practices that can be adapted for development in Ukraine. The article conducts a thorough analysis of the definitions of the concept of innovation infrastructure and its tasks, including ensuring interaction between science, education and production, information support, financing of innovation projects and staffing. The key elements of the innovation infrastructure, such as science and technology parks, technopolises, business incubators and spin-off firms, which contribute to the intensification of innovation activity, are considered. The features of the American, European, Japanese and Chinese models of technology parks are studied. It has been found that the American model is the most advanced and is widely used as a basis for the creation of technology parks in the world. European technology parks are focused on small and medium-sized businesses, while the Japanese model involves the construction of new cities to integrate research centres and industrial production. The Chinese model is based on the active attraction of foreign investment and government support. The development of innovation infrastructure is critical to enhancing the innovation potential of the economy. Ukraine can use the experience of leading countries to create an effective innovation system that will contribute to economic growth, productivity and integration into global markets. Implementation of the proposed areas of infrastructure development, such as the introduction of technology parks and business incubators, will help create a favourable environment for innovation.

KEYWORDS

business incubator, innovation center, innovation infrastructure, innovative territorial structure, science park, spin-off company, technopark, technopolis.

e-ISSN **3041-2498**

Публічне управління і політика

https://www.eu-scientists.com/index.php/pmap

Розвиток інноваційної інфраструктури в країнах світу

Лілія В. Олексенко [1 *]

[1] *ТОВ «Інститут інноваційної біоекономіки» (Україна). Старший науковий співробітник, к. е. н., доцент.*

*** *Автор-кореспондент,*** e-mail: liliyaolek@ukr.net

СТАТТЯ

Дослідницька

отримана:
3 листопада 2024 р.
переглянута:
10 грудня 2024 р.
прийнята:
12 грудня 2024 р.
опублікована онлайн:
26 грудня 2024 р.

DOI:
10.70651/3041-2498/2024.3-4.03

АНОТАЦІЯ

У статті розглянуто сучасні тенденції розвитку інноваційної інфраструктури в різних країнах світу. Інноваційна інфраструктура відіграє ключову роль у стимулюванні економічного зростання та забезпеченні конкурентоспроможності національних економік. Мета дослідження полягає в аналізі функціонування інноваційної інфраструктури, її основних елементів і моделей, а також у виявленні кращих практик, які можуть бути адаптовані для розвитку в Україні. У статті проведено ґрунтовний аналіз визначень поняття інноваційної інфраструктури та її завдань, включаючи забезпечення взаємодії між наукою, освітою та виробництвом, інформаційну підтримку, фінансування інноваційних проектів і кадрове забезпечення. Розглянуто ключові елементи інноваційної інфраструктури, такі як науково-технологічні парки, технополіси, бізнес-інкубатори й фірми «спін-офф», які сприяють активізації інноваційної діяльності. Досліджено особливості американської, європейської, японської та китайської моделей технопарків. Встановлено, що американська модель є найбільш досконалою і широко використовується як базова для створення технопарків у світі. Європейські технопарки орієнтовані на малий та середній бізнес, тоді як японська модель передбачає будівництво нових міст для інтеграції науково-дослідних центрів і промислового виробництва. Китайська модель базується на активному залученні іноземних інвестицій і державній підтримці. Розвиток інноваційної інфраструктури є критично важливим для посилення інноваційного потенціалу економіки. Україна може використовувати досвід провідних країн для створення ефективної інноваційної системи, яка сприятиме економічному зростанню, підвищенню продуктивності та інтеграції на світові ринки. Реалізація запропонованих напрямів розвитку інфраструктури, таких як впровадження технопарків і бізнес-інкубаторів, сприятиме формуванню сприятливого середовища для інноваційної діяльності.

КЛЮЧОВІ СЛОВА

бізнес-інкубатор, інноваційний центр, інноваційна інфраструктура, інноваційний територіальний устрій, науковий парк, «спін-офф» компанія, технопарк, технополіс.

1. Introduction

With the development of the globalization process, the position of the state on the world stage is determined by its overall competitiveness, which, in turn, directly depends on the structure and level of efficiency of the country's innovation system.

The intensification of innovation activity largely depends on the effectiveness of the interaction of all elements of the innovation infrastructure, as a form of interconnection between science and production. Ensuring the innovativeness of the national economy in modern conditions implies not only the presence of scientific and technical potential, stable functioning of the mechanism of financial support for innovation processes, but also the creation of an inseparable chain "science – production", which requires the formation and development of a large number of elements of innovation infrastructure.

2. Literature Review

Many leading scientists are engaged in the study of the problems of development of innovation infrastructure and innovation activity. Thus, O. Esmanov, Y. Shtyka and M. Lynnyk investigate strategies for innovative development of territories, in particular the concept of "smart specialization." The article focuses on the essence and key aspects of approaches to the formation of an innovative environment that contributes to economic security and competitiveness [3]. V. Tsekhanovych (2019) analyzes the models of innovation infrastructure in Euroregions, emphasizing the need for cooperation between territories to stimulate innovation [20]. A. Podlevskyi and O. Sereda (2017) consider the functioning of technology parks, comparing the world experience with Ukrainian realities, pointing to the potential of technology parks in the development of the innovation environment [12]. The role of business incubators in the development of innovations is covered in detail in the works of O. Kondratenko and O. Nikolaev (2018), who focus on the intensification of innovative development through the introduction of incubation programs in Ukraine [5]. Similarly, J. Bibeau, R. Meilleur, and É. St-Jean (2024) investigate the formalization of business incubator networks and their impact on innovation [1]. N. Osadcha (2015) analyzes the intensification of innovation activity in science and technology parks, emphasizing their role in solving global economic challenges [11]. These research papers provide valuable theoretical and practical contributions to the understanding of mechanisms to stimulate innovative development, emphasizing the importance of infrastructure support, business incubators and regional strategies to improve the competitiveness of the economy. At the same time, the problem of adaptation of foreign experience for the development of innovation infrastructure in Ukraine requires additional research.

3. Problem Statement

The article is aimed at analyzing the innovation infrastructure in the countries of the world as one of the elements of intensification of innovation activity in Ukraine.

4. Methods and Materials

In the course of the study of the development of innovation infrastructure in the countries of the world, dialectical methods of cognition of processes and phenomena were used, monographic (for the analysis of innovation infrastructure), abstract-logical (for theoretical generalization and formation of conclusions), comparative analysis (for determining the features and differences of innovation infrastructure in different countries of the world), empirical (for a comprehensive assessment and analysis of the object of study).

5. Results and Discussion

In the Law of Ukraine "On Innovation Activity", innovation infrastructure is interpreted as "a set of enterprises, organizations, institutions, their associations, associations of any form of ownership, which provide services to ensure innovation activity" [13].

According to O. Esmanov, Y. Shtyka and M. Lynnyk [3], innovation infrastructure is "a set of interconnected, complementary production and technical systems, organizations, firms and corresponding organizational and management systems necessary and sufficient for the effective implementation of innovation activities and the implementation of innovations."

Z. Varnalii and O. Garmashova [21] understand innovation infrastructure as a set of interconnected and interacting institutions, the functioning of which is aimed at increasing the efficiency of innovation activity at all stages of the innovation process.

N. Yarkina [22] considers innovation infrastructure as a set of elements that ensure the search and implementation of new ideas of goods and services, materials, methods of production and organization of activities. The functions of the elements of the innovation infrastructure include the search for information about the market, scientific information; conducting research and development, designing new products and technologies for their manufacture, etc.

Thus, innovation infrastructure is a set of enterprises, organizations, institutions, their associations, associations of any form of ownership, the purpose of which is to provide an effective mechanism for integrating all stages of the innovation process, preserving and developing the innovation potential of the country, including promoting scientific and technical activities, stimulating the production of high-tech products, designing and introducing new products and technologies for their manufacture, organizational and marketing decisions [7].

Innovation infrastructure should solve the following set of tasks:

- ensuring the interaction of the scientific sphere, education and production;
- information support, i.e. creating access to scientific, scientific, technical or marketing information that can be used at different stages of the innovation process;
- financial support of innovation activity, which can be carried out at the expense of state funds, resources of domestic and foreign enterprises and organizations, etc.;
- staffing, which provides for the training of scientific and technical workers, as well as professional innovative managers;
- design, technological and production support of innovations;
- examination of innovative projects, programs, as well as certification, standardization and quality control of innovative products;
- diffusion (promotion) of innovations both to national and foreign markets, which includes marketing activities, patent and licensing work, intellectual property protection;
- reducing the level of risks that arise in the process of developing and implementing innovations [14; 20].

To solve these problems, the innovation infrastructure includes various elements, which scientists and experts propose to combine into several groups. In the State Target Economic Program "Creation of Innovation Infrastructure in Ukraine," production and technological, financial and economic, regulatory, territorial and personnel subsystems are distinguished in innovation infrastructure [17].

The formation and development of a new post-industrial society is possible with a sufficiently high level of creative activity of a modern intellectual personality. Therefore, comprehensive measures aimed at the formation and development of innovative territorial structures (ITS) – scientific and technological, scientific, research parks (technology parks), business incubators and technopolises, which contribute to the rise of the economy and the activation of the creative process, have become among the priority state programs in highly developed countries. The implementation and improvement of innovative territorial structures in the world leading countries is the most important state task and an integral part of the state innovation policy. According to many researchers, ITS as complexes of legal, financial and social institutions that ensure the interaction of scientific and entrepreneurial structures and have strong national roots, traditions, political and cultural features, are the most important part of national innovation systems.

To a large extent, this position on ITS is caused by their significant contribution to the innovative development of a particular country. It is important for the creation of effective ITS to unite the efforts of active representatives of various fields of activity at the regional level, since it is here that the fastest and most effective exchange of information is possible, there are all the conditions for the transfer of experience in mastering innovative approaches and methods [10].

The state of development of innovation infrastructure directly affects the development of Euro regional cooperation in the innovation sphere. Regional innovation infrastructure is a set of special innovation institutions and networks that are interconnected and provide development and support for all stages of the innovation process in the region in order to increase its innovation potential [20].

Consider the types of structures that are part of ITS.

Spin-off firms are enterprises that are separated from the structure of universities, independent institutes, state research centers and special laboratories of the largest industrial corporations, where a significant amount of fundamental work is carried out under grants and discoveries and inventions are made. Their mass emergence began in the late 60s for the purpose of commercial organization of scientific achievements, which became a by-product of the implementation of research programs by parent institutions, that is, the implementation of research projects of a fundamental nature by universities and the implementation of research and production programs by industrial companies (under contract agreements).

The stimulating role of the subsidy system is manifested in the fact that spin-off firms are organized mainly by scientists and engineers from universities, independent institutes and corporations, who work mainly on the implementation of government contracts. The peculiarity of these enterprises is that their emergence is associated with the movement of public finances, and further formation and development are based mainly on venture financing [2].

A business incubator is a structure specializing in creating favorable conditions for the emergence and effective operation of a small innovative enterprise (MIP) that implements original scientific and technical ideas. The main purpose of business incubators is to provide MIP with material, informational, consulting and other necessary services, to conduct expertise of innovative projects, search for investors and, if necessary, provide guarantees, etc. [1].

In developed countries, the business incubation model has been working for a long time and has established itself as a powerful driver of innovation in industry. A number of business incubators have been legally established in Ukraine, but they are actually only at the initial stage of operation [5].

The European type of business incubators are innovation and technology centers – legal entities that are created in the form of non-profit organizations to assist innovation entities in the development and implementation of innovative projects, the development of their innovation activities, the protection and representation of their interests in authorities and management, and the protection of intellectual property. World experience has proven that the efficiency of most enterprises that are part of a business incubator (or innovation and technology center) is quite high. According to the National Association of Business Incubators of the United States, the ratio of successful companies to bankrupt companies under normal conditions is 20:80, and in business incubators, on the contrary, it is 80:20 [4].

The development of innovation business incubators as the basis and core of future technology parks, science parks and technopolises seems to be the optimal tactical measure. Their appearance next to academic institutes and universities (or directly within them) would provide a significant number of specialists with creative and highly paid work.

According to the definition of the United Kingdom Science Park Association, a science park is an organization based on private property rights, the main purpose of which is to support start-up companies and incubate innovative fast-growing technology businesses by: creating infrastructure and support services that cooperate with economic development agencies; maintaining official and working relations with the university or a leading research center; active management of technology and knowledge transfer for business development of small and medium-sized enterprises located in the park [19].

The analysis of the functioning of science parks in modern conditions requires clarification of the essence of the varieties of park formations: industrial zone, industrial site, industrial (industrial) park and science park. It should be noted that a significant difference between science parks and classical industrial parks is the presence of large research and educational centers, as well as the focus on R&D and small-scale production of innovative products. In the national institutional environment of Ukraine, there is the following definition of a science park: "... a legal entity created on the initiative of a higher educational institution and/or a scientific institution by combining the founders' contributions for the organization, coordination, control of the process of development and implementation of science park projects" [15].

According to Article 3 of the Law of Ukraine "On Science Parks", a science park is created for the purpose of developing scientific, technical and innovative activities in a higher educational institution and/or scientific institution, effective and rational use of the available scientific potential, material and technical base for commercialization of scientific research results and their implementation in domestic and foreign markets [15]. In the actual definition and purpose of the formation of a science park, the national legislation does not clearly emphasize the support of start-up companies and the incubation of

innovative fast-growing technology businesses. At the same time, support tools, infrastructure and support services are not formulated [11].

Technopolis is a scientific and industrial complex created for the production of new progressive products or the development of new high-tech technologies on the basis of close relations with universities and scientific and technical centers. It combines science, technology and entrepreneurship, and there is close cooperation between academic science, entrepreneurs, local and central authorities.

Technopolis is created in such a way as to facilitate and strengthen the interaction of research and industrial sectors to the greatest extent, to ensure the speedy development and commercialization of scientific research results. Research organizations implement joint scientific and technical projects with industrial companies, sell them licenses and know-how, and participate in the revision and testing of inventions. In the technopolis, access to documents and technologies is facilitated, and "know-how" moves freely. The share participation of scientific organizations in the costs and profits of industrial companies obtained through the implementation of joint scientific and technical projects, the use of students and employees of scientific organizations, research laboratories, scientific instruments and equipment for their implementation is widely practiced.

The key factors of the successful development of the technopolis can be considered the development of a radical plan for its formation, the creation of a critical mass of talented scientists, engineers and entrepreneurs, the presence of close ties between academic science, industry and authorities, the wide involvement of risk capital and other financial resources [2].

The most effective element of innovation infrastructure both in Ukraine and around the world has become territorial-industrial and scientific complexes – technology parks.

A technology park or technology park is a legal entity or a group of legal entities acting in accordance with a joint venture agreement without creating a legal entity and without pooling contributions in order to create organizational foundations for the implementation of technology park projects for the production implementation of high-tech developments, high technologies and ensuring the industrial production of products competitive on the world market [16].

The task of technoparks is not only to stimulate the formation of new MIPs using the results of scientific research of university, academic and other research centers, but also to create conditions for these enterprises that would allow them to go through all stages of the cycle of promoting scientific knowledge in the material sphere in a shorter time and at lower costs, and contribute to the transfer of technologies. Technoparks combine the interests of developers and consumers of scientific achievements. Recently, virtual business incubators and technology parks have appeared that offer services to those firms that are not geographically united.

One of the main reasons for the spread of technology parks in the world is the opportunity to solve the problem of reorganizing the existing education system with their help – bringing it closer to the needs of the development of the modern knowledge-intensive sector. Many technology parks, which include higher educational institutions or maintain close contacts with them, are engaged in the training of highly qualified specialists directly for their research departments and firms.

The creation of technoparks requires quite significant financial resources, the volume of which depends on the activities of the future technopark, the size of the area allocated for it, the volume of planned construction works, the number and nature of objects to be built, the remoteness of the technopark from the city, the state of communications, etc. In each case, the financing model depends on the level of economic development of the country, the economic policy of the government, the financial capabilities of the founders and other factors. As a rule, a technopark begins to make a profit no earlier than in 5–10 years [10].

Over the course of their history, technology parks have evolved significantly. Today, there are several models of technology parks, namely: American, European, Japanese and Chinese.

The American model of the technopark has the following features:

- close connection with universities and state research centers;
- often the presence of one customer;
- the main activity is the provision of a certain territory for lease to the owners of knowledge-intensive firms;
- the presence of a business incubator as one of the main links of the technopark, which is a professional organization for the "cultivation" of MIP, ensuring improved conditions for their functioning.

The average American technopark has about 50 hectares of land with 10 buildings, in which from 15 to 45 tenant companies with 500 employees are located, the budget is about $ 0.5 million [12].

The world's first technopark was created in the United States of America in the early 50s, when Stanford University (California) began to rent out vacant plots of land owned by it, along with premises for lease, to enterprises that received lucrative military orders from the federal government. For 30 years, Stanford University continued to build, form infrastructure and lease all the vacant land of the science park, which marked the beginning of the famous Silicon Valley. Such world-famous companies as Hewlett-Packard, Polaroid and others began their activities here. Currently, the number of technology parks in the United States exceeds 160 [10].

The American system of commercialization of technologies and, above all, the creation and operation of technology parks is the most advanced in the world. The American model of technology parks, taking into account local characteristics, is widely used as a basic model for creating technology parks in all highly developed countries of the world.

The European model of technology parks provides for the presence of innovation centers that are focused on the needs of small high-tech enterprises; the presence of several founders; the presence of a building designed to accommodate dozens of small firms in it, which contributes to the formation of a large number of small and medium-sized innovative enterprises.

The first European parks were created in 1971 in Scotland at the University of Edinburgh and on the campus of the University of Cambridge. Despite the fact that in Europe science and technology parks began to be created later than American ones, they also acted as generators of creating new jobs in industry aimed at introducing the latest achievements of science and technology.

European technology parks of the early 70s repeated the early model of the American prototype, when the main activity of the technopark was to lease land to owners of knowledge-intensive firms. This approach did not contribute to the rapid implementation of innovative ideas and projects. Therefore, the so-called "technology business incubators" are increasingly being built in technoparks to accommodate many small innovative start-up firms. The Cambridge Science Park (UK) fits this definition. It is home to about 80 companies whose activities cover a wide range of high technologies. Many of them maintain fruitful contacts both with higher educational institutions and with each other.

Especially the rapid development of technology parks in Europe was caused by crisis situations. When in the early 80s many areas of Great Britain were hit by the crisis of the textile and coal industries, Margaret Thatcher decided to create technology parks in such regions near universities. Now there are more than 40 of them. The bet on technology parks in the UK has fully justified itself.

European technology parks, which were created much later than the American ones (especially in the 80s), are characterized by a shorter period of formation. They were based on existing experience, had detailed programs and business plans, and therefore developed faster and more efficiently.

At the beginning of the XXI century. The European innovation infrastructure consisted of more than 1.5 thousand different innovation centers, including more than 260 science and technology parks. European technology parks, as a rule, rely on large research centers and are a kind of bridge for technology transfer between the scientific field and industry. The clients of technology parks in Europe are a large number of enterprises of both public and private ownership. About 70% of all clients are private firms [10].

The European technopark "Chateau Bombert Technopole" in Marseille (France) occupies an area of 180 hectares, uniting 50 enterprises employing 1100 employees. The companies offer infrastructure, a business incubator, conference halls, a restaurant, a technological institute with 230 researchers and 1200 students, and an industrial development center. The Science Park "Sophia Antipolis" (France) is located on the Riviera on an area of more than 2000 hectares. The maximum envisaged number of employees is about 6 thousand. people [6].

In Germany, technology centers are considered as a tool for overcoming socio-economic problems in the transition from modern industry to innovative industry of the future, associated with the reduction of jobs at old enterprises and the inability to fully compensate for them by creating new ones. In such a situation, cooperation between technology parks and higher educational institutions, as well as research centers on the creation of small enterprises, is of great importance. innovative enterprises designed to ensure qualitative changes in the level of employment of the population in the regions. That is, support for innovative business is carried out mainly through the efforts of local governments. There is no centralized network of innovation centers in Germany. Each region has its own structure and even within one region it is possible to exist several organizations engaged in the promotion of innovations. The purpose and objectives of the centers are to provide information, consulting services and financial support to the enterprises that are part of them. Such services are provided by the staff of the park itself. To develop business plans and support in financial matters, resources and specialists from outside can

be involved. Support in the field of management, patent examination, patenting of inventions, insurance and accounting is carried out, as a rule, by partners of technology parks. Priority areas of activity – research in the field of information and communication technology; software development; Ecology; Biotechnology; medical equipment; Agriculture.

In the coming years, closer cooperation of technology parks and their merger into a single nationwide network is expected, with the strengthening of specialization of individual centers on certain problems. The main priority is planned to be given to the further development of cooperation with research institutions and the implementation of information services. It is assumed that these processes will be accompanied by an increase in the area under the technopark, an increase in the coefficient of their workload and the establishment of ties with large enterprises.

The German experience of creating and operating a technology park in Cologne is quite interesting. The Cologne Technopark was created on the site and in the premises of an old chemical plant with a total area of about 141 thousand square meters and production – about 50 thousand square meters. Until the beginning of the 80s, this enterprise, which employed about 10 thousand people. people, were on the verge of collapse. Quite complex financial problems were exacerbated by environmental problems and, as a result, the decline of the general infrastructure in the surrounding region. In 1981–1982. The plant was given for a nominal fee to a third-party private investor – an American, who at his own expense cleaned the plant premises and the surrounding area, carried out the necessary reconstruction, created the proper infrastructure for doing business and leased the premises to numerous small private companies on terms more favorable than those existing in the region. In order to increase the attractiveness of the participants in the technopark, a technology center was founded, which provided free professional services to everyone (regardless of their participation in the technopark) in drawing up business plans, organizing, starting and further doing business. The conclusion of the center and its recommendations have become extremely important for obtaining bank loans. Such a scheme turned out to be quite effective: the activities of the technopark led to a positive transformation of the entire region, and first of all, its industrial and social infrastructure. However, this transformation became possible only under the conditions of a sufficiently favorable environment (legislative, tax, etc.) for establishing and running a business, especially a small one [10].

The Japanese model of technology parks is characterized by the following features:

- the creation of technopolises involves the construction of completely new cities, in which research centers and knowledge-intensive industrial production are concentrated;
- emphasis on the creation of “soft infrastructure”, which consists of qualified personnel, new technologies, information support, telecommunications networks and risk capital;
- when creating technopolises, it is necessary to take into account regional, ethnic and cultural characteristics;
- the main goal of technopolises is the commercialization of scientific research results, which involves specialization in applied research.

Japanese technopolises should be located no further than 30 minutes away. driving from cities (with a population of at least 200 thousand people) and within one day’s drive from Tokyo, Nagoya or Osaka; occupy an area of no more than 500 square miles; have a developed infrastructure (modern scientific and industrial complexes, universities and research institutes in combination with convenient areas for life, equipped with cultural and recreational infrastructure) [21].

About 70% of Japanese technology parks were created to support small and medium-sized businesses in the regions, while about 58% of their total number is focused on the production of high-tech products.

The main sources of financing for the creation of technology parks in Japan are: state funding – 30%, municipalities – 30%, enterprises and individuals – 30% and foreign investments – 10%. Loans for the creation of technology parks are issued at the lowest interest rates (3–4 times less than ordinary loans). To attract foreign investors, the Japanese government has developed a system of preferential conditions. For example, investors who intend to invest in the scientific and production facilities of the Kyushu Island Technopark (specializing in the production of microelectronics, communications and computer technologies) are provided by the municipal authorities with loans of up to UAH 10 million. USD. at low rates and a debt repayment period of up to 10 years [10].

Technopolis Tsukuba (“city of brains”) is located 35 miles northeast of Tokyo. The number of inhabitants is 11.5 thousand. persons working in 50 state research institutes and in two universities. Tsukuba is home to 30 of Japan’s 98 leading government research laboratories. Unlike other

technopolises, Tsukuba is a city of fundamental research, which accounts for almost half of the budget funds allocated for research and development, and the role of the private sector in it is small [12].

The Chinese model of technology parks provides:

- some of the technoparks are created within the zones of economic and technical development, and the rest are located outside the industrial zones and are concentrated around large scientific and engineering centers;
- technoparks have close contact with the local administration and are well integrated into the region or city where they are located;
- the state provides strict political leadership, financial support and management of technology parks;
- have many tax privileges and other advantages that attract foreign investors.

Currently, there are 120 special economic zones in China, including 53 of national importance, 50 provincial parks and 30 parks at universities. The first technopark was established in 1985 in Shenzhen. The Chinese Academy of Sciences, which became one of the founders of the technopark, provided it with powerful technological support [18].

When considering the peculiarities of the evolution of the NIS of the PRC, one can find many direct borrowings of the experience of the neighboring East Asian "dragons" – South Korea and Taiwan. In particular, China used in its strategy for the initial development of various industries the active involvement of foreign technologies, both in the form of foreign direct investment and through the creation of joint ventures. Thanks to this deliberate policy of the Chinese leadership, many of the world's largest multinational companies have located their basic production facilities in the Celestial Empire, which has facilitated the massive transfer of advanced knowledge and technology to local plants and factories. Another powerful stimulus for the accelerated growth of the national economy was the strategy adopted by China of aggressive export of its products to the leading foreign markets, primarily the markets of the United States and the European Union.

Venture capital has played an important role in China's NIS in recent years, and in China the level of its development can already be considered quite mature even in global terms. Thanks to serious venture capital investments, focused primarily on the domestic market, there is a noticeable increase in the number of innovative high-tech companies in the country, and the number of international venture projects (especially with the participation of American investors) is also growing dynamically.

Over the past decade, there have been quite noticeable changes in the system of legislative regulation of innovation activity in China. Thus, the legal mechanisms for the protection of intellectual property rights have been significantly revised in the country towards greater compliance with international standards. However, reforms of the legal system are still noticeably late compared to the pace of modernization and development of patent administration systems. In China in the second half of the 2000s. new antitrust legislation was enacted, as well as steps were taken to redesign and improve national technical standards and regulations in the ICT sector.

In the state policy of the country as a whole, a dual approach to the role of the largest foreign companies (and, first of all, TNCs) in the development of national innovation systems is preserved. On the one hand, they are considered as the most important catalysts for the overall process of technological development of national economies, but, on the other hand, they are constantly harshly criticized for excessive monopolization of key technologies and artificially limiting the opportunities for rapid growth for local companies [8].

A common type of innovation infrastructure is an innovation center. An innovation center is an innovation structure that is an association of enterprises and firms united by a common desire to achieve a high commercial result based on the use of scientific and technical developments and inventions. Innovation centers occupy an intermediate position between manufacturers of scientific and technical products (centers of fundamental and applied research) and industry, mainly small and medium-sized enterprises, employing up to 250 people. This position gives them the opportunity to play an interactive role, namely, to supply new technologies to potential users and inform research institutes about the needs and requests of small and medium-sized businesses. Thus, the strategic course of innovation centers is based on their potential ability to support the innovation process, accelerating the necessary exchange of technologies and information between different components of the scientific and technological infrastructure. The range of services provided by innovation centers of Western European countries is quite multifaceted:

- introduction of new technologies and research results from the scientific and technical sector into industry;

- providing small and medium-sized enterprises with services for the protection of their inventions and intellectual property rights related to patenting and obtaining a license;
- provide advice to small and medium-sized enterprises on management, marketing, market research methods, quality management, etc. This approach is implemented through special training programs that are carried out in conjunction with consulting companies or relevant research organizations;
- development of new activities based on advanced technologies by assisting in the creation and formation of the company's infrastructure (joint ventures, organization of interaction between existing companies and enterprises, etc.).

Due to the specifics of their activities and the availability of a wide range of contacts with the regional industry, innovation centers play an important role in the implementation of many commercial initiatives in the region, such as: evaluation of regional plans for technological development, business parks, networks between scientific institutes, participation in trade fairs, attraction of foreign investments, holding seminars. Innovation centers, having stable relations with all organizations and institutions, are considered as the central points of regional innovation networks.

Almost all European innovation centers are based on state funding, both at the federal and regional levels. An exception to the Western European practice of operating innovation centers is Great Britain, where they are fully financed from private sources. Therefore, their activities are mainly focused on direct technology transfer [9].

6. Conclusions

Therefore, when developing innovative infrastructure both in Ukraine and in other countries, it is necessary to pay attention to the fact that its most effective element is technology parks. The general target orientation of their functioning is to increase the efficiency of innovation activity by establishing closer relationships between science and production. Innovation policy should be selective and based on the development and implementation of programs that cover all stages of the innovation process (from fundamental and applied research to the production and use of new products) and the organization of the world market segment of the marketing, sales, branded service system, etc.

References

1. Bibeau, J., Meilleur, R., & St-Jean, É. (2024). To formalize, or not to formalize, business incubators' networks: That is not the question. *Technovation*, 130, 102904. https://doi.org/10.1016/j.technovation.2023.102904
2. Chervanov, D. M. (1999). *Menedzhment innovatsijno-investytsijnoho rozvytku pidpryiemstv Ukrainy* [Management of innovation and investment development of Ukrainian enterprises]. Kyiv: Znannia (in Ukrainian)
3. Esmanov, O., Shtyka, Y., & Lynnyk, M. (2024). Strategies for innovative development of territories and smart specialization: Essence, features. *Digital Economy and Economic Security, 3* (12), 13–18. https://doi.org/10.32782/dees.12-3 (in Ukrainian)
4. Karahan, M. (2024). Advancing sustainable entrepreneurial universities: Sustainability transformations of university business incubators in Germany. *Small Business Economics, 63*(3), 575–609. https://doi.org/10.1007/s11187-023-00860-5
5. Kondratenko, O. O., & Nikolaiev, O. D. (2018). Rol biznes-inkubatoriv u aktyvizatsii innovatsijnoho rozvytku Ukrainy [The role of business incubators in intensifying the innovative development of Ukraine]. *Visnyk ekonomichnoi nauky Ukrainy*, (2), 99–104. http://www.venu-journal.org/download/2018/2/18-Kondratenko.pdf (in Ukrainian)
6. Lecluyse, L., & Knockaert, M. (2021). Science parks in Europe: A comparison of science park characteristics and activities in Belgium, Spain and Denmark. In *Handbook of Research on Business and Technology Incubation and Acceleration*. Edward Elgar Publishing. https://doi.org/10.4337/9781788974783.00021
7. Lysenko, N. O., & Biloshkurska, N. V. (2012). Zastosuvannia vyrobnychoi funktsii Tinbergena pry analizi innovatsiinoi skladovoi ekonomichnoi bezpeky pidpryiemstv APK [Application of the Tinbergen production function in the analysis of the innovation component of the economic security of agribusiness enterprises]. *Innovatsiina ekonomika, 4*(30), 140–144. (in Ukrainian).
8. Martseniuk, Z. R. (2012). Mekhanizm pobudovy konkurentospromozhnykh natsionalnykh innovatsiinykh system Kytaiu ta Indii [The mechanism for building competitive national innovation systems of China and India]. *Ekonomichnyi Chasopys-XXI*, (1–2), 15–18. https://ea21journal.world/index.php/ea-v118-05 (in Ukrainian)

9. Oleksenko, L. V. (2020). Innovation infrastructure as a factor in intensifying innovation in the world's leading countries. In *Management of Economy: Theory and Practice. Chumachenko's Annals: Collection of Scientific Papers* (pp. 223–242). Institute of Industrial Economics of the NAS of Ukraine. https://doi.org/10.37405/2221-1187.2020.223-242
10. Onikiienko, V. V., Yemelianenko, L. M., & Teron, I. V. (2006). *Innovatsijna paradyhma sotsialno-ekonomichnoho rozvytku Ukrainy* [Innovative paradigm of socio-economic development of Ukraine]. Kyiv: RVPS NAN Ukrainy (in Ukrainian)
11. Osadcha, N. V. (2015). Aktyvizatsiia innovatsijnoi diialbnosti v naukovykh i tekhnoparkakh iak vyklyk hlobalnoi ekonomiky [Activation of innovation activity in science and technology parks as a challenge of the global economy]. *Visnyk ekonomichnoi nauky Ukrainy*, (1), 108–113 http://www.venu-journal.org/download/2015/1(28)/pdf/21-Osadcha.pdf (in Ukrainian)
12. Podlevskyi, A. A., & Sereda, O. A. (2017). Functioning of technological parks: World experience and Ukrainian realities. *Bulletin National University of Water and Environmental Engineering*, *4*(80), 9–22. https://visnyk.nuwm.edu.ua/index.php/econ/article/view/525
13. Pro innovatsijnu diialnist: Zakon Ukrainy vid 4 lypnia 2002 roku №40-IV [On innovative activity: Law of Ukraine of July 4, 2002 №40-IV]. https://zakon.rada.gov.ua/laws/show/40-15#Text (in Ukrainian)
14. Prokopenko, O., Bezliudnyi, O., Omelyanenko, V., Slatvinskyi, M., Biloshkurska, N., & Biloshkurskyi, M. (2021). Patterns identification in the dynamics of countries' technological development in the context of military conflict. *Eastern-European Journal of Enterprise Technologies,* *2*(13(110), 6–15. https://doi.org/10.15587/1729-4061.2021.230236
15. Pro naukovi parky: Zakon Ukrainy vid 25 chervnia 2009 r. №1563-VI [About science parks: Law of Ukraine of June 25, 2009 №1563-VI]. http://zakon.rada.gov.ua/laws/show/1563-17 (in Ukrainian)
16. Pro spetsialnyj rezhym innovatsijnoi diialnosti tekhnolohichnykh parkiv: Zakon Ukrainy vid 16 lypnia 1999 roku №991-XIV [About the special mode of innovative activity of technological parks: The Law of Ukraine of July 16, 1999 №991-XIV]. https://zakon.rada.gov.ua/laws/show/991-14#Text (in Ukrainian)
17. Pro zatverdzhennia Derzhavnoi tsilovoi ekonomichnoi prohramy "Stvorennia v Ukraini innovatsijnoi infrastruktury" na 2009–2013 rr.: Postanova Kabinetu Ministriv Ukrainy vid 14 travnia 2008 r. №447 [On approval of the State Targeted Economic Program "Creation of Innovative Infrastructure in Ukraine" for 2009–2013: Resolution of the Cabinet of Ministers of Ukraine of May 14, 2008 №447]. https://zakon.rada.gov.ua/laws/show/447-2008-%D0%BF#Text (in Ukrainian)
18. Sitnikova, S. E., Halo, L. A., & Polusmakova, N. S. (2018). Problems and perspectives of improving the process of innovations' commercialization in a modern university. In *The Impact of Information on Modern Humans* (pp. 321–327). Springer International Publishing. https://doi.org/10.1007/978-3-319-75383-6_41
19. The United Kingdom Science Park Association. (n.d.). https://www.ukspa.org.uk
20. Tsekhanovych, V. (2019). Models of innovation infrastructure in euroregions. *Ekonomichnyj visnyk Donbasu*, 4(58), 95–99. https://doi.org/10.12958/1817-3772-2019-4(58)-95-99
21. Varnalii, Z. S., & Harmashova, O. P. (2013). Konkurentospromozhnist natsionalnoi ekonomiky: problemy ta priorytety innovatsijnoho zabezpechennia [Competitiveness of the national economy: Problems and priorities of innovation]. Kyiv: Znannia Ukrainy (in Ukrainian)
22. Yarkina, N. M. (2013). *Ekonomika pidpryiemstva* [Business economics]. Kyiv: Lira-K (in Ukrainian)