

Analysis of design characteristics of advanced manufacturing buildings

Hou Xinliang¹, Jing Yang²

¹Central & South China Municipal Engineering Design and Research Institute Co., Ltd, Wuhan, China

²Architectural Design and Research Institute, Xi'an University of Architecture and Technology, Xi'an, China

Abstract: *With the rapid development of science and technology, advanced manufacturing has become an important engine to promote economic growth. From a multi-angle analysis, it is not a single specific industry, but the Internet, materials, biology and other high-tech from the research to the actual application of the entire process industry chain, as an important part of advanced manufacturing, its architectural design features are increasingly apparent. Based on this, this paper deeply explores the characteristics of the architectural design of advanced manufacturing industry, in order to enhance the scientific rationality of architectural design.*

Keywords: *manufacturing industry, Buildings, design*

1. Introduction

Advanced manufacturing industry is an important basis for China's economic development. In order to ensure that it can better play its role, its architectural design should show unique artistry and innovation while meeting the production demand, ensure that different industries are scientific and reasonable on the whole, and also pay attention to green environmental protection, improve the energy efficiency and environmental friendliness of buildings.

2. Definition of advanced manufacturing

Advanced manufacturing refers to the application of advanced science and technology and as well as efficient production management and organization methods, to achieve high quality, high efficiency, low energy consumption, low pollution production mode. It covers a variety of fields, including mechanical engineering, electronic technology, materials science, and more. Actual development can effectively improve national economic competitiveness, promote industrial upgrading, and promote sustainable development.

The core of advanced manufacturing industry is technological innovation and process improvement. Factories through the introduction of advanced production equipment and technology, improve production efficiency and product quality, reduce production costs. At the same time, factories optimize the production process and management mode to realize the automation and intelligence of the production process, and improve production efficiency and flexibility. During this period, attention was paid to environmental protection and resource utilization. Factories should adopt clean production technology and circular economy model to reduce environmental pollution and waste of resources. For example, the use of energy-efficient equipment and green materials to reduce energy consumption and waste generation; Recycling and recycling to maximize the use of resources and reduce dependence on natural resources.

The development of advanced manufacturing industry needs the support and guidance of the government, and the enterprises themselves should also make continuous efforts. Government departments should formulate relevant policies and regulations, provide financial support and tax incentives, and encourage enterprises to carry out technological innovation and process improvement. At the same time, enterprises should strengthen personnel training and introduction, improve their own technical level and management ability; Factories should strengthen technology research and development and innovation capabilities and constantly introduce and apply advanced production

equipment and technology; Factories should establish a scientific production management system to improve production efficiency and product quality^[1].

3. The significance of advanced manufacturing building design

In today's society, the development of advanced manufacturing has become an important force to promote economic growth and improve national competitiveness. As an important part of the manufacturing industry, architectural design has the following important points:

Improve production efficiency. With the continuous advancement of technology, the demand for space, equipment and personnel in the manufacturing process is constantly changing. Therefore, reasonable architectural design can make full use of limited space resources, provide good environmental conditions for production, and improve production efficiency. For example, The factory can through reasonable layout design to shorten the transportation distance of raw materials and finished products, reduce logistics costs; The factory should create a comfortable working environment for employees, improve labor productivity through reasonable ventilation, lighting and air conditioning system design. Achieve energy conservation and emission reduction. At present, the problem of global climate change is becoming increasingly serious, and governments of all countries have put forward the goal of energy conservation and emission reduction. As one of the main sources of energy consumption and carbon emissions, the task of energy conservation and emission reduction is particularly important for the construction industry. Through the use of advanced building materials and technologies, such as green buildings, energy-saving buildings, etc., can effectively reduce the energy consumption of buildings and reduce carbon emissions. In addition, reasonable lighting, shading and thermal insulation design can also reduce the heat load of buildings and further achieve energy conservation and emission reduction^[2].

Improve product quality. Excellent architectural design should meet the production needs and provide guarantee for product quality. For example, The factory can through reasonable workshop layout and equipment configuration to reduce the interference factors in the production process to ensure the stability of product quality; Through reasonable design of people flow, logistics and information flow, it can improve the cooperation of production process and reduce the error rate in production process. In addition, The factory can reduce the interference in the production process and further improve product quality through reasonable noise, vibration and electromagnetic shielding design. The factories should improve the corporate image. The modern and technological architectural appearance can attract the attention of customers and investors, and greatly enhance the image and popularity of the enterprise. In addition, it can also create a pleasant working and living environment for enterprises through reasonable greening, landscape and public space design, and improve employee satisfaction and loyalty.

4. Main features of architectural design

4.1 Functionality and flexibility

For the functional aspect, the building design process should provide the necessary space for advanced manufacturing. Because advanced manufacturing usually involves a large amount of production equipment and materials, buildings must have sufficient space to accommodate these equipment and materials. In addition, the building also needs to provide enough space to accommodate workers and technicians so that production activities can be carried out. At the same time, necessary facilities should be provided. Including power supply, water supply, gas supply and other infrastructure, as well as production lines, warehouses, office areas and other production facilities. These facilities must be able to meet the production needs of advanced manufacturing to ensure the smooth running of the production process.

In addition to meeting the needs of production activities, it is also necessary to consider that the exterior design of the building should match the image of the advanced manufacturing industry, showing the professionalism and technical strength of the enterprise. In addition, the interior design of the building should also take into account the working environment and comfort of workers and technicians, improve production efficiency and employee satisfaction. When designing advanced manufacturing buildings, designers need to work closely with engineers and production personnel. Architectural designers should understand the requirements of production process in detail, and carry

out architectural design according to the requirements. Through cooperation, we ensure that the building design can meet the needs of advanced manufacturing, providing the necessary space and facilities for production activities.

For flexibility, with the progress of science and technology, new production technologies and processes continue to emerge, making the production process more efficient, intelligent and automated. Advanced manufacturing buildings are required to be flexible enough to adapt to new production technologies. For example, the spatial layout and equipment configuration inside the building need to be able to quickly adjust to different production processes and technical requirements. In addition, the structure and materials of the building also need to be flexible to allow for renovation and upgrading. At the same time, the current consumer demand is diversified and personalized, advanced manufacturing needs to be able to quickly respond to changes in the market, and provide customized products and services. Advanced manufacturing buildings are required to be flexible enough to meet the needs of different products and production lines. For example, functional areas and work Spaces inside buildings need to be able to adjust quickly to different production needs and processes^[3].

In addition, the production equipment and tools of the building should be mobile and adjustable for rapid replacement and adjustment. Due to the constantly changing production technology and market demand of advanced manufacturing, buildings may need to undergo frequent renovation and upgrading. Therefore, the design of the building should take into account future development and change, with a certain degree of scalability and renewability. At the same time, buildings also need to be collaborative and interconnected. Since the production process of advanced manufacturing usually involves the collaboration between multiple links and multiple departments, the design of the building should promote the communication and collaboration between various departments. For example, the interior of the building can improve the efficiency of communication and cooperation between different departments by designing reasonable traffic flow lines and shared Spaces.

4.2 Security

In order to ensure the safety performance of advanced manufacturing buildings, effective measures need to be taken to prevent potential hazards. Emphasis is placed on the structural design of the building to ensure that it can withstand various external pressures and shocks. This includes the use of high-strength building materials such as steel and concrete, as well as solid foundations and structural frames. In addition, it is also necessary to consider the fire performance of the building, through the use of refractories and firewalls and other measures to reduce the risk of fire.

In addition to structural design and fire resistance, advanced manufacturing buildings also need to take into account the storage and handling of chemicals and flammable and explosive materials. In this regard, it should be ensured that there is sufficient storage space inside the building, and these storage areas should be separated from the production area to reduce the occurrence of accidents. In addition, buildings need to be equipped with proper ventilation systems to facilitate the timely discharge of harmful gases and vapors to avoid the risk of accumulation leading to explosion or poisoning. In addition, architectural designers should consider the safety of personnel and strictly ensure that there are enough emergency exits and escape channels inside the building, so that personnel can quickly evacuate in the event of an accident. In addition, buildings need to be equipped with appropriate firefighting equipment, such as fire extinguishers and sprinkler systems, as well as emergency lighting and alarm systems to provide necessary information and guidance in case of an emergency.

At the same time, the safety of the surrounding environment should be considered. Designing scheme should ensure that there are no storage areas for flammable and explosive materials around the building and that there is a sufficient safe distance between the building and surrounding facilities. The building's drainage system can smoothly discharge rainwater and waste water, avoiding pollution to the surrounding environment. During this period, attention is paid to the service life and maintenance costs of each protective equipment. Architectural designers should choose materials and equipment with good durability and easy maintenance to reduce the frequency of maintenance and replacement.

4.3 Environmental protection

In order to protect the environment, the design of advanced manufacturing buildings must take environmental protection into account. In terms of environmental protection, various environmentally friendly materials and technologies are mainly used to reduce the impact on the environment.

For environmentally friendly materials, renewable, recyclable or degradable materials should be used to reduce the consumption of natural resources. For example, designing scheme use recycled wood, bamboo, etc., instead of traditional concrete and steel to reduce carbon emissions and resource consumption. In addition, low VOC (volatile organic compounds) coatings and glues can be used to reduce indoor air pollution^[4].

Environmental protection technologies should be limited in the design scheme, including energy-saving lighting systems, efficient air conditioning systems, intelligent control systems, etc. Through the use of these technologies, energy consumption and emissions are reduced. For example, the use of LED lighting systems to replace traditional incandescent and fluorescent lamps to reduce energy consumption and extend the life of lamps. In addition, the ground source heat pump system is used to replace the traditional air conditioning system to provide more efficient cooling and heating effects.

In addition, the design of advanced manufacturing buildings also needs to take into account the treatment and recycling of waste. The waste generated in the production process should be sorted and treated to reduce pollution to the environment. The waste is divided into recyclables, harmful substances and general refuse, and corresponding treatment measures are taken. At the same time, the waste is reused, such as the waste paper is recycled to produce paper, and the waste plastic is recycled to produce plastic products. At the same time, architectural designers should pay attention to the conservation and recycling of water resources. The rainwater collection system is used in the architectural design, and the rainwater is used for non-potable purposes such as watering plants and flushing toilets. Architectural designers should use water-saving equipment, such as water-saving taps, water-saving toilets, etc., to reduce water consumption. Using wastewater treatment technology, wastewater is treated and reused for industrial production or other non-drinking purposes.

Focus on ecosystem protection and restoration. Measures such as green roofs and vertical greening are adopted in architectural design to increase green space and improve air quality. The use of ecological wetlands, rain gardens and other measures to promote the water cycle and biodiversity protection. Use ecological compensation measures, such as planting trees and restoring wetlands, to restore damaged ecosystems.

4.4 Digitalization and intelligence

With the development of information technology, these enterprises need to make use of technologies such as big data, cloud computing, Internet of Things and artificial intelligence to digitize and intelligentize production processes. In order to meet this demand, building design needs to fully consider the application of information and communication technology, and provide corresponding infrastructure, such as high-speed networks, data centers and intelligent control systems. The architectural design should pay attention to information security and privacy protection. With the increasing demand for digitalization and intelligence in enterprises, a large amount of data is collected, stored and processed. This data contains the company's core trade secrets and customer privacy information, so it must be properly protected. Building design should consider the use of advanced security technologies and measures, such as firewalls, encryption technology and access control, to ensure the security and privacy of data. On this basis, it provides the information communication foundation for high-speed network. High-speed networks can support the transmission and processing of large amounts of data, improving production efficiency and response speed. During the design process, designers should work closely with network engineers to ensure the reliability, stability, and scalability of the network. In addition, the building design should also take into account the future development of network technology to facilitate upgrades and expansions.

In addition, the building design also needs to provide data centers as data storage and management centers. It is the core hub of enterprise data, carrying a large number of data storage, backup and recovery tasks. During the design process, the relevant personnel should consider the layout, capacity and security of the data center. At the same time, the building design should also take into account the energy consumption and environmental impact of the data center, and adopt energy-saving and environmentally friendly design strategies. In the design, intelligent control system should be provided to realize the automation and optimization of the production process. The intelligent control system can realize the real-time monitoring and control of the production process through sensors, actuators and algorithms. During the design process, designers should work closely with automation engineers to ensure the reliability, flexibility and programmability of intelligent control systems. In addition, the integration of intelligent control system with other systems should also be taken into account in

architectural design to achieve comprehensive production management and optimization ^[5].

4.5 Humanization

Humanized design is a crucial link in the design of advanced manufacturing buildings. In order to achieve this goal, designers need to consider several aspects. When considering the working environment and working conditions of employees, architectural designers should pay attention to factors such as space layout, lighting and ventilation. Reasonable spatial layout can improve work efficiency and facilitate communication and cooperation between employees. Good lighting and ventilation can improve employee comfort and help reduce fatigue. In addition, designing scheme should effectively deal with noise, temperature and other issues to ensure that employees work in a suitable environment. In order to meet the work habits and work needs of employees, convenient work facilities should be provided. The office area should have enough space for employees to place documents, equipment and other items, while taking into account the needs of employees in different positions, such as management, technical staff, etc. The rest area should provide comfortable seats, tea rooms and other facilities, so that employees can relax after intense work. Meeting rooms need to be equipped with advanced audio and video equipment to meet a variety of meeting needs.

In terms of paying attention to the physical and mental health of employees, the following points should be paid attention to: air quality is crucial to the health of employees, designers need to ensure that indoor air quality is up to standard, and air quality can be improved by setting air purifiers, green plants and other ways. In terms of lighting, it is necessary to provide sufficient natural light and soft artificial light to reduce irritation to the eyes. In terms of color, you can choose warm and comfortable tones, such as light blue, light green, etc., to create a pleasant working environment.

5. Conclusion

To sum up, the characteristics of advanced manufacturing building design are mainly reflected in the aspects of functionality and flexibility, safety and environmental protection, humanized design and technology integration. These features not only reflect the characteristics of advanced manufacturing, but also reflect the development trend of architectural design. Therefore, in the design of advanced manufacturing buildings, these characteristics must be fully considered in order to achieve efficient, safe, environmentally friendly, humanized and technological production activities.

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