

Research on architectural space design of modern biomedical industrial park

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Abstract: *As an important part of the high-tech industry, the biomedical industry is ushering in unprecedented development opportunities. In the future, with the improvement of innovation and research and development strength, the expansion of market size and the improvement of policy environment, the biomedical industry needs to continue to maintain a rapid growth trend and make greater contributions to the development of human health. In the rapid development of biomedicine industry, industrial park is an important carrier of industrial aggregation and development. The rationality and advancement of its architectural space design are directly related to the operation efficiency of the park, the growth of enterprises and the sustainable development of the entire industry. In this paper, the architectural space design of modern biomedical industrial park is deeply discussed. The study uses a variety of methods, including literature review, case analysis and field study, to analyze the advantages and disadvantages of existing design strategies, propose optimization schemes, and explore their impact on improving the efficiency and sustainable development of the biomedical industry.*

Keywords: *modern biomedicine; Industrial park; Architectural space design; Efficiency improvement; Sustainable development*

1. Introduction

With the rapid development of the biomedical industry, the architectural space design of modern biomedical industrial park, as an important platform to support the development of the industry, has become increasingly important. Scientific and reasonable space design can not only meet the production needs of the industry, but also promote the cooperation and innovation between enterprises, and then promote the sustainable development of the entire industry. With the continuous progress of science and technology and the rapid development of biomedical industry, the architectural space design of modern biomedical industrial park is also facing many challenges, which not only involve technology, safety, environmental protection and other aspects, but also involve regulations, policies, humanized design and other fields. In order to cope with these challenges, architectural designers need to constantly innovate ideas and methods. Combined with the characteristics of the industry and actual needs, to create a modern biomedical industrial park that conforms to regulations and policies and meets the needs of humanity. This study uses a variety of research methods, such as literature review, case analysis and field investigation. Through the review of relevant literature at home and abroad, to understand the current research progress and theoretical framework; Combined with the analysis of typical cases, the successful design practice and experience are discussed. Through field visits, we have a deep understanding of the industrial parks in actual operation and collect first-hand data, aiming to identify existing problems and challenges by analyzing the status quo of architectural space design of modern biomedical industrial parks, propose targeted optimization strategies, and provide theoretical support and practical guidance for the construction and transformation of related industrial parks[1].

2. Overview of the development of biomedical industry

2.1 Overview of industry status

As a representative of high-tech industry, biomedicine industry has achieved remarkable development in the world in recent years. With biotechnology as the core, the industry covers many fields such as drug research and development, medical devices, and biotechnology services. At present, the biomedical industry has become an important force to promote global economic growth, and plays a vital role in improving people's health and responding to major epidemics. In terms of innovation and research and

development, the biomedical industry is gradually realizing the leap from following to leading. On the one hand, breakthroughs have been made in the creation of new drugs, and new biotechnology drugs and gene therapy products have been emerging. On the other hand, innovative ideas such as personalized medicine and precision medicine are also widely used in the field of biomedicine. At the same time, the R&D investment of enterprises in the industry continues to grow, providing a solid material foundation for innovation[2].

2.2 Market size and growth

The biomedical industry chain covers many links such as upstream raw material supply, midstream R&D and production, and downstream sales and services. Upstream raw material suppliers provide necessary raw materials and technical support for the biomedical industry; Midstream R&D and production enterprises are responsible for the research and development and production of new drugs; Downstream sales and service enterprises are responsible for product marketing and customer service. The whole industry chain synergies to jointly promote the development of the biomedical industry. At the same time, the scale of the biomedical market continues to expand, showing a steady growth trend. As the global population ages and health awareness increases, the demand for biomedical products continues to grow. In addition, the continuous emergence of new technologies has also provided new impetus to the market growth. It is expected that the biopharmaceutical market will continue to maintain rapid growth in the next few years.

2.3 Analysis of policy environment

The government has an important role to play in promoting the development of the biomedical industry. Many countries have formulated plans for the development of the biomedical industry, providing tax incentives, financial support and other policy measures. At the same time, with the enhancement of the awareness of intellectual property protection, the innovation environment of the biomedical industry is also gradually improving. With the deepening of globalization, international cooperation and exchanges in the biomedical industry have become increasingly frequent. Governments and enterprises have strengthened communication and cooperation with international partners to jointly promote innovation and development in the field of biomedicine. By sharing research and development results and jointly addressing global health issues, international cooperation in the biomedical industry has made positive contributions to global economic growth and the improvement of people's health.

2.4 Technology development trend

A number of globally competitive leading companies have emerged in the biomedical industry. These companies have not only achieved remarkable results in innovative research and development, but also made important breakthroughs in marketing and internationalization strategies. By increasing research and development investment, expanding the international market and other measures, they continue to enhance their status and influence in the global biomedical field. In the future, the biomedical industry will show the following technological development trends: First, personalized medicine and precision medicine will become the mainstream, providing patients with personalized treatment plans through genetic testing and other means; Second, new technologies such as immunotherapy and gene therapy will make important breakthroughs and provide new means for disease treatment; Third, digital and intelligent technologies will be widely used in the field of biomedicine, promoting industrial upgrading and efficiency improvement.

3. The importance of architectural space design of biomedical industrial park

It is of far-reaching significance to optimize the architectural space design of biomedical industrial park. By improving industrial efficiency, promoting scientific research and innovation, ensuring personnel safety, promoting sustainable development, optimizing resource allocation, enhancing the attraction of the park, promoting industrial agglomeration and enhancing the corporate image, and other aspects of the park, it promotes the healthy development of the biomedical industrial park and contributes to the prosperity of the biomedical industry. The following is a detailed analysis of its significance and significance.

3.1 Improve industrial efficiency

In the biomedical industrial park, reasonable architectural space design can effectively improve industrial efficiency. By optimizing the layout of production area, storage area and research and development area, the transmission distance of materials, personnel and information is reduced, the production cycle is shortened, and the production efficiency is improved. At the same time, reasonable space layout also helps to improve equipment utilization and reduce resource waste. In addition, good architectural space design can enhance the overall image of the biomedical industrial park and enhance the attraction of the park. The beautiful park environment, comfortable office space, advanced facilities and equipment can attract more excellent enterprises and talents to settle in, and promote the sustainable development of the industrial park.

3.2 Promote scientific research and innovation

The optimization of architectural space design can provide good environmental support for scientific research and innovation. For example, by providing a comfortable office environment, advanced laboratory facilities, flexible research space, etc., stimulate the innovation vitality of researchers and promote the scientific and technological progress of the biomedical industry. Moreover, the architectural space design is an important part of the corporate image. A reasonably designed, beautiful and generous industrial park can not only promote the scientific research and innovation of enterprises, but also enhance the overall image of enterprises, show the professional quality and comprehensive strength of enterprises, and help to enhance the brand value and social recognition of enterprises.

3.3 Ensure the safety of personnel

In the biopharmaceutical industry, personnel safety is of Paramount importance. Optimizing the design of building space can better meet the safety requirements, such as reasonable planning of escape channels, setting up security isolation areas, configuring necessary protective facilities, etc., to ensure that personnel can be quickly evacuated in an emergency and reduce security risks.

3.4 Promoting sustainable development

Sustainable development is one of the important characteristics of modern industrial park. By optimizing the design of building space, the efficient use of resources, environmental protection and energy saving can be realized. For example, the adoption of green building materials, the design of energy-saving buildings, and the implementation of rainwater collection and utilization measures to promote the green development of biomedical industrial parks.

3.5 Optimizing Resource Configuration

Optimizing the design of building space is helpful to realize the rational allocation of resources. Through reasonable planning of the size, location and interrelationship of different functional areas, it can ensure the effective use of resources and avoid resource waste and over-investment. At the same time, optimizing the architectural space design will help promote the agglomeration of the biomedical industry. Through rational planning of the spatial layout of upstream and downstream enterprises in the industrial chain, logistics costs and information exchange costs between enterprises can be reduced, cooperation and exchange between enterprises can be strengthened, industrial agglomeration effect can be formed, and the competitiveness of the entire industry can be enhanced.

4. Challenges faced by architectural space design of modern biomedical industrial park

4.1 Complex function layout

Biomedical industrial parks usually cover research and development, production, storage, logistics, administration and other functional areas. Each area has its own specific needs and standards, and how to achieve efficient integration and layout of these functions in a limited space, while ensuring smooth communication and cooperation between various areas has become a major challenge for architectural space design. In addition, the construction and operation costs of biomedical industrial parks are usually high. How to control costs and improve benefits through reasonable building space design on the premise

of meeting functional requirements and safety standards is an important issue that needs attention in the development of industrial parks.

4.2 Strict safety standards

The biomedical industry involves a large number of biological experiments, drug production and other high-risk links, and has extremely high requirements for safety standards. Building space design needs to fully consider the requirements of fire prevention, explosion prevention, pollution prevention and other aspects to ensure the production environment and employee safety. At the same time, with the increasing awareness of global environmental protection, the architectural space design of biomedical industrial parks also needs to meet the increasingly high environmental protection requirements. This includes the use of environmentally friendly materials, energy conservation and emission reduction measures, waste disposal, etc., to reduce the negative impact on the environment.

4.3 Rapid technical update

With the rapid development of biomedical technology, the introduction of new technologies often requires the corresponding adjustment and transformation of the architectural space of the industrial park. How to ensure that the architectural space design can not only meet the current technical needs, but also adapt to the development trend of future technology is a major problem facing the architectural space design of industrial parks. With the popularization of the concept of global sustainable development, the architectural space design of biomedical industrial park also needs to take into account the rational use of resources, environmental protection and sustainable development of society. This requires building space design not only to meet current needs, but also to leave room for future development.

4.4 Humanized design challenges

In the construction of modern industrial park, humanized design is paid more and more attention. The architectural space design of the biomedical industrial park also needs to consider the work needs and living habits of employees, create a comfortable, healthy and safe working environment, and improve the work efficiency and satisfaction of employees. Moreover, the biomedical industry involves many fields and departments, and the relevant regulations and policies are complex and changeable. Architectural space design needs to pay close attention to changes in relevant regulations and policies to ensure that the design meets the requirements of regulations and avoids risks caused by violations of regulations.

5. Architectural space design strategy of modern biomedical industrial park

5.1 Reasonable planning and layout of functional areas

First of all, according to the characteristics of the biomedical industry and the development goals of the park, it is necessary to rationally plan different functional areas, such as research and development areas, production areas, storage areas, administrative regions, etc. Each functional area should be laid out according to its functions and characteristics to achieve efficient workflow and convenient resource sharing. At the same time, it is necessary to take into account the possible expansion and changes in the future, and leave some flexible development space for the park. Secondly, the smooth and efficient flow of people and logistics should be fully considered in the design. In terms of people flow, it is necessary to reasonably plan the route of employees to reduce unnecessary detour and congestion; In terms of logistics, it is necessary to optimize the transportation path and storage space of the goods to ensure the fast and accurate arrival of the goods. At the same time, through the introduction of intelligent management system, to achieve real-time monitoring and scheduling of people flow and logistics, further improve efficiency. Finally, due to the rapid development of biomedical technology and the needs of industrial upgrading, the architectural space design should have a certain degree of flexibility and scalability. This requires that the design should take into account possible future changes, such as technological updates, product line adjustments, etc., to leave room for the future development of the park. For example, modular design and detachable structure can be used to facilitate rapid adjustment and transformation of the space in the future.(As shown in figure 1)

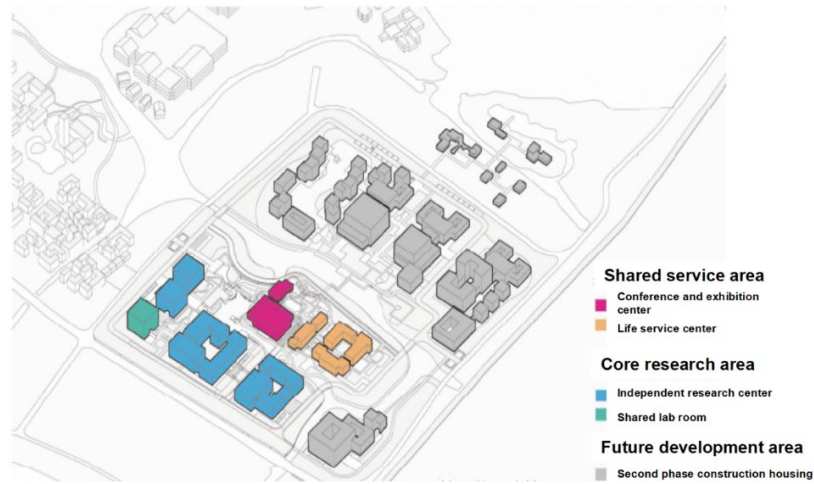


Figure 1: Functional zoning construction schematic[3]

5.2 Strengthening security and emergency response

The biomedical industry involves a large number of high-risk links such as biological experiments and drug production, so the safety issue is an important part of the architectural space design. The design should fully take into account various safety risk factors, such as fire, explosion, pollution, etc., and set up appropriate safety facilities and emergency response mechanisms. At the same time, safety drills and training should be conducted regularly to improve employees' safety awareness and emergency handling capabilities. At the same time, the biomedical industry has high requirements for environmental cleanliness. Therefore, effective cleaning measures should be taken in the design, such as setting up air purification systems, sealed doors and Windows, etc., to ensure that the cleanliness of the production environment meets the requirements. At the same time, for areas that may produce pollution, special protective facilities should be set up, such as exhaust systems, sewage treatment systems, etc., to prevent the spread of pollutants.

5.3 Application of intelligent and automated technology

With the development of intelligent technology, the application of intelligent and automated technology to building space design can improve the operational efficiency and safety of the park. For example, intelligent lighting system and automatic air conditioning system are introduced to realize intelligent monitoring and automatic adjustment of the internal environment of the park. Through the introduction of intelligent security system, automatic inspection system, etc., to improve the security level of the park. In order to ensure sustainable development, the concept of green energy saving and environmental protection should be fully considered in the architectural space design of modern biomedical industrial park. Reduce building energy consumption and environmental impact through the use of energy-efficient building materials, renewable energy utilization, rainwater recycling and other technical means. At the same time, the ecological environment quality of the park is improved by greening vegetation and setting up ecological landscape[4].(As shown in figure 2)

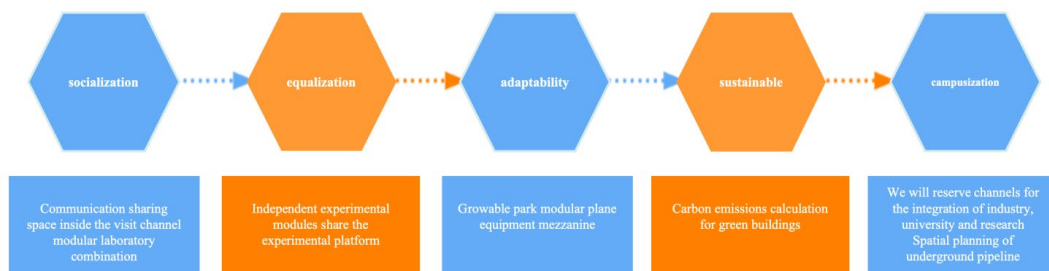


Figure 2: Combination of cutting-edge trends and technical methods of biomedical industrial park architecture

5.4 Improve comfort and humanistic care

Architectural space design should pay attention to the comfort and humanistic care of employees. Through reasonable space layout, comfortable office environment, convenient living facilities and other measures, improve employees' job satisfaction and sense of belonging. At the same time, we should pay attention to the physical and mental health and safety needs of employees, and provide employees with a safe, healthy and comfortable working environment. Through scientific and reasonable design strategies and implementation measures, an efficient, safe, comfortable and sustainable modern biomedical industrial park can be created.

6. Conclusion

Modern biomedicine industrial park is an important carrier of scientific and technological innovation and the development of biomedicine industry, and its architectural space design strategy directly affects the operation efficiency, environmental quality and future development potential of the park. This study found that there are many shortcomings in the architectural space design of modern biomedical industrial parks, such as low space utilization, unreasonable functional layout, and weak awareness of environmental protection and energy conservation. To solve these problems, the corresponding optimization strategies are put forward, including improving space utilization, optimizing function layout, strengthening environmental protection and energy saving design. At the same time, the study also explores the positive impact of these optimization strategies on improving the efficiency and sustainable development of the biomedical industry. The architectural space design strategy of modern biomedical industrial park needs to comprehensively consider many factors such as functional layout, optimization of human flow and logistics, clean protection, flexible expansion, green environmental protection, intelligent automation, safety emergency and comfortable humanistic care. Through the in-depth study on the architectural space design of modern biomedical industrial park, this study puts forward targeted optimization strategies, which provides useful references for the construction and transformation of related industrial parks. In the future, with the continuous development of the biomedical industry, the importance of architectural space design will be more prominent, and relevant research and practice will also need to continue to progress and innovation.

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