



WORLD EXPERIENCE IN ORGANIZATION OF TECHNO PARK STRUCTURES

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ABSTRACT

The article discusses global and local experience in the formation of technopark structures. The stages of its formation have been studied. Recommendations were made on the establishment of technoparks in Uzbekistan.

KEYWORDS: *technopark, structure, design, model, science, innovative technologies, development.*

I. INTRODUCTION

Many years of world experience have shown that technoparks are the main means of implementing scientific ideas and promising innovations that have practical and material value in the shortest possible time. At present, it is important to properly organize technoparks in each region, improve architectural and planning solutions. A number of innovative technology parks have been created in Uzbekistan since 2017, which creates great opportunities for them. Currently, there is a need for the correct organization of technoparks in each region, for the improvement of architectural and planning solutions. In search of an effective solution to this problem it is important to analyze the world experience of creation of modern technology parks and define the features of their formation.

II. MAIN PART

Technoparks are areas that connect research activities, industrial facilities, exhibition areas, educational institutions and infrastructure to promote innovative projects. The purpose of the technoparks is to bring together high-tech companies in their territory and create prototypes of innovative products and provide a full range of development services. Modern technoparks include three main components that are inextricably linked and form a single complex: a) research facilities; b) production facilities; c) administrative and public facilities.

The main objects of technoparks: buildings and structures of technopark; living space; industrial zone; green areas; main streets; highways in the technopark area [1].

The International Association of Science Parks (IASP) emphasizes the equivalence of concepts such as "technopark", "technopolis", "technology zone", "research park" and "science park". The term "science park" is commonly used in the UK, "research park" in the US and "technopark" in the CIS [2].

Technoparks can belong to three organizational models: America, Asia and Europe [3].

In general, the technopark structure of the American model has been formed on the basis of innovation enterprise-lessees of different sizes and service companies. The technopark structure did not take into consideration such parameters as enterprise size, sector profile, possible ways of development. Subsequently, the organizers of technoparks faced all these questions. There are structures not having office of prime responsibility, as a rule, they are accidental formations of the innovation enterprises that acquired useless territories near the big universities or science absorbing industry. A typical example of "research park" where on the lands of university there are no enterprises and laboratories of industrial companies as such, but there are non-commercial research institutes closely associated with industry.

U.S. universities have leased part of their vacant land to innovative companies at low prices, helping them to thrive. Territorial proximity and social connections between companies and university staff contributed to the formation of a unique environment called a "technopark" [4]. It is on the basis of these factors that the American model of technoparks was formed (Figure 1).

There are three types of science parks in the United States: 1) science parks; 2) research parks (new developments will develop only at the level of technical prototypes); 3) business incubators [5].



Figure 1. The first technopark in the USA - Stanford Research Park.

- Developed infrastructure.

The European experience has completed the formation of the general idea of technoparks, complementing the American experience with a high culture of organizing places for the application of intellectual labor, more advanced models for combining science, education and business and their architectural complexes. The Technopark acquired a number of new functional elements, and thus became a unique architectural object with a specially organized environment, and not a conditional area is given for chaotic development [3].



Figure 2. Skolkovo Innovation Center in Russia

This is how the first technopark in the United States appeared - Stanford Industrial Park. It is now called Stanford Research Park and is home to over 150 companies.

This technopark is located on the campus of Stanford University. The technopark has administrative buildings, offices and shopping and entertainment facilities. This technopark, located in a free zone, is the city's premier innovative real estate.

There is no single model for European technology parks. Incubator-type technology parks, called innovation centers, are common in most countries, but they vary considerably in size, the composition of client firms, and the degree of dependence on research centers. The purpose of creating a technopark here is to accelerate scientific development, revive economic activity, and create new jobs [6].

Most European technology parks are located on the territory of universities with a long history, and their architecture contains buildings of historical value.

The generally accepted requirements for the creation of technology parks and innovation centers were developed by the European Association of Technoparks:

- the presence of large green areas;
- high quality of architectural solutions of buildings and complexes of technoparks;

Technoparks in Russia appeared in the 80s of the last century. Technoparks in Russia are formed on the basis of 4 different functional models. For example, in Russia, 13% of general technoparks operate according to the university model, 11% according to the infrastructure model, 32% according to the innovation model and 44% according to the partnership model. The experience of creating technoparks based on industrial enterprises in Russia has become more successful. By 2020, the number of technoparks in Russia was 179. One of the largest technopark projects in Europe is the project of the Skolkovo innovation center - a modern innovative city with unique and high-quality architecture [7] (Figure 2). It consists of quarters, each of which has its own structural and functional elements. Each area has everything you need to live and work.

The master plan of the Skolkovo innovation center pursues the following main goals:

- surround the center with a green zone;
- creating opportunities for effective interaction of human, scientific, research and business institutions that form the basis of the innovation environment;
- ensuring a high quality of life based on the principles of sustainable development and, thereby, increasing the attractiveness of the territory.

The Skolkovo Innovation Center is located on an area of 400 hectares. The technopark building with a total area of just under 100,000 square meters has a small office, laboratory, coworking center, cafe, shop, congress hall and public areas. 15,000 employees live and work at Skolkovo. The Technopark is located 3 km from the highway. From Technopark to the center of Moscow 20 minutes drive. Skolkovo conducts research in 5 specialties: biomedical technologies, energy-saving technologies,

information and computer technologies, space technologies and nuclear technologies.

The Asian model plays an important role in the creation of technoparks in most countries of the Eastern Hemisphere. In the Asian model of technoparks, Japanese technoparks play an important role. The Japanese model of research areas laid the foundation for entirely new “technopolis” cities [8]. They combine scientific research in advanced industries, ensure the constant repetition of innovations, the integration of fundamental research and applied developments, their application in practice, thereby establishing themselves as a rapidly developing form of integration of science and production. The word technopolis itself originated in Japan in the 1980s and refers to the synthesis of two important ideas based on Japan's industrial strategy. To obtain the status of a technopolis, the city had to meet such requirements as the presence of a university, high convenience of transport, and a well-developed infrastructure. In contrast to the US Silicon Valley, Japanese Technopole concept requires a more balanced approach to the development of high technologies. This suggested not only focusing on technology, but also creating entirely new science cities with research and technology centers, new universities, residential buildings, parks and cultural institutions.

These technopolises are composed of three interrelated areas:

- scientific corps of universities, state research institutes and corporate research laboratories;
- industrial zone with factories, logistics centers and offices;
- living quarters for researchers and their families.

In the Asian region, the idea of technoparks reached a new level, which led to the emergence of technopolises. Technopolis is, in fact, a translation of the idea of creating a technopark for the entire city. Although technopolises were created earlier, France has succeeded in this regard, but it is the Japanese state program that has mandatory requirements for technopolises, for example:

- population of no more than 200,000 people;
- natural areas;
- access to half-hour transport from a major regional center.

Later, the ideas of technopolises became popular in Asian countries. Currently, large technology parks are built in China, India, Malaysia and Singapore.



Figure 3. Tsukuba Science City in Japan

Tsukuba Science City- This is the largest project in Japan (Figure 3). Tsukuba Science City actually covers the whole territory of Tsukuba and is divided into two main areas: "Research and Education District" is the territory of research and educational institutions, which includes residential and public spaces (about 2.7 hectares), but also has an area of about 25.7 hectares suitable for construction. In August 2008, the population of Tsukuba was 209,000, of whom 78,000 lived in the science and education area and 131,000 in the neighboring areas. Further growth in population and construction will soon transform the science city of Tsukuba into a large technology city in Tokyo, according to an analysis by the ministries of land, infrastructure, transport and tourism.

According to research by Japanese scientists, in the process of their evolution there are three main functional types of technopolis - industrial park, incubation center and science park. There are also three conceptual zones - a park, an incubator and a research institute.

Currently, there are 4 models of technoparks in the CIS countries: university model, infrastructure model, innovation model and cooperation model.

Since 2017, Uzbekistan has also begun to pay more attention to the construction of technoparks. One of them is “INNO” innovative training and production technopark. “INNO” innovative training and production technopark specializes in robotics, energy, electrical engineering and biotechnology (Figure 4).

The technopark was built on the campus of Almazar district of the capital and has an area of 1.94 hectares. The project includes the construction of an innovative 3-storey educational and research center and an indoor greenhouse. The technopark covers an area of almost 11,000 square meters [9].



Figure 4. "INNO" innovative training and production technopark in Tashkent

On the first floor of the technopark there is a biotechnology laboratory equipped with modern special equipment, a production room, a soil fertility analysis laboratory, an electric vehicle for the exhibition, a sound laboratory, robotics and standardization rooms. On the second floor there are 8 coworking rooms for students, 3 training rooms, a kitchen, a rest room, 2 offices, a negotiation room and an administration room. On the third floor there are 17 office rooms, 2 negotiation rooms, a sports room, a modern library, an administration room and a warehouse. The indoor greenhouse has modern heating and irrigation, and an automated system that keeps the temperature constant. a building constructed of lightweight metal construction. Technopark is built on the basis of completely innovative solutions. The main building is made of monolith. All metal carcasses are treated with fire protection paints. The walls are heated and waterproofed. The exterior and interior are equipped with energy-saving equipment. The roof has energy-saving solar panels up to 40 kilowatts. While the exterior of the Technopark building is one-sided, the interior's modern look and innovative design are even more impressive. The modernity of the hi-tech style combines simplicity and luxury, a combination of colors.

Another convenience is that the internship in the innovative technopark is free for students, and tax benefits are introduced for residents [10]. These conditions in the Technopark serve to expand the innovative ideas of the younger generation and implement them. The purpose is to attract more students of higher education institutions in this area, to conduct practical classes indoors, to combine theoretical knowledge with practice, to improve the curriculum based on advanced technologies. made. They see the most advanced techniques here, as in large factories, and try to use them with the help of experts.

III. CONCLUSION

1. In general, the technopark is a new type of multifunctional public-industrial complex, which in its development goes through stages from a single building to a structure on a regional scale. In addition to scientific, production and commercial functions, it also includes the functions of social and communal services.
2. To create technoparks and innovation centers, it is necessary to have large green areas, buildings with high-quality architectural solutions and developed infrastructure.
3. The similarity of the American and European models: in both models, large areas are built up with low-rise buildings and structures, which ensures a low density of land use. The difference between the two is environmental protection. In American technology parks, industrial complexes are located in a very chaotic manner, with no restrictions on environmental protection and ecological considerations. As a result, the ecological situation here has worsened. From the very beginning, great attention was paid to improving the natural and ecological situation in European technology parks.
4. In the Asian region, the idea of technoparks has reached a new level, which has led to the emergence of technopolises. Based on the experience of Asia, the "Asian model" can be considered the most optimal solution in the development of architectural projects of the technopark complex in the conditions of Uzbekistan. Despite the fact that the technopolises are relatively far from the city and its infrastructure, the areas of production, management and services are very well developed. The positive aspects of this are:
 - consolidation of innovative activities;
 - reduction of long distances for specialists;
 - general use of infrastructure by the same type of companies;
 - the presence of hazardous waste from the technopark away from cities;
 - opportunities for further development;
5. It was found that the structure of the technopark goes through the stages of development from a single building (business incubator) to a regional urban structure (technopolis).



6. Built in the heart of the university campus, Inno Technopark is a magnificent building that helps students realize their ideas. The purpose is to attract more students of higher education institutions in this area, to conduct practical classes indoors, to combine theoretical knowledge with practice, to improve the curriculum based on advanced technologies. They see the most advanced techniques here, as in large factories, and try to use them with the help of experts.
- “INNO” Innovative training and production technopark is a building-type technopark structure. The limited areas of the building-type technopark are its main advantages and main disadvantages, which lead to the following:
- impossibility of expansion;
 - lack of an advanced functional structure;
 - lack of a complete recreation system;
7. Based on the experience of Europe and Asia, it is recommended to design technology parks in the Republic of Uzbekistan according to the “integrated model”. This model has a very loose fit over an area much larger than the point model. It is located within the city limits and is in close contact with it. This allows placing additional buildings and structures with their own functional capabilities on the territory of the technopark, as well as creating a full-fledged green zone. Based on world experience, the construction of technoparks in the spatial solution "Integrated Model" can be divided into several stages. First of all, the main part of the technopark will be created. It covers the following areas: scientific, educational, laboratory, industrial and business incubator. Some time after the launch of its main part, it will be necessary to create appropriate conditions for existing companies and expand new directions. One of the advantages of this model is the ability, if necessary, to increase the area of any area. At the same time, the region can develop as business and science-oriented companies grow and create new directions: commercial, exhibition, entertainment and others. Despite the diversity of research areas of technoparks, this is, first of all, a territory that combines research activities, industrial facilities, exhibition areas, educational institutions and infrastructure to promote innovative projects. The formation process of each technopark is individual. This requires deep planning in advance.

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