Functional and Sustainable Design of Products Based on Ecological Concepts

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Abstract. As products and necessities of human production and life, in the context of rapid economic development and the rapid development of production and manufacturing, the excessive use of products has become the focus of global attention to the destruction of the ecological environment and the waste of resources. As a result, sustainable development has also become the core issue of future social and economic development, and green concepts and sustainable design have also become the focus and development trend of future product design. This article enhances the product's own value and social value through functional optimization of products, recycling and re-creation of materials. From the functionality to the service life of the product, it will be based on reducing resource consumption, protecting the ecological environment, maintaining and promoting the long-term and stable development of society.

Keywords: Ecological Concept · Product Design · Product Functionality · Sustainable Design

1 Introduction

At a time when the topic of ecology has received much attention, all walks of life have begun to take the green route, and the product industry has also integrated the concept of environmental protection and energy saving in terms of production materials, transportation costs, and usage methods, making it an effective way to reduce energy consumption in production and recycle for reuse green cycle. The green design of the product is indeed effective in ecological protection, but the energy consumption of recycling, energy consumption of processing, and time-consuming degradation are still problems to be solved. Therefore, sustainable design has become a more suitable design idea and form after green design, not only the environmental protection and sustainability of materials, but also the sustainability of product functions. Through the optimization and innovation of materials and functions, the product can be extended. Long service life, so that it can exert greater and more value in addition to the original function, convey the green concept to people more directly, subtly change people's past pollution and waste behavior, and implement the concept of ecological environmental protection and sustainable development into daily production Life.

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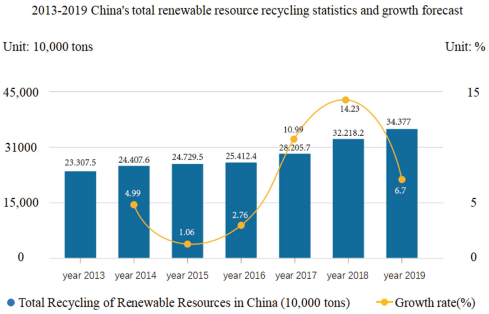

Fig. 1. 2013–2019 Statistical growth forecast of China's total renewable resource recycling. (Image source: Compiled by Foresight Industry Research Institute, Ministry of Commerce)

2 Ecological Concept and Sustainable Development

Ecological concept refers to the concept of ecological protection and ecological development of human beings for the natural environment and social environment, and involves the relationship between human beings and the natural environment and social environment. These include safeguarding national ecological security, improving environmental quality, and improving resource utilization efficiency. Ecological protection is not achieved overnight, but requires perseverance and continuous reform and advancement. During the "Thirteenth Five-Year Plan" period, my country's ecological environment has been continuously and effectively improved. In the 2022 National Ecological Environmental Protection Conference, it was also proposed that while seeking progress while maintaining stability, we should adhere to reform and innovation, always focus on the people, and make people feel that they are around them. Optimization of the environment.

Sustainable development refers to the protection of natural resources and ecological environment while meeting people's living needs, so that future generations have sufficient and abundant living resources and development conditions. While protecting the existing resources, we should start to achieve sustainable development from the aspects of resource recycling and rational utilization of renewable resources. The 19th National Congress of the Communist Party of China clearly proposed to boost the renewable resources industry and develop a circular economy. As shown in Fig. 1, according to the data in the "China Renewable Resources Recovery Industry Development Report (2019)", the total amount of renewable resources recovered in my country is 320 million tons. A year-on-year increase of 13.4%, and has a trend of increasing year by year. The "Implementation Plan for Promoting Green Consumption" announced on the morning of January 21, 2022 also mentioned opposing waste, encouraging a green and low-carbon lifestyle, and incorporating it into the evaluation criteria list and certification catalogue of green products in due course.

3 Development Status and Trend of Product Functional Design

3.1 Product Functionality

(1) Basic functions: As the core of the product, in addition to meeting the basic needs of users, it also needs to achieve quality assurance and safety assurance. The basic function is the foundation and premise of the product and the original purpose of the consumer's purchase, while the quality and safety guarantee are the competitiveness of the product. High quality can improve the service life of the product, and the safety of materials and structures is the health guarantee for users.
(2) Psychological function: When purchasing a product, users will also consider its shape design, packaging form, etc. to meet their psychological needs. With the development of the manufacturing industry, a variety of products have emerged, and users' consumption concepts have gradually developed in the direction of appearance, brand, innovation, and personality. In addition to personal use, it will also be used in different occasions, which aggravates the user's emphasis on satisfying psychological needs.
(3) Additional functions: It refers to satisfying the user's use and interests after consumption, such as the transportation and installation of large-scale products, after-sales service during the warranty period, etc., to expand and improve the user's sense of use. With the development of Internet e-commerce, this additional function has also produced obvious commodity competition, and various discounts and after-sales services have a positive impact on expanding user groups and increasing product competitiveness to a certain extent.

3.2 Trends of Product Functional Design and Environmental Protection

Under the promotion of the green concept, people pursue the quality of life and pay more attention to environmental protection and minimalism in product requirements. The choice of products ranges from meeting the needs of use to the pursuit of price, quality, appearance, and user experience, and then to whether it can be used. To achieve resource conservation and recycling, this is a process from rationality to sensibility and then to rationality, and green design is gradually infiltrating into products.

(1) Simple and portable: Simplify the original complex and cumbersome product packaging and the structure of the product itself, so that the packaging can "reduce weight" in the original decoration and protection function, and convert it into degradable materials or even zero packaging, which is green and energy-saving. Highlight the product. The design of the product itself also tends to be lightweight and portable, saving production materials and transportation costs, as well as saving storage space, making it lightweight and easy to carry. Greatly solve the user's burden of use, improve the frequency and efficiency of use.
(2) Disassembly and assembly: Now many products are assembled in the form of assembly, and many young people are also willing to assemble by themselves. Not only can they experience the fun and sense of accomplishment of assembly, but this mode of assembly and disassembly is a kind of resource and transportation cost

saving. Purchasing or sizing according to demand, to achieve the ultimate use of space and products, the shortage and damage of assembled parts can be partially replaced and repaired, which improves the service life and cycle of the product, and the replaced parts can also be used in other parts. In objects and the environment, maximizing sustainable use while maintaining functionality.

(3) Integrated type: Integrate various original products from the aspects of use occasions, related functions, similar materials, etc., so that they can play multiple functions in one product. It not only improves the efficiency of the user's work and avoids cumbersomeness, but also makes full use of resources and reduces energy consumption under the purpose of people-oriented design [3].

4 Sustainable Design of Products

With the development of social economy, the speed of product replacement in people's production and life is accelerated. Although people's awareness of environmental protection is strengthened, and green degradable materials are also used in products. Natural degradation of materials still takes a lot of time, and sorting and recycling products also requires a lot of manpower and material resources. Therefore, sustainable design has become an advanced stage of environmental protection and green design. Sustainable design is based on sustainable development, in which the three elements of people, products and the environment are mutually reinforcing and inseparable. The concept of sustainable development in product design has also become the premise of design and the direction of future product design. Not only through production materials, production processes, recycling, but also emotional design and the combination with innovative thinking. Thinking from multiple dimensions is a more systematic design method, which subtly improves people's living environment and consumption concept (Fig. 2).

4.1 The Purpose of Sustainable Product Design

The concept of sustainable design gradually penetrates human life and reshapes social values and lifestyles. The concept of sustainable design is to reduce the consumption of natural resources, coordinate environmental protection and resource utilization, and advocate high-quality and healthy development methods. Products are the facilitators of people's production and life, meet the needs of life, and exist in all aspects of life. The sustainable design of products is an intuitive way and an important way for designers to

Time for the garbage to degrade naturally in the land

Paper	3-4 months	Nylon fabric	30-40 years
Cigarette butts	1-5 years	Leather	50 years
Wool fabric	1-5 years	Cans	80-100 years
Tangerine skin	2 years	Plastic	100-200 years
Tin can	10 years	Glass bottle	4000 years

Fig. 2. Time for the garbage to degrade naturally in the land. (Image source: wenku.baidu.com)

convey the concept of environmental protection. Widely spread, change people's extravagant and wasteful living habits, and penetrate the concept of ecological environmental protection and sustainability from the subconscious.

4.2 Trend and Inevitability of Sustainable Product Design

In the field of product design, sustainable design has become an inevitable trend and design goal, and green concepts have also been integrated into various fields. The production of various degradable materials and new materials for recycling and reuse undoubtedly pays attention to the concept of environmental protection, reflecting the Sustainable development has become an inevitable trend in the development of the design industry.

(1) Extend the product life cycle
The environmental protection of materials is a necessary condition for the production of green products, but the diversified production of products cannot fundamentally reduce energy consumption. More and more people begin to pay attention to the service life of products, which is also the source of sustainable products. In June 2021, DT Finance and First Financial Business Data Center (CBNData) launched the "2021 Young People's Consumer Behavior Survey". After 2131 valid samples were counted, the emphasis on quality was "You buy a product." What are the most important factors to consider when buying a product?", "What characteristics of the product are consumers of all ages willing to spend more on?" and "What reasons would you choose to repurchase?" accounted for the top three questions. The various functions and quality assurance of the product itself have become an important choice for users. Extend the life cycle of products by increasing the frequency of use, improving publicity and methods, improving quality, discovering new functions, developing markets, finding potential markets, and innovative uses, and even transforming into another form of use to develop a new life cycle [5].

(2) Have more added value
In addition to the added value of the product itself. Return the product to nature for degradation and reproduction in a green and environmentally friendly form, so that it has recycling value; give the product appreciation value through production technology or publicity means, such as Coca-Cola bottles of various years or co-designed with art brands, which are eagerly collected by many people, Make it collectible; the unique shape of the product or the graphic colors on the appearance have artistic aesthetics, and the product can be sustainable through decoration. Many young people with ideas and strong hands-on ability will DIY re-create the used products to make the products sustainable. It has functions other than the original product itself, and has appreciation value.

(3) Ecological protection and resource energy conservation
In the product design, in addition to thinking about its appearance, form, functional characteristics, etc., it is necessary to think deeply about whether it reduces the impact on the environment and whether it reduces resource consumption and green design. The raw materials for the production of products should be clean, non-polluting, renewable raw materials, or environmentally friendly materials processed through technical means. The production process is also to avoid resource waste and

environmental pollution, and at the same time do a good job in recycling and reusing waste materials. Products are put into the market, and the disposal of discarded outer packaging and expired products should also be followed up. The after-sales service of the product during use and the recycling and reuse of the product at the end of its service life minimize the burden on the environment and resources, thus forming a green and energy-saving production closed loop [4].

4.3 Approaches to Sustainable Design in Products

(1) Material optimization

Materials are the basis of product production. In the process of social development, the use of materials has become increasingly abundant, the means of acquisition have become more advanced, and the forms of use have become more diverse. While satisfying people's production and life, it ignores the pressure on the ecological environment. With the advocacy of ecological civilization, green low-carbon, and sustainable development, everyone's awareness of energy saving has been aroused, and the selection of product materials has also begun to reflect on the original paper, plastic, adhesive, etc., and develop in the direction of ecological energy saving. The packaging is also optimized in accordance with the principles of reducing consumables, safe degradability, and recycling [2].

Before the change, people pursued exquisite and luxurious packaging. Now, under the ecological concept, the packaging of products has begun to lose weight to avoid excessive packaging. In addition to basic protection and explanation, the production materials also emphasize green environmental protection, using natural materials or synthetic materials under scientific and technological means to make them degradable and reusable packaging materials.

Plastic is a common non-degradable substance in our life. As shown in Fig. 3, the edible biofilm has replaced the plastic sheet packaging of instant noodle cakes. This film is obtained from potato starch, glycerin and water, and added to it. Seasoning ingredients, when dissolved, will play a role in seasoning, killing two birds with one stone.

The food packaging provided on the plane is usually paper or plastic, which is not only inconvenient to recycle but also a waste of resources. The edible coffee cup developed and designed by Air New Zealand and Twiice in Fig. 4 has greatly alleviated this problem. This kind of coffee cup is made of corn and paper, which can keep the crunchy taste after pouring into the drink, and can also be eaten as a dessert later. This kind of cup not only tastes sweet, but also interesting and environmentally friendly. Response and support.

(2) Emotional optimization:

In addition to improving original functions, products can also be endowed with emotional value. Many users use emotion to select products and make final decisions in addition to rational analysis of product performance. For example, choosing some domestic brands, classic brands, products with nostalgic forms, humanities and arts, traditional culture, home and country feelings, and cultural self-confidence, etc., make the products have another spiritual meaning, and people will put their

Fig. 3. Designer Holly Grounds Works.

Fig. 4. Edible coffee cup.

personal habits and emotions into the product in order to prolong the service life of the product [1].

As shown in Fig. 5, this is a sprouting pencil. The ends of our common pencils are generally installed with erasers, decorations, or replaced at both ends, but this has a high risk factor. At the end of this pencil, the seeds of various plants are added under the water-soluble film. When the pencil is inconvenient to use, insert the end of the pencil into the soil and water it, and it can grow and sprout after a week. This pencil not only has another function besides writing, but also endows it with the profound educational meaning of using growth instead of discarding and returning green to nature. With the growth of green leaves, different plants will be harvested, which not only conveys the concept of green environmental protection, but also brings surprises to users and the experience of cultivating plants.

Fig. 5. The works of the DEMOCRATECH design team.

Fig. 6. Reusable folding tray.

(3) Function optimization:
Under the fusion of science and technology and creative thinking, the functions of products and packaging are not only original functions, but innovations based on them, giving them another function. Skip recycling, fundamentally solve the problem of green environmental protection, achieve sustainable development design from the perspective of users, reuse resources to a great extent, and improve the cost performance and utilization rate of products.

Figure 6 this reusable folding tray, called Calzone, is made of medical silicone and can be heated directly through microwaves and ovens. After being folded, it has a strong airtightness, and it is both a dinner plate and a fresh-keeping box, which can be used for multiple purposes.

As shown in Fig. 7, the bottle of this sustainable soap is solid soap, and the inside of the bottle is filled with 100 ml of liquid body wash. After the liquid is used up, the bottle can continue to be used until it is decomposed, and the whole process of use will not leave any plastic waste.

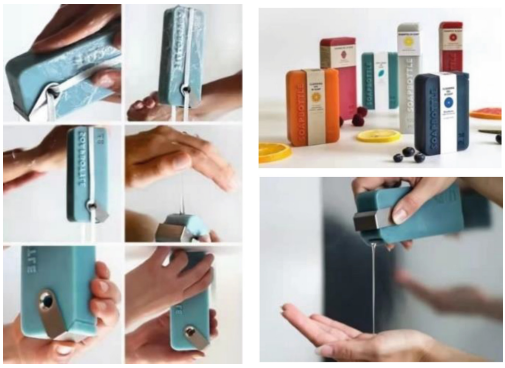

Fig. 7. The works of designer SOAPBOTTLE in cooperation with Marie Stella Maris Foundation.

5 Conclusion

The application of sustainable design in products under the ecological concept, while maximizing product functions, improves the environment, saves resources, and enhances the comprehensive use value of products. Starting from the materials commonly used in life, it integrates the green concept of sustainable development [6]. Make it form a virtuous circle that is taken from nature, used for life, and then returned to nature. Taking the ecological concept as a spiritual guide, coordinating environmental protection and resource utilization, and advocating a high-quality, green and healthy development method. On the one hand, the sustainable concept solves the problem of recyclable energy and materials, establishes a lasting design concept that improves the quality of life, and reduces the consumption of irrecoverable resources through the transformation of technology and production systems. Sustainability is a topic that the world thinks about, and future product design will also closely follow the theme of ecological civilization and green development, practice and innovate in products and a wider range, and empower and play a strong role in the development of ecological civilization effect.

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