

# Development status of industrial design standardization and construction of industrial design standard system

Shasha Wang, Zhen Lv, Yanfeng Wang\*, Xiaoqiang Wang, Congyuan Cao

Institute of Industrial Product Quality Standards China National Institute of Standardization  
Beijing, China

\*Corresponding author e-mail: wangss@cnis.ac.cn

**Abstract.** The development level of industrial design is closely related to the comprehensive competitiveness of a country. This paper summarizes the current problems in China's industrial design industry, reviews the current situation of standardization development of industrial design, and explains the importance of carrying out standardization development of industrial design. On the basis of the status quo of industrial design research and development needs, it also proposes a standard system of industrial design to help China improve the development level of industrial design.

**Keywords:** industrial design; standardization; standard system

## 1. Introduction

Industrial design is an innovative activity that integrates and optimizes the materials, functions, structures, forms and packaging of industrial products using scientific and technological achievements and knowledge of engineering, aesthetics, psychology, economics and so on. Industrial design is a vital part of the productive service industry, and its development level is one of the important symbols of a country's industrial competitiveness. In the rapid rise of Germany, Japan and other industrial and manufacturing powerhouses in the last half century, industrial design has played a leading role in the development of manufacturing. Studies have shown that the overall competitiveness of a country, the level of design and the degree of innovation are directly proportional to each other, and many developed countries and regions of the world have fully recognized the role of design for innovation-oriented economy and incorporated it into the framework of national development strategies. In particular, Finland, Denmark, the United Kingdom and South Korea have matured systems and implementation programs for national design mechanisms and strategic goal setting [1]. Even if China has given great policy support in industrial design, the results are slightly less effective in a short period of time, and there is still a large gap with the industrial design level of developed countries.

In the last decade, the development of industrial design in China has been explosive. Through the joint efforts of the government, industry, academia, research and application, China's industrial design has taken shape, with more than 120 industrial design organizations, more than 10,000 industrial design enterprises, and about 200 industrial design awards and events as of 2022. However, at present, the gap between China's industrial design level and that of developed countries is still large. This has been a shortcoming for China to move forward from “a manufacturing country” to “a matured manufacturing power”. The industrial design is still scattered, disorganized and unbalanced with a small scale. Practitioners in industrial design lack deep research and innovation abilities. In addition, university courses tend to be theoretical and relatively outdated and single in contents, and the combination of research direction and market demand in research institutes is not close enough [2-3]. The reason lies in the late start of China's industrial design, which is still in the primary stage. Therefore, it is urgent to improve the overall design level of the manufacturing industry and the design awareness of industrial products.

Standards are the technical support for economic activities and social development, and an important aspect of national basic systems. The National Standardization Development Outline issued by the CPC Central Committee and the State Council in 2021 proposes to strengthen the

construction of basic standards of industrial technologies and increase the development and application of basic common standards. Combined with the current situation of China's industrial design and the present policy support, this paper proposes to overtake the developed countries by means of standardization. It has studied the significance and feasibility of the standardization of industrial design, put forward the framework of standard system of industrial design by referring to the actual needs in industrial design and the status quo of scientific research, and proposed feasible measures to enhance the overall level of China's industrial design.

## **2. The Research Status Of Industrial Design Standardization**

On December 29, 2021, the Standardization Administration of China has approved the establishment of the National Working Group on Basic Standardization of Industrial Design, which is responsible for the revision of national standards in the fields of definitions of terms, general principles, processes and methods, quality evaluation and other basic general national standards in industrial design (excluding environmental design). The secretariat is undertaken by the China National Institute of Standardization. The establishment of this working group will build a standardization technology platform for industrial design, which can integrate the strength of enterprises, universities, research institutes, industry organizations and other parties to form a synergy to promote the development of industrial design and give full play to the leading and supporting role of standardization for a manufacturing country with high quality.

Some scholars have carried out some research on industrial design standardization. They mainly focus on the feasibility of standardization, standardization needs, and standardization recommendations, etc. Wang [4] has analyzed the relationship between standardization and industrial design, and proposed that the technical standards of products should be developed and improved according to the requirements of industrial design. Qian et al. [5] has proposed that industrial design standardization is an effective means for a country to improve social productivity, and also for an enterprise to reduce costs, improve quality and establish brand identity. Lan [6] has conducted a lot of research on industrial design standardization in recent years. She has elaborated on the connotation, necessity and feasibility of industrial design standardization, and proposed the research content of the standard system of industrial design. The first is to establish a design evaluation system, the second is to set up technical indicators and parameterize the indicators, and the third is to develop experimental methods and environmental parameters for technical indicators. However, the research on the study of the standard system of industrial design mainly put forward some slight suggestions in terms of standardization needs, and a comprehensive and in-depth planning of the standard system should be discussed.

## **3. The Significance of Industrial Design Standardization**

On the basis of various research results and literature review, it is found that the development of industrial design standardization is of great significance to the development of industrial design. Nevertheless, many people still believe that design belongs to innovative and personalized behavior, while standardization is standardized behavior, so the two are prone to contradiction. Thus, the focus of industrial design standardization is to delineate the scope of standardization, deal with the relationship between personalization and unification, and take advantage of standardization to promote the development of innovative activities.

### **3.1 Promoting the high-end manufacturing industry to open up the domestic and international double cycle**

Since the reform and opening up, while China's manufacturing industry has achieved leapfrog development, it is not strong as a whole, of which industrial design is a vital short board. It is the urgent need to carry out the standardization of industrial design, develop and implement basic and

common technical and methodological standards in the field of industrial design, and use advanced standards to force the transformation and quality upgrade of the manufacturing industry, so as to open the blockage of industrial product design and promote double-cycle development. Due to the over-emphasis on individuality, many foreign countries have not systematically promoted standardization from the national level during the practice of developing industrial design, which provides an opportunity for China to promote the internationalization of industrial design standards. The priority to carry out research on standardization among other international countries and the mastery of discourse power of international standards and rules of industrial design will greatly enhance the international competitiveness of China's manufacturing industry.

### **3.2 Facilitating the rapid and orderly development of China's industrial design**

China's industrial design is in a period of rapid growth. But compared with the world's advanced level, there is still a large gap due to outstanding problems such as inadequate industry concentration, less leading enterprises, and disconnection between industry, academia and research. Due to the lack of a unified and coordinated industrial design standard system, China's industrial design presents the status quo of disorderly development. The professionalism of design teams needs to be improved, and the problems of industrial products caused by poor design quality and insufficient security occur from time to time. It is necessary to reasonably regulate and appropriately restrain the behavior of industrial design through the development and implementation of standards, which is conducive to promoting the specialization and scale development of industrial design and enhancing the overall level of China's industrial design, so as to facilitate the rapid and orderly development of industrial design.

### **3.3 Satisfying consumers' needs to pursue a more beautiful life**

Nowadays, people's requirements for industrial products are increasing. They not only consider functions, but also focus on quality, brand and culture of products, as well as psychological satisfaction and good experience. In meeting the growing needs of the people for a better life, the standardization of industrial design can play an important role in guiding industrial upgrading and preventing consumers from buying foreign products. On the one hand, standardization can improve the efficiency of industrial design. Through the development of standards, the relatively mature advanced experience in the field of industrial design can be summarized to play the role of bridge in the promotion of technology and innovation, which can improve the design efficiency, save design costs, and drive the overall level of industrial design in China. On the other hand, standardization can play a binding and guiding role. Through the development of physical design principles and index requirements, the interests of consumers can be protected. Moreover, through the development of humanistic design guidelines and aesthetic indicators, the needs of consumers for diversification, personalization, and high-end service can be well satisfied.

## **4. The Standard System of Industrial Design**

To study the standardization of a certain industry, the priority of the standard system is the key feature of China's standardization. Targeted at solutions for the current problems of China's industrial design, standardization needs are surveyed. In combination with the whole life cycle of design activities, the preliminary framework of the basic standard system of industrial design is built up as shown in Fig. 1. The basic standard system of industrial design is planned to be composed of four major parts: general foundation, design principles, design evaluation and design management.

### **4.1 General**

This part mainly includes terms and definitions and method tools. Regarding the definition of terms, there has been no clear description of the connotation and extension of industrial design in

the world, and no unified understanding has been formed in China. Some people have made a narrow and broad definition of industrial design. Chinese universities have also divided the training direction of industrial design students into art and engineering according to the characteristics of their respective schools. The International Council of Societies of Industrial Design (ICSID) has defined industrial design in 1957, 1980, 2006, 2015, etc.; the Industrial Designers Society of America, the Association of Quebec Industrial Designers, and others have also defined industrial design. The document *Some Guiding Opinions on Promoting the Development of Industrial Design* jointly issued by 11 ministries including the Ministry of Industry and Information Technology of China also elaborates on the connotation of industrial design [7]. In order to unify and scientifically define the terms commonly used in the field of industrial design, there is an urgent need to develop standards related to industrial design terminology, to scientifically classify terms from the disciplinary system, to establish a terminology structure, and to define related terms at different levels.

## 4.2 Design Principles

This part mainly includes general principles, standards for special groups, key industries, and strategic emerging industries. Regarding the part of general principles, there are a lot of explorations on the principles of industrial design and product design in the academic field. Chen [8] has proposed the human-oriented, systematic and environmentally friendly design principles; Li [9] has put forward the principles of wholeness, structural functionality, inter connections, orderliness, purpose, and dynamism from the perspective of system theory; and Wu [10] has suggested the principles of innovation, aesthetics, priority of use, and economic utility and so on. The above studies provide a theoretical basis and ideas for the development of general principles of industrial design. But due to the limitations of the above researchers in their own research directions, a comprehensive and systematic design principle has not been formed. Therefore, it is necessary to unify and standardize general principles through standardization. For special groups, key industries and emerging industries, Japan, Northern Europe and other countries and regions have carried out a large number of industrial design standards aimed at improving the convenience of life for the elderly and derived the concept of accessibility design. Chinese scholars have also carried out research in related aspects, but the current research areas are scattered and no standardized and comprehensive complete system has been formed. In addition, there are groups involving children, disabled groups, etc., which will be an important branch of industrial design standardization [11-12].

## 4.3 Design evaluation

This part mainly includes industrial design evaluation indicators and evaluation methods. Design activities involve natural, social, scientific and technological, humanistic, physiological and psychological factors. There are plenty of choices. Design is also influenced by personal subjective consciousness. It is often difficult to judge design results by intuition and experience alone. As a result, a scientific and comprehensive evaluation system is needed to evaluate the design activities from different levels at each stage of the product design in a timely and multi-faceted manner, in order to improve the overall comprehensive benefits of product design. At present, the way to directly evaluate good or bad design is mainly through various design awards. However, different countries and different times have different evaluation requirements, and the evaluation level of each award varies. For providing the overall industry level of industrial design, a set of phased, systematic, comprehensive and scientific evaluation indexes and methods are particularly important. Up to now, relevant studies have also been carried out. Chen [13] et al. have analyzed the history and development of design evaluation criteria worldwide, and proposed the concept of indices and quantitative methods for design evaluation criteria. The evaluation factors are mainly technical, economic, social, humanistic, machine-related, environmental, system-related and aesthetic. Sun [14] has constructed an index system for evaluating the innovation efficiency of industrial design.

After analyzing the causes of low innovation efficiency of industrial design of enterprises, he has proposed countermeasures to improve the industrial design innovation of industrial enterprises.

#### 4.4 Design management

This part mainly includes industrial design process control and designer qualification requirements. The concept of design management is proposed to enhance the attention of design enterprises or institutions to the management of their design products, to standardize the design process, and to improve the competence of designers and the overall efficiency of product design [15]. Industrial designers are the main body of design activities, and their ability determines whether the design can be carried out in an efficient and orderly manner. At present, there are relevant studies on industrial designers' qualification management and competence evaluation. Cao [16] has proposed a system of industrial designers' competence structure elements and given the weights of each element. After calculation, senior, intermediate and junior levels are distinguished, and the focus and improvement direction of designers' competence at all levels are clarified. The above studies have provided a reference for the standardization of industrial design management.

### 5. Conclusion

Industrial design is a marginal interdisciplinary discipline involving many fields such as social sciences, humanities and natural sciences, and the formation of design ideas is influenced and constrained by historical, social, humanistic, technological, economic and environmental factors. It is because of the above characteristics of industrial design that the standardization road of industrial design is extremely difficult. However, through a lot of surveys, it is found that there are various problems that hinder the healthy development of industrial design and that carrying out basic, general, and comprehensive standardization of industrial design is an effective way to clear the obstacles to the development of the industry. In sum, the standardization of industrial design will release great energy in enhancing the international competitiveness of China's manufacturing industry, promoting the rapid and orderly development of industrial design, and meeting the diversified and high-end needs of consumers.

### Acknowledgment

This work received financial support from the Dean Fund of China National Institute of Standardization (262022Y-9452) and China State Administration for Market Regulation Science and Technology Program (S2022MK0431).

### References

- [1] Chuan Li and Pau Rausell Köster, "Exploring the opportunities and challenges of European design policy to enable innovation. The case of designscape project," *Sustainability*, vol. 12, June 2020.
- [2] Mario Buono and Sonia Capece, "Technological research and invention in the industrial design," *The Design Journal*, vol.20, pp. S4052-S4064, July 2017.
- [3] Yiding Bu and Jiajun Li, "Influence of industrial design on competitiveness of enterprise product," *E3S Web of Conferences*, vol. 179, pp.02088, January 2020.
- [4] Jicheng Wang, "Industrial design and standardization", *Journal of Engineering Graphics*, *Journal of Engineering Graphics*, vol. 1, pp. 102-106, February 1993.
- [5] Qiong Qian and Jun Xie, "Thoughts on the standardization development of industrial design in China," *Literary contention*, vol. 20, pp. 104-106, October 2010.
- [6] Cuiqin Lan, "Technical system for construction of industrial design standard," *Packaging Engineering*, vol. 40, pp. 99-105, July 2019.

- [7] Matthew Tommey, Karl Hurn, and Mark Evans, "The state of industrial design or industrial design in a state: an exploration of the current status of industrial design," *Journal of Design Research*, vol. 19, pp. 273-289, January 2021.
- [8] Qian Chen, "Analysis of three basic principles and their application in contemporary industrial design," *Inheritance & Innovation*, vol. 8, pp. 98-99, August 2010.
- [9] Xiaojia Li, "Analysis of industrial design principles based on system theory," *Industrial Design*, vol. 3, pp. 98-99, March 2019.
- [10] Jingwei Wu, "Talking about the basic principles of industrial product design," *Light Industry Science and Technology*, vol. 36, pp. 110-104, April 2020.
- [11] Anna Lewandowska; Bogdan Branowski; Katarzyna Joachimiak-Lechman; Przemyslaw Kurczewski; Jaroslaw Selech et al, "Sustainable design: a case of environmental and cost life cycle assessment of a kitchen designed for seniors and disabled people," *Sustainability*, vol. 9, pp. 1329-1329, July 2017.
- [12] Shih-Wen Hsiao; Chu-Hsuan Lee; Menghua Yang, and Rongqi Chen "User interface based on natural interaction design for seniors," *Computers in Human Behavior*, vol. 75, pp. 147-159, October 2017.
- [13] Shengnan Chen, and Rong Pan, "Quantitative research on index type of industrial design evaluation criteria," *Journal of Zhejiang University of Technology*, vol. 23, pp. 461-465, July 2017.
- [14] Zhicong Sun, "Research on the evaluation of industrial design innovation efficiency of industrial enterprises," *Hebei University of Science and Technology*, Dissertation for the Master Degree, December, 2021..
- [15] Cuiqin Lan, "Design methodology model and evaluation criteria for industrial design," *Design Research*, vol. 10, pp. 4-8, October 2020.
- [16] Nannan Cao, "Research on the ability evaluation of industrial designers," *Wuhan University of Technology*, Dissertation for the Master Degree, November 2013.

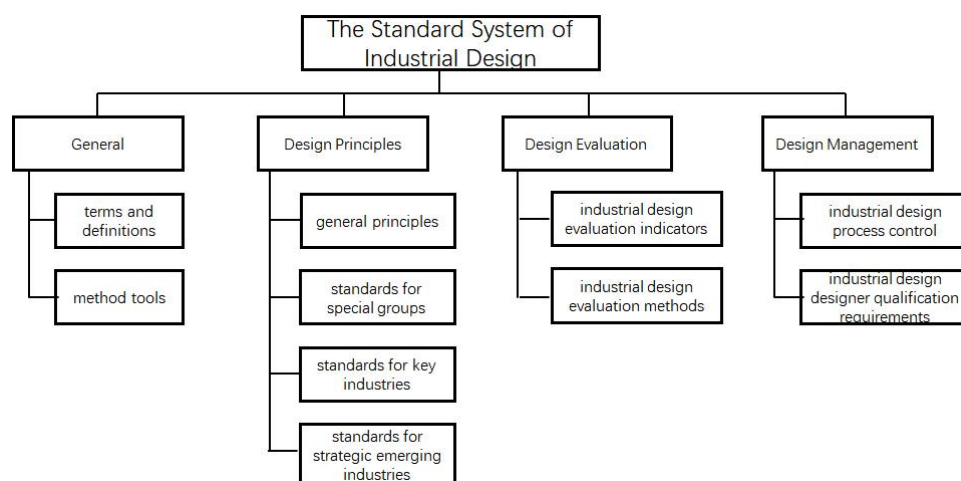


Figure 1. The structure diagram of the standard system of industrial design.