Experience and Inspiration in the Construction of Advanced Enterprise Technology Standard System at Domestic and International

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Abstract. The technical standard of an enterprise is an organic whole containing all the standards of the whole process in the enterprise following certain internal linkage, which is the technical basis for the production, operation, and management of the enterprise, and is the core of the enterprise standard system. The purpose of this paper is to present the experience and inspiration for the construction of the enterprise technical standard system and to provide reference for the construction of the enterprise technical standard. This paper firstly outlines the connotation and characteristics of enterprise technical standard system, summarizes the practice of constructing technical standard system for advanced enterprises at domestic and international, distills the useful experience of constructing technical standard system for Chinese enterprises, and finally gives suggestions that can effectively promote the construction of the technical standard system.

Keywords: Technical system · Standard system · International experience

1 Introduction

Following the industrial revolution, scientific and technical standards have been regarded as a key factor in promoting economic and social development, which helps to realize the socialization of production and modernization of management. At present, China is actively implementing the standardization strategy to help innovation development, coordinated development, green development, open development, and shared development with standards, and to jointly improve the international standard system [1], the State Council of the Central Committee of the Communist Party of China issued in the year 2021 "National Standardization Development Outline" pointed out that standards are the technical basis for supporting economic activities and social development, and are an important part of the national basic system. Standardization has a fundamental, strategic, and leading role in promoting the modernization of the national governance system and governance capacity. Further strengthening the standardization work is an important task in building a strong socialist modernization.

The formulation and implementation of scientific and reasonable enterprise technology standards can effectively promote the sustainable development of enterprises, promote scientific progress, broaden the space for innovation, and can help enhance the comprehensive strength of enterprises, thus giving them a greater competitive advantage. Through in-depth exploration and analysis, the development of a set of perfect, in line with the current market demand, can effectively support the development of enterprises, with operability, to meet the needs of customers, and can effectively enhance the competitiveness of enterprises an important role to play in enhancing the international influence of Chinese enterprises [2].

At present, domestic and foreign experts and scholars have constructed technical standard systems in many fields, mainly using dimensional classification methods and system engineering methods. In terms of using the dimensional classification method to construct the enterprise technology standard system. Chen Minghao proposes to use four methods as engineering dimensional model, WBS-OBS double decomposition structure model, value chain model, and classification method to build urban rail transit engineering construction standard system, integrate all kinds of standards, further improve professional standards such as design, construction, and acceptance by using classification method, and build a standard system applicable to urban rail transit engineering construction, which plays a role in improving engineering construction level [3]. Liu Xiuling made an in-depth analysis of the construction of the technical standard system of automobile enterprises in the reorganization and integration, summarized the deficiencies in three dimensions of logic, hierarchy, and thinking, and used Hall's three-dimensional model for comprehensive analysis to improve the construction of the technical standard system of enterprises [4]. Hu Xiaolu et al. took the standard system framework of intelligent agricultural machinery and equipment as the target basis and summarized the dimensions of level, binding, and generality that constitute the standard system framework. The three-dimensional framework structure of the equipment standard system is constructed using level, category, and industrial link [5]. Lv Hui et al. used classification methodology for a complex electronic equipment standard system, combined with the needs of complex electronic equipment to build the standard system [6]. Peter Chemweno et al. used the dimensional analysis method for the collaborative robot system, taking the perspective of human-robot interaction and collaborative operation as the entry point, combined with the guidelines proposed by ISO 15066 standard, to build a standard system for identifying the collaborative robot and human A standard system for identifying potential risks that exist when collaborative robots interact closely with human operators, which establishes safeguards in the process of structured hazard analysis and risk assessment [7]. Fahimeh Abedi et al. used a dimensional analysis approach to develop a system of technical standards to measure the concept of safety and improve the consistency of safety in online dispute resolution systems, using the perspective of both parties to a dispute and the dispute problem as the entry point. Solved the problem that the online dispute resolution system has few regulating systems and large changes [8]. In the application of the system engineering method to build an enterprise technical standard system. Ma Rupo et al. proposed a construction method based on the physical-factual-humanistic method and assisted by the standardized system engineering method and proposed a technical standard system for power generation enterprises [9]. Qiu

Shaofeng constructs the framework of a technical standard system for integrated monitoring of underground infrastructure operation based on the six-dimensional structure method of system engineering and proposes the technical standards and development directly related to integrated monitoring of underground infrastructure operation [10]. Ricardo Manuel Arias Velásquez et al. use the system engineering theory method to apply IEEE standards for the main problems that arise when building overhead lines construction and the national regulations of Colombia, Peru, and Spain to study the grounding resistance values of each tower and propose recommendations for building a better technical standard system [11]. Janne Lehenkari et al. used a systems engineering perspective to analyze the construction of technical system standards for cell phone systems in Northern Europe as a practical design effort and propose requirements related to the construction of a technical standard system [12]. According to the domestic and foreign research scholars on the construction of the technical standard system, most of them adopt the dimensional classification method, and system engineering method, although both methods can complete the construction of the corresponding technical standards there are also certain limitations.

Although there are many studies on the construction of technical standards system, there are still some unresolved problems, for example, most small and medium-sized enterprises do not fully understand the role of standards, think that the standardization work is only related to large enterprises, and they are out of reach, irrelevant, cannot correctly perceive the role of standardization work on enterprise development. In addition, China has not yet established a long-term supervision mechanism to ensure that the standardization management process is in line with the norms, enterprises still exist in the "preparation of light implementation", "there is a standard that does not comply with the standard, the implementation of the standard is not strict" and other standard implementation problems, therefore, the establishment of a sound technical standards system Therefore, the establishment of a sound technical standard system, the implementation of strict standards, regular supervision and inspection, as well as timely assessment and improvement, is a necessary step in the development of enterprises. At the same time, there is also a lack of systematic training in the implementation of enterprises, in the process of arbitrarily lowering the standard or not following the provisions of the standard implementation, enterprises also do not have the corresponding supervision and management system, resulting in the operation of the system "two skins" phenomenon.

As China's socialist market economy becomes more and more perfect and the process of domestic and international market integration accelerates, the role of technical standardization in China's social development and national economy is becoming more and more significant, and is an important part of promoting the transformation of scientific and technological achievements. On the road to new industrialization, it is necessary to have technical standards support. Establishing a perfect technical standard system for enterprises, incorporating the whole process of production and operation, is very necessary work for enterprises to optimize the allocation of resources, ensure that their production meets the market demand, improve the business management environment, and adapt to global trade competition.

2 The Connotation and Characteristics of Enterprise Technical Standard System

According to the definition of "Enterprise Standard System Technical Standard System" (GB/T 15497–2003), the technical standard is a standard that is developed in the face of the technical matters that need to be coordinated and unified in the standardization process of enterprises. Technical standards are formulated to develop technical specifications with coherence for technical activities. Technical standards need to refer to the level of technical development and practice in different periods and provide optimal solutions for technical problems that recur and are universal in social production activities.

In order to better achieve the sustainable development of enterprises, we need to develop a set of perfect and operable enterprise technical standards to meet the needs of different industries, to help enterprises achieve fast and efficient management, and finally reach the international leading level. Therefore, the technical standard system should be comprehensive, systematic, updated, reliable, and supervised: the enterprise technical standard system should cover all business areas of the enterprise, including R&D, design, production, quality control, etc., to ensure that the technical activities of the enterprise can be carried out following certain standards and specifications. The enterprise technology standard system should also be a system consisting of multiple standards and specifications, which should be connected and coordinated with each other to form an organic whole. In addition, with the development of enterprise technology, the enterprise technology standard system should be updated in time to meet the new technical requirements and market demand. Enterprise technology standard system should be reliable, and the process of developing standards and norms should be scientifically researched and verified to ensure that the standards and norms can play a guiding role in improving the technical level and product quality of enterprises. The enterprise technical standard system should have special institutions or personnel responsible for the supervision and inspection of the implementation of standards and norms to ensure that they can be effectively implemented.

3 Experience in Building Technical Standard Systems for Domestic and Foreign Enterprises

Advanced enterprises at domestic and international have many practices in building technical standard system, this section outlines the typical experience of foreign and domestic technical standard system construction and summarizes the inspiration for the construction of technical standard system of Chinese enterprises.

4   Typical Foreign Experience

United States

(1) Microsoft.

Microsoft has developed a system of technical standards through the development of internal standards, specifications, processes and guidelines. These standards and specifications are used to guide the company's internal activities such as product development, testing, deployment and maintenance. Microsoft manages its internal management and technical standards system as a strategic priority for the company and is constantly updating and improving it. At the same time, Microsoft sees collaboration as one of the key means to promote technology standards, and the company works with other companies to share technology, knowledge, and best practices to jointly develop technology standards. In addition, Microsoft actively participates in various open standards development organizations, such as W3C, IETF, OASIS (Open Services Architecture Consortium), etc. Microsoft introduced the Windows operating system in the early 1980s, which became the standard for IBM PC compatibles and promoted the rapid development of the PC industry. Microsoft also introduced many standard software development tools and technologies, such as the introduction of Visual Studio and the.NET framework, which greatly improved the speed of writing PC applications and allowed writers to have more choices. And Office, the world's leading office software, has a wide variety of features, including document management, electronic forms, presentations, and, in particular, Microsoft has introduced the Office Open XML (OOXML) file format standard, which allows Office software to achieve perfect compatibility with other software, thereby greatly reducing authoring costs.

(2) Amazon.

With the rapid development of technology, in recent years, the popularity of e-commerce has benefited many traditional retail methods, and the sale of many products has shifted from traditional channels to the Internet, thus giving rise to a new mode of e-commerce logistics. Amazon.com is no exception, they continue to strengthen their own transport and packaging capabilities and have many years of practical experience, their transport packaging safety testing not only to ensure the quality of products, but also to greatly reduce the rate of product breakage but also to enhance the level of packaging design, thereby alleviating the burden of customers to buy. The ISTA 6-Amazon standards, developed specifically for Amazon by the ISTA Association, provide a variety of experimental items for cargo, including, for example, pre-treatment of cargo, environmental treatment, compression testing, drop testing, stacking vibration testing, random vibration testing, horizontal extrusion (squeeze grip) testing, rotary drop testing, and inclined impact testing. The test can be divided into According to the different packaging methods, there are two logistics packaging standards, ISTA 6-Amazon.com-SIOC and ISTA 6-Amazon.com-OB. Amazon.com cooperates with ISTA to build a technical standard test system to ensure the safety of transported packages, and it is the establishment of this standard that ensures that Amazon's goods are rarely damaged,

which is an important guarantee that Amazon can become a pioneer in the field of e-commerce logistics.

Germany

Siemens' Intellectual Property and Operations Department employs more than 1,600 people, including more than 30 experts with extensive experience in driving the standardization process worldwide, including establishing uniform standards, implementing uniform strategies, and conducting product compliance reviews; in addition, corresponding standardization teams have been established in subsidiaries and other affiliates to ensure that the company's standardization process is The company has also established corresponding standardization teams in its subsidiaries and other subsidiaries to ensure that the company's standardization process is implemented smoothly. Siemens is committed to improving the company as a whole and has set up a special international standards information system. This system contains more than 300,000 corporate, German, European and international standards. And it provides comprehensive, field-specific skills training. Siemens' standardization efforts are strongly supported by organizations including DIN, CEN, CENELEC, ISO and its IEC. Siemens has invested a large number of technical standardization personnel to work in these international organizations, including more than 300 people in key positions, to more easily promote more corporate standards to become international standards. Siemens also emphasizes that all subsidiaries must comply with international standards such as IEC, ISO and ETSI in their production processes to ensure product quality and globalization of the company.

4.1   Typical Domestic Experience

(1) Huawei.

Huawei has made many contributions in the field of digital intelligence. With the continuous development of information and communication technology, it has gradually transformed from an independent industry into a platform industry accessible to the whole society, providing opportunities for all industries to realize digital intelligence and driving a new round of technological revolution. With its standardization strategy, Huawei has gained a head start in global business expansion and actively participates in various industry organizations, such as standards organizations and open source communities, providing acceleration for industrial development and expanding industrial space. Currently, Huawei has joined more than 400 standards organizations and open-source communities, including the IEC, an important international standardization organization. Huawei holds more than 400 key positions in these organizations, including board memberships. Huawei actively participates in standards development in the digital technology field, actively joins hands with partners in the digital technology field, and works with industrial partners to complete the first version of 3GPP 5G standards development. Huawei submitted more than 5,000 standard proposals throughout the year, and the cumulative number of submissions reached more than 60,000. Around the world, Huawei is also actively involved in digital intelligence transformation, providing effective support to promote the application of cutting-edge technologies such as 5G, AI, IoT, and cloud. Huawei has also been committed to driving changes in standards, achieving win-win situations by promoting synergy between enterprises and research institutions,

and has been recognized by some key institutions in Europe, providing strong support for the promotion of cutting-edge technologies such as IP microwave, edge computing, and AI. Huawei has adopted a synergistic and inclusive attitude to continuously deepen the exchange of technology and industry norms with Europe.

(2) Haier.

The first smart home intelligence grading technical standard released by Haier Smart Home in conjunction with China's Household Appliance Research Institute in March 2022 brings new opportunities for the development of smart home modernization, which divides the intelligence level of smart home into five levels: basic level, auxiliary level, active level, high level and complete level. In Haier joined hands with a number of industry head enterprises to collaboratively promote the convening of the national standard launch meeting of "Intelligent Home Appliance System Interoperability Part 6: Interface Specification for Intelligent Home Appliance Public Management Unit", this standard aims to solve the difficulties in the interconnection of intelligent home appliances. Through the development and release of a series of standards, the smart home field will enter a new standardized development stage, which will have a superimposed effect and further promote enterprises to innovate, leading to the emergence of new products and the growth of new industries. By the end of 2021, Haier has made tremendous progress in the smart home field. It not only has 82 global international standards, but also 602 national industry standards, making it the only company in the world that covers international standards such as ISO, IEC, IEEE, OCF, and Matter, the smart home interconnection standard.

4.2 Implications for China

From the practice of domestic and foreign enterprises' technical standard system construction, we can see that whether it is Google, Siemens, and other foreign advanced enterprises or Huawei, Haier and other domestic enterprises, they all attach great importance to the technical standard system, through the summary of the above-mentioned enterprises' practice examples, the following useful inspiration for China's enterprise technical standard system construction.

(1) Different enterprises should develop their own industry characteristics of the technical standards system. According to the industry characteristics and needs, combined with the industry's future development trend to build their own technical standard system is an important guarantee that advanced enterprises at domestic and international can occupy a dominant position in the industry. The technical standards constructed by advanced enterprises at domestic and international are shown in Table 1. Enterprises in the information technology industry should actively construct technical standards systems for communication and information security, and also need to construct industry technical standards such as 3GPP, ETSI, W3C standards, etc. In the intelligent home appliance industry, each enterprise can fully learn from Siemens' practice, build a special standard information system, fully integrate the country, the industry and international standards, and provide reference in building a new technical standard system. In the e-commerce retail industry, Amazon's transportation packaging security technology standards can be used as a reference for relevant enterprises in China. In the e-commerce retail industry, goods are the key to the success or failure of enterprises, so enterprises

Table 1. Domestic and foreign advanced enterprise technology standard system table

Industry Type	Company Name	Technical standard system
Information Technology Industry	Microsoft	Net Framework, Office Open XML, etc.
	Huawei	3GPP 5G, ICT digital and intelligent standards
Smart Appliance Industry	Siemens	Standard Information System
	Haier	Intelligent home intelligence level standard
E-commerce retail industry	Amazon	ISTA 6-Amazon.com-SIOC, ISTA 6-Amazon.com-OB standards

need to develop relevant standards that consider the integrity of goods during packaging and transportation.

(2) With the development of the times, technological innovation has become a key factor for enterprises to achieve long-term growth. In the increasingly competitive market, enterprises must improve the quality and efficiency of their products and services by continuously introducing new technologies and promoting technological innovation in order to be invincible in the market. At the same time, technological innovation is also the core of the enterprise to build a technical standard system, which is one of the necessary conditions to maintain the competitive advantage of enterprises, such as Huawei, timely follow-up of 5G, AI, and other new digital technologies continue to breakthroughs and widespread use, make full use of emerging technologies to supplement its technical standard system, accelerate industrial development and expand the industrial space. Haier also keeps up with the booming development of the smart home industry and develops a number of industry technical standard systems. Whether it is Huawei or Haier, as the leading enterprises in the industry, they are actively using advanced technology, constantly promoting the improvement of their technical standard system through technological innovation, and guaranteeing their foresight and leadership. Therefore, Chinese enterprises should constantly update and improve their technical standards according to technological progress in the process of building technical standard systems, maintain their competitive advantages in the market, strive to achieve industry leadership, and in the market competition to obtain greater development and better results.

(3) Enterprises should actively participate in mainstream international standard organizations. Participation in mainstream international standard organizations not only helps enterprises better understand the trend and direction of international standardization but also helps them formulate scientific and reasonable technology development strategies and product planning. Domestic and foreign enterprises in the practice of technical standard system construction are inseparable from the support of the international standard system, whether it is Microsoft, Amazon, Siemens, and other foreign advanced enterprises or Huawei, Haier, and other leading domestic enterprises, are actively participating in various open standards development organizations, ISTA, DIN, CEN, CENELEC, ISO, IEC and IEEE and other international standard organizations, and are in Therefore,

in the process of developing and revising international standards, Chinese enterprises need to actively participate in international standards organizations, and through cooperation and communication with other enterprises and industry organizations, jointly promote the technical progress of the industry and the development of standardization work, and promote the healthy development of the industry.

5 Conclusions and Recommendations

As a result of our research, we found that the technology standards systems of advanced companies are both comprehensive and efficient, as well as advanced. These standards not only help companies achieve technological innovation and enhance their core competencies but also promote synergy between internal technology departments and external partners. In addition, these standards should be consistent with international standards so that companies can stay ahead of the curve in future development. By actively participating in the development and revision of international standards, we can greatly enhance the competitiveness of enterprises in the global market.

This section proposes the following suggestions for effectively promoting the construction of a technical standards system for enterprises based on the above content.

(1) Closely follow the national development strategy.

In order to better realize the national strategy and enterprise strategy, we should focus on the positioning of the enterprise, carefully design the top-level architecture, grasp the advantages of the enterprise, highlight the core, guide the preparation of future technical standards with scientific methods, and use the principles of system science to optimize the enterprise's technical standardization system.

(2) The establishment of sound technical standards development and management mechanism.

The establishment of a sound mechanism for the formulation and management of technical standards can promote the construction of a technical standards system, facilitate collaboration and communication among various parties, strengthen the supervision and evaluation of the implementation of technical standards, and at the same time promote the internationalization and generalization of technical standards. Only through the establishment of a sound mechanism can we ensure the scientificity and reliability of technical standards and provide a solid foundation for the development of various industries, while providing a broader space and opportunities for global technological innovation and development.

(3) Strengthen the training of technical standardization personnel.

Standardization talent is an important support and power source for the construction of technical standard system. In today's rapidly developing science and technology field, the construction of a talent team has become a key factor in technological innovation and competition. Enterprises should train high-quality technical and standardization talents, improve their standardization, laws and regulations and international standards, and other aspects of literacy, to provide strong support for technical standardization work. At the same time, strengthening the construction of the talent team also needs to focus on interdisciplinary and cross-disciplinary talent training, cultivating talents with multidisciplinary cross-cutting capabilities, and promoting the innovation and enhancement of

technical standardization work. In addition, it should also strengthen the internationalization of talents and comprehensive quality training, improve the ability of international exchange and cooperation of talents, and promote the influence and discourse of China's technical standard system in the international arena.

6   Summary

With the rapid development of technology, enterprise technology standardization has become an important strategy to support the reliable, safe, stable, and intelligent development of the industry. Chinese enterprises are facing both opportunities and challenges in the process of vigorous development. Therefore, we must grasp the opportunities and bravely meet the challenges, strengthen the management of technical standardization, deeply understand its role, and closely combine it with technological progress and policy improvement in order to achieve better results. Through improvement and innovation, it will be able to guide the development of enterprises more effectively and enhance their core competitiveness.

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