

Green Innovation Design of Products under the Perspective of Sustainable Development

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Abstract. with the continuous development and progress of productivity, product design spans with the age now and forms a diversified formation. But when there is a progress of science and technology, the speed of consumption of resources is also increasing, the relationship between mankind and the nature further worsens, resources will be exhausted, pollution is increasingly serious and shocking public nuisance events occur frequently. People pay more attention to the environment due to the harms to the nature caused by the development of industry, science and technology. Nowadays, people have clearly recognized the important role of design in environmental protection. The ecological research on constructing a new aesthetic relationship between human and nature has drawn wide attention from all circles of the society. Green innovation design has become the focus of global concern.

1. The role of green innovation design in sustainable development

Design is pushing the progress of mankind and caring the relationship between man and nature and creating a reasonable way of life. According to history, the choice of green design is inevitable, only green design can achieve the harmony of natural environment, social culture, and economic development, therefore, the development of green design is essential. First of all, green design is a basic guarantee of product quality. In terms of product design, green design is not only the principle of "3R" (reduce, recycle and reuse), but also to meet the green and healthy standards in many aspects of the product and prevent the environmental destruction and resource waste, such as product materials, functions, technology, quality, in addition to these aspects, the green design also pays more attention to the physical and psychological impacts of products on the users[1].

Secondly, in the economic aspects, green design also has its high value. People realize that environmental damage will affect their own living standards, the public awareness of environmental protection has been improved, while the Government enacts the relevant legislation, people are slowly looking forward to the green innovation design. With the people' in-depth understanding on green innovation design, the products designed by this method are accepted and chased after by people.

2. Principle of green design

Compared with the traditional design, the green design should follow the following principles:

2.1 Principle of making full use of resources

The principle of making full use of resources means giving priority to consider the properties and renewability of the resources when selecting and using resources, which is consistent with the concept



of sustainable development and the waste cannot be caused by improper design. Second, in the designed products, try to use the products in the entire life cycle farthest. As shown in Figure 1.

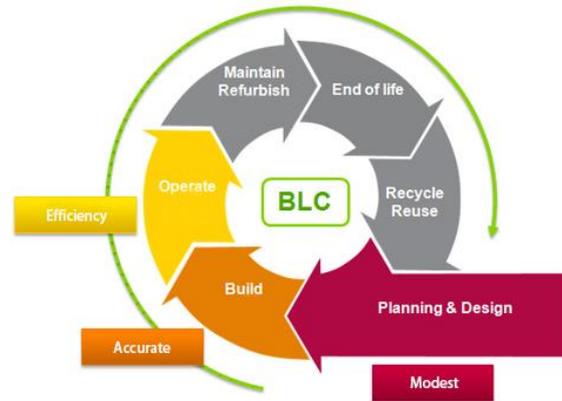


Figure 1. The whole life cycle of products

2.2 Principle of energy conservation

The principle of energy conservation refers to selecting renewable energy sources, such as wind energy and solar energy, rather than fossil fuels, such as coal and oil, making the designed products consume the fewest energy sources in the whole life-cycle.

2.3 "Zero pollution" principle

When designing any products, consider how to eliminate pollution, avoid the end treatment method of treatment after pollution, develop new products by the strategy of prevention first, governance second, and control pollution from the root.

2.4 Principle of advanced technology

Green design must make the product be in "green" color, requires using the most advanced technology, and requires designers to be creative, so that the product has the best market competitiveness.

2.5 Principle of the best ecological and economic benefit

Green design should not only consider the economic benefits created by the product, but also start from the point of view of the sustainable development to consider the impacts of the environmental behavior of products in the life cycle on ecological environment and society as well as the loss of environmental and ecological benefits and social benefits. In other words, the green design should make the green product producers not only obtain the good environmental benefit, but also obtain the good economic efficiency, namely the best ecology economic efficiency.

3. The inevitability and necessity of green design

The irreversible era development direction of the 21st century is the green design, which is a brand new product design philosophy. The emergence of green design is not accidental, it is inevitable and necessary. In the process of product development, it is the only way and it is the inevitable choice to ensure human survival and achieve sustainable development; and it is the inevitable product under green consumption wave in the new century and the foothold of the future enterprises [2]. In order to properly implement green design, we must explore new approaches to industrial design and follow certain guidelines, by which the environmental protection can be integrated into industrial design better. In addition, it must be recognized that green design is still in the formation stage of the development process. In order to improve it, more designers are needed to know it, understand it to solve the various problems in the systematic process. As shown in Figure 2. and 3.



Figure 2. Bamboo material products



Figure 3. Bamboo material products

In the past industrial design, there is a lack of green design concept, when designing products, the designers do not consider the conservation of materials and recycling of materials and the result is that the non-renewable resources on earth are gradually swallowed. With the rise of postmodernism, product modeling pursues individuation excessively, the product shapes are exceedingly strange, so that the product manufacturing is more difficult and the utilization of materials reduces, and a lot of resources are wasted. In addition, driven by commercial design, product replacement cycle is shorter and shorter, thus accelerating the depletion of non-renewable resources on earth. Therefore, in order to alleviate the resource crisis and energy crisis on earth and take full advantage of the limited resources on earth, and industrial design can walk on green design road only [3].

First of all, green design is the inevitable choice of self-improvement of industrial design concept. In its formation and development process, the industrial design constantly improves, and improves its own shortcomings. But no matter how industrial design concept evolved in the past, it did not consider the environmental factors, namely, in the design, the green concept is not integrated, which is its greatest shortcoming and indirectly brings some negative impacts on human beings. We know that for any kind of product, no matter how long its life is, but it cannot avoid the dumped ending caused by ageing and damage. Because there is no green consciousness, the previous design results that the product is abandoned and non-recyclable, non-reusable, the product wastes have accumulation. Also because there is no green design sense, some toxic materials or the materials difficult to be degraded will be selected in the design, so that the product wastes will pollute the environment. With the explosion of world's population, the speed of generating household refuse and product waste is faster and faster. It is reported that since the 1990s, about 1 billion tons of household wastes has been generated in the world, which is almost 3 times of the weight of the entire human. And in the treatment process, there may be secondary pollution. In the new century, in order to fundamentally solve the excessive garbage, reduce pollution, the way is to take the green design road in industrial design only.

Secondly, the green innovation design is necessary to guarantee the sustainable development. In modern times, the science and technology develop rapidly, the productivity improves in a fast speed, and the unprecedented material and culture treasures are created, thus the human civilization reaches a new stage. To conform to this irreversible time trend, for the industrial design, a subject need to be perfected constantly, the idea of sustainable development must be blended in the product design process in order to combine the ecology, environment and economic development as an organic whole with reason as goal, in the economic development, it is necessary to consider the long-term bearing capacity of natural ecological environment, make sure that the environment and resources can not only meet the economic development requirements, but also be regarded as one of the factors for the survival of mankind to directly meet the long-term survival demands of human, in order to form a comprehensive development strategy that the resources and energies can be effectively used, and environmental pollution can be reduced to minimum extent, and all of these can be realized by

developing on the green design road in the industrial design. So green design is necessary for the sustainable development of human society, and is a vital part of sustainable development. The green design is an inevitable product under the trend of green consumption in 21st century. In the 1970s, with the deterioration of environment, the people's environmental awareness improved constantly, especially in 1980s, the "Green Movement" with the topic of environment protection was carried out in the globe gradually. In western countries, the "green food"-based green revolutions were broken out one by one. Under the effect of green food, the green products such as green refrigerator, green computer, green auto and green buildings come out in succession. The green consumption aimed to improve the quality of life was born at the right moment. The green consumption is a pattern of consumption to follow health, uphold nature and be beneficial to environment protection. When people are on shopping, they not only concern the function, life, type and price of the products, they even pay more attention to the environmental performance, and prefer to buy the green products with more costs[4]. As shown in Figure 4 and 5.



Figure 4. Biodegradable toothbrush



Figure 5. Biodegradable boxes

In addition, people consume the resources and energies in the life with the purpose not only to live in comfort, but also to save resources and energies in quantity. An oversea consumption survey shows that there are more than 70% of American express that the green image of enterprises and the products may directly affect the purchasing behavior: in European market, nearly half of the customers will consider the environmental issues while buying the products, and 94% of Italians favor the green products, and 82% of the Germans will pay attention to the environmental factors while consuming the products, in Asia, such as Japan, Korea and Hong Kong, the customers are also wild about the green products. It is thus clear that the green consumption has become the trend in the international market. To adapt this trend, the designers must blend the environment protection in the product design, in order to meet the environment protection requirements in material and design, meanwhile, combine the green property of packing material, finally obtain the green products, which is the meaning of green design.

Finally, the green design is the basis of the enterprises in the future, and the effective approach to eliminate the green trade barrier. With the rapid development of information technology, the world seems to be smaller, and the globe changes to be the global village in broad sense, and the concepts of domestic market and foreign market also become indefinable. During the process of economic globalization, the enterprise must get into international market if it wants to develop in the future. The precondition of getting into international market is that the products must meet the international standards and specifications. With the arising of green consumption in the globe, various countries in the world have formulated demanding green product standards, if some enterprises produce the products which are not meeting the standards, as a result, they will be removed from the world market relentlessly, and finally, the enterprises will go to die[5].

4. Green innovation design promotes the sustainable development

With the development of human society, especially the accelerated industrialization process and

expanded urban size, the regional pollution, ecological damage and resource and energy exhaustion become serious and endanger the human's survival and sustainable development. Considering the demands of information society in the 21st century and the consumer demands under the condition of population expansion and resource reduction, in the future, the design shall be aimed at the healthy, hygienical, safe and easily operational equipment, thus the parts of equipment or products can be easily replaced and reused, in order to save resources and energies as much as possible, and reduce the environment pollution. The green design conforms to the history development tendency, focuses on using the resources effectively, improving the product quality, and reducing the waste amount caused as industrial and agricultural production activities and various vital movements, which is a design method meeting the environmental requirements. In a word, the green design can save energy and resource, can relieve the environment pollution, and realize the healthy and harmonious development of society, economy and environment, and there are perfect environmental benefits.

5. Conclusion

As a new design method, the green innovation design is widely accepted in western developed countries, after it fully displays effect in enterprises, the objective ecological and economic benefit can be obtained. Asia, Japan and Korea have conducted many researches, China also conducts some researches on green design and green manufacturing, and meanwhile, the Natural Science Foundation of China and 863 High-technology Research Project also subsidizes some scientific research projects, including green design and green manufacturing, and resource optimization, which have been applied in some green product design. As a new design method, it is not mature yet in theory, and there are still some works to be done; so it is necessary for the enterprise circles and academic circles to pull together in order that it can be widely used in the product design.

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