Solutions in the Field of Chinese Furniture Design Based on Ecological Problems

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Abstract: This article analyzes the ecological and environmental problems brought about by furniture design in the context of industrial production, and focuses on the production status and influence of furniture manufacturing in China.Citing the seven steps of “product pollution” described by Victor Papanek in the book “‘Design for the Real World”, this method introduces the ecological and environmental problems brought about by the entire process of furniture manufacturing.And put forward the countermeasures taken by China from the entire process of furniture manufacturing to recycling, as well as the improvement methods of furniture design.

INTRODUCTION

In the context of industrialization and mass product production, the energy consumption and environmental pollution faced by mankind have now become the most serious ecological and environmental problems.Since the 1990s, there have been ecological crises around the world, and the entire international community has begun to explore and implement rationalized ecological protection programs.Furniture manufacturing accounts for a high proportion of the production of daily necessities and is highly dependent on raw materials. It is an important field that affects the ecological environment.Green manufacturing is an advanced manufacturing approach, which comprehensively considers environmental impact and resource efficiency and is considered as the future direction of modern manufacturing industry. The development of green manufacturing of furniture will affect the entire ecology.(Xiong, et al., 2020)

China's furniture manufacturing volume is huge,taking the most representative wooden furniture as an example, after 2004, China became the world's largest exporter of wooden furniture. According to China Customs statistics, China's wooden furniture exports reached 92.732 billion yuan in 2017, far greater than the imports of 6.034 billion yuan. (Kazakova and Qiu, 2022) From the perspective of the structure of China's furniture market, by 2020, wooden furniture will account for 40.48% of the entire furniture market, and metal furniture will account for 50.91% (Mid-longitude vision). China's furniture output in 2021 will be 1.12 billion pieces. It has become the largest furniture producing country in the world. Important environmental aspects of wooden furniture manufacturing include also energy consumption and raw material extraction. According to the report "Global Forest Resources Assessment Report 2015" by the Food and Agriculture Organization of the United Nations (UNFAO), the global forest area is 3.999 billion hectares, with a coverage rate of 30.6%, and the forest area continues to decrease. (State Forestry and Grassland Administration). Production process includes steps such as drying, machining (i.e., sawing, planing and

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bending), assembly, pre-finishing, coating and finishing, which may cause environmental impacts in different forms. (Parikka-Alhola, 2008)

According to the survey of relevant materials, the pollution caused by furniture has become the third largest pollution in the world, second only to the pollution caused by decoration and construction. （ Li ， 2015 ）In the most difficult crisis of global warming, countries around the world have proposed a low-carbon economy. Low-carbonization of furniture manufacturing is also particularly important, that is, low-carbon design concepts, low-carbon materials, low-carbon production, low-carbon packaging, low-carbon recycling, low-carbon marketing, and low-carbon logistics (Xiong，2012).

2 METHODS

The processes involved in furniture manufacturing are complex and cause unnecessary pollution to the environment from production to recycling. In his book 'Design for the Real World' design critic Victor Papanek states seven steps that lead to 'product pollution':

1. Natural resources are destroyed; moreover, these resources are usually

irreplaceable

2. The very destruction of these resources by strip-mining, open pit mining, and

so forth, creates a pollution phase [1 and 2 form phase I]

3. The manufacturing process itself creates more pollution [phase II]

4. This same manufacturing process also brings about worker alienation and

anomie.

5. Packaging [this is essentially a repetition of phases I and II]

6. The use of the product creates a more pollution and user alienation and user

anomie [phase III]

7. Finally, discarding the product creates even more lasting sources of pollution

[phase IV]

According to design critic Victor Papanek's analysis of the four stages of pollution caused by the product manufacturing process, a series of design proposals have been carried out in the field of Chinese furniture design. Chinese furniture design discusses ecological design schemes from the use of materials, the furniture manufacturing process to the user's use process, the life cycle of furniture, and the recyclability of furniture after use. So as to solve the ecological environment problems caused by furniture products in the whole production and use cycle.

3 RESULTS

In recent years, China has attached great importance to integrating the concept of environmental protection into furniture design, and has adopted a series of measures. For example, in July 2018, China began to implement the document scheme of GB/T 35607-2017 "Green Product Evaluation-Furniture" (Cai, et al., 2021). The green evaluation indicators of the life cycle of furniture products are determined from the aspects of resource attributes, environmental attributes, and quality attributes. The whole process of the life cycle of furniture products requires a systematic design process, which involves many industries and professional parts. (Iritani, et al., 2015) Therefore, it is necessary to consider the impact of each step on the ecology before designing.(Sun and Liu, 2019) The green design of the product life cycle of furniture means the design of the entire system of furniture. It is to think about the design from the perspective of harmony between people, products and nature, and to advocate the reduction of energy consumption and the recycling of energy.(Ren and Wang, 2018)

Product design has also been seen as important to promoting greater use of sustainable materials.(Bumgardner and Nicholls,2020).As the source of furniture production, furniture materials are also the primary factor affecting the environment. Chinese modern and contemporary home decoration style "New Chinese" furniture style is one of the most popular mainstream styles in the market. While inheriting the language of traditional Chinese furniture, the new Chinese style furniture does not use the high-quality hardwood commonly used in traditional furniture. Because of the centuries-long growth cycle of high-quality hardwoods, some species are on the verge of extinction. The new Chinese-style furniture is mainly made of cheap black walnut, elm , African rosewood, Southeast Asia, African rosewood, etc., and is matched with metal, fabric, leather and other materials. The diversified use of materials, especially the use of renewable and easily renewable materials, is very important to the protection of natural resources.(Yin and Ruishuang,2021)Bamboo grows widely all over the world, especially in the Asia-Pacific region. Bamboo has the characteristics of easy reproduction, fast growth, short growth cycle, high mechanical properties, high strength, and strong compression resistance. (Boran, et al., 2013)Due to the influence of traditional Chinese culture, bamboo furniture is also widely welcomed in the market, because bamboo has the meaning of integrity and backbone in traditional Chinese culture.Therefore, in China, bamboo furniture will be an important substitute for wooden furniture in the future. Due to the rapid development of synthetic technology, panel furniture is also developing rapidly in China. China is the world's largest producer of composite panels. Synthetic panels can more widely absorb degradable and renewable materials, such as rice and wheat panels, hemp stalk panels, and cotton stalk panels that have become more popular in the market in recent years.(Chen, et al., 2017) At the same time, lightweight honeycomb panels, paper materials, rattan materials, etc. in the Chinese market can be used as substitutes for wood, and have great potential for development, thereby protecting limited forest resources.Therefore, selecting materials from the source of furniture manufacturing can effectively control the large-scale waste of resources caused by furniture production.

In the furniture production process until it is sold, this process consumes and wastes resources very seriously. Ingvar Kamprad, the founder of IKEA, put forward the "anti-three stupid packaging concept": the air of transportation is stupid, it is stupid to make consumers pay for excessive packaging, and it is stupid not to be able to deliver furniture to home on the same day. In March 1953, on the product shopping list of IKEA's first fair, guests saw IKEA's first table called "Max" which was completely assembled by users themselves.（Du ，2015）In the 1980s, RTA furniture appeared in Europe, laying the foundation for the current flat furniture by means of product parts and integrated packaging.(Lihra and Graf,2012)Immediately, large-scale furniture forms of componentization and flat packaging emerged in the market. (Chu, et al., 2019) The flat furniture design style is carried out under the background of globalization, urbanization, progress in the transportation industry, widespread application of wood-based panels, and the popularity of minimalist design concepts. Its purpose is to reduce factory assembly, transportation and storage costs. . The flat design scheme in furniture has the characteristics of simple form, easy disassembly and assembly of structure, easy movement of the whole, and replaceable parts. The flat design scheme in furniture first saves the use of materials because of its simplicity in form, and the selection of materials is basically based on light-duty environmentally friendly synthetic materials. Especially for the application of panel furniture, computer numerical control machine (CNC) technology can be adopted to effectively manage the application of materials.（Dotson，2015）.Secondly, the disassembly of the furniture and the user's own assembly save the transportation cost during the transportation and the assembly cost and storage cost of the furniture factory. The flat design of the furniture makes aging parts easy to replace and prolongs the service life of the furniture. Therefore, the flat design concept in furniture can effectively reduce the ecological damage caused in the furniture production process.

The waste recycling link after the furniture is used is an important stage to determine the environmental protection properties of furniture. On the basis of the green evaluation index of the life cycle of furniture, the recycling of waste furniture will realize the recycling of energy. Taking wood as an example, in the early 1990s China developed a standard configuration system for waste wood recycling. If this standard configuration system for waste wood recycling is effectively implemented, it can fully reduce the negative impact of furniture on resources and the environment. (Seegers and Melnyk,1997)The recyclability of furniture takes into account the selection of green materials, the structure is easy to disassemble, and the types of materials are limited. Recyclability of furniture is a systematic design process. Therefore, if the environmental protection design in the furniture design and production process is realized, every step from furniture production to recycling should be systematically designed.

4 DISCUSSION

In this study, starting from the whole process of furniture manufacturing, we focus on finding ways to reduce the pollution of furniture manufacturing in China. From the seven steps of "product pollution" described by design critic Victor Papanek, this guideline also applies to furniture manufacturing. In the whole process of furniture manufacturing, the possibility of pollution should be reduced in every step, and ecological furniture design should be carried out according to the living habits of modern consumers and the development of modern technology. First of all, Chinese furniture manufacturing should strictly abide by international furniture manufacturing environmental protection standards. At the same time, more stringent environmental protection standards suitable for the country should be formulated, and strict supervision and implementation should be carried out. Secondly, in the design of furniture before furniture manufacturing, the simplicity of product form, the renewability and degradability of materials, and the simplicity of processing procedures should be considered. Prevent manufacturing waste due to imperfect design thinking. Thirdly, in the furniture manufacturing process, the development of environmental protection manufacturing technology, the control of the number of molds used, the treatment of sewage discharge, and the treatment of exhaust gas from processing machines are systematically considered. Then, the environmental pollution and waste of resources brought about by the assembly method, storage method, transportation method, transaction method, and display method after the furniture is manufactured must be considered in place. Finally, the service life of furniture and the recycling of furniture after aging should be considered, and the commercial thinking of "throw away after use" and "planned waste system" should not cause ecological problems.

5 CONCLUSIONS

Due to the huge scale of China's furniture market and the complex fields involved in the furniture industry, the green design norms in the field of furniture design are very critical to the development of the entire ecology. Therefore, in the entire process of furniture design, production, use, and recycling, China should strictly formulate standard and environmental protection strategies to protect the ecological environment of the earth.

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