Proceedings of Business and Economic Studies, 2025, Volume 8, Issue 2
http://ojs.bbwpublisher.com/index.php/PBES
Online ISSN: 2209-265X
Print ISSN: 2209-2641

A Review on the Internationalization of Technical Standards

Kaiyu Zhi*

Xi'an International Students University, Xi'an 710128, Shaanxi, China

**Author to whom correspondence should be addressed.*

Abstract: The internationalization of technical standards is a crucial means to promote high-quality economic development, enhance corporate competitiveness, and participate in global economic governance. Drawing widespread academic attention, this paper systematically reviews existing research on the internationalization of technical standards, covering aspects such as the concept of technical internationalization, challenges and countermeasures, influencing factors, and the relationship between technological innovation and technical standards. The aim is to advance the refinement of related technical fields and provide theoretical support and guidance for practical activities in the internationalization of technical standards.

Keywords: Internationalization of technical standards; Technological innovation; Technical standards

Online publication: April 28, 2025

1. Research background

The internationalization of technical standards is pivotal for driving high-quality economic growth, boosting corporate competitiveness, and engaging in global economic governance. Developed countries such as the United States, Germany, and Japan recognized the importance of standards competition early on. In contrast, China's development in this area lags by approximately 10–15 years. With first-mover advantages, developed countries dominate 90% of global international standards, wielding significant influence, while China accounts for only 2% [1], reflecting its relatively weak voice in international standardization. China's lack of mature coordination mechanisms has resulted in weak interactive effects between innovation and standards, hindering their mutual advancement [2].

Scholars have explored the internationalization of technical standards through conceptual definitions, challenges and countermeasures, influencing factors, and the interplay between innovation and standards. These studies lay the groundwork for future research and offer theoretical guidance for enterprises. Therefore, a comprehensive review of existing research is necessary to provide a robust theoretical foundation for enterprises to advance standard internationalization through innovation-standard synergy.

2. Concept of internationalization of technical standards

2.1. Technical standards

Standards serve as the technical backbone of a nation's economic activities and social development, vital for industrial technological progress, market expansion, and corporate internationalization. China initiated standardization work in 1949, establishing government-mandated standards to stabilize the chaotic post-founding era. Post-reform, China aligned its standards with international norms, joining the International Organization for Standardization (ISO) in 1978. ISO defines standards as technical specifications or public documents developed through consensus among stakeholders to enhance public welfare. China's Basic Terminology for Standardization (1983) describes standards as unified norms for homogeneous entities or concepts within a field grounded in science. ISO emphasizes that technical standards, whether mandatory or advisory, include technical requirements and solutions to ensure product/service safety or market access. By 2003, China elevated technical standards to one of its three core strategies for technological development, alongside talent and patents.

2.2. Internationalization of technical standards

The internationalization of technical standards represents a specialized form of standardization globalization, characterized by their technical nature and the incorporation of specifications governing technical pathways [3]. To date, the concept of "internationalization of technical standards" lacks a clear definition. Over 40 years of reform, China's understanding has evolved: in the 1980s–1990s, it focused on aligning with international standards; by the 2000s, it expanded to participating in international standardization and enhancing China's influence. Since 2013, the vision has shifted toward globalizing Chinese standards and transitioning from participant to leader in international standard-setting. Current research also categorizes corporate internationalization of technical standards into stages. Zhou *et al.* divide it into "alignment," "followership," and "leadership" phases [4]. Policy documents further classify stages as "adopting international standards," "developing international standards," and "promoting China-led standards." Regardless of classification, the internationalization of technical standards is a dynamic, evolving process intertwined with technological innovation.

3. Challenges and countermeasures for the internationalization of technical standards

Existing research examines challenges at macro (national), meso (industry), and micro (corporate) levels. National challenges include an incomplete standardization system, suppression by developed countries, etc. Industry-level challenges involve limited secretariat seats in international organizations and internal interest conflicts. Corporate challenges are fragmented and complex, encompassing weak innovation, inadequate standard-setting experience, and talent shortages. Scholars propose targeted countermeasures.

3.1. National level

At the national level, around 2000, China had minimal involvement in setting international technical standards. The primary national task was to align domestic standards with international norms as quickly as possible. Scholars at the time advocated strategies for the internationalization of technical standards centered on actively adopting international and advanced foreign standards [5]. By 2020, China had achieved progress in standardizing technologies in aerospace, telecommunications, and high-speed rail. Scholars' focus on countermeasures shifted, emphasizing the need for China to strengthen interaction and cooperation with global and regional standards organizations, actively participate in drafting international standards, and encourage leading enterprises to integrate technological innovation with standard creation. This approach aims to align Chinese standards with the needs of Belt and Road Initiative (BRI) partner countries. Domestically, the government must first recognize the

importance of the internationalization of technical standards and elevate it to a national strategic priority. However, Xie *et al*. argued that the government should reduce direct intervention in standardization processes and allow market mechanisms to play a greater role [6]. In contrast, some scholars emphasized that both government and market should fulfill their respective roles. Government-led standards should focus on safeguarding baselines and ensuring safety, while market-driven standards should prioritize strengthening advantages and expanding markets.

3.2. Industry level

Industry associations serve as intermediaries between enterprises and governments, as well as between industries and markets. They articulate the demands and expectations of enterprises to governments while disseminating national policies to enterprises on behalf of governments. Additionally, they relay international market information to domestic enterprises and showcase the achievements of Chinese enterprises globally. Therefore, industry associations should strengthen collaboration with standardization organizations, actively seek underrepresented seats in technical committees of international standards bodies (e.g., ISO, IEC), and assume more roles as conveners or secretaries. Grounded in market needs, they must conduct in-depth research on international norms—such as EU standards, German standards, British standards, French standards, Japanese standards, and specialized technical standards—as well as analyze international market responses. The timely adoption and localization of international standards and advanced standards from developed countries will expand channels for Chinese standards to go global.

3.3. Enterprise level

Enterprises should adopt a market-oriented approach to establish market-driven standard-setting systems, conduct technological R&D, and prioritize niche markets lacking dominant standards but possessing certain technological foundations to leverage their competitive advantages. Enterprises should also build standard innovation systems, create dedicated standardization departments, and integrate technical standards with technological innovation and intellectual property to enhance independent innovation capabilities. Additionally, as latecomers, Chinese enterprises must strategically utilize China's vast user resources and information resources, leveraging market advantages to offset technological gaps. Prioritizing market preemption over immediate profit returns is a critical influencing factor for the internationalization of technical standards.

4. Influencing factors in the implementation of AI in management accounting

4.1. Stakeholder perspectives

From the perspective of stakeholder roles, influencing factors can be categorized into governments, industry associations, enterprises, and others. First, the internationalization of technical standards is not only market competition but also intergovernmental rivalry. Consequently, governments worldwide act as drivers, promoting their domestic enterprises to internationalize technical standards, enabling their technologies to expand globally and capture larger international market shares. Governments support this through policy measures — such as funding support and qualification support — by understanding the current state of national standard internationalization and acting as coordinators [7]. Second, industry standards associations play a critical role by acquiring timely international standards information and securing seats in international standards organizations, which safeguards enterprises' participation in global standardization activities. Finally, enterprises themselves are the primary executors of the internationalization of technical standards, serving as the frontline actors in technological innovation and international standard-setting. Their R&D capabilities, synergy between innovation and standards, and capacity to build standard innovation systems directly impact the success of standard

internationalization. Generally, enterprises with stronger capabilities wield greater standards influence, which further accelerates the development of their internationalization of technical standards.

4.2. Factor characteristics

From the perspective of influencing factor characteristics, there are two main dimensions: innovation-related capabilities and standard-related capabilities. First, innovation-related capabilities encompass corporate R&D investment, technology absorption capacity, and collaborative R&D capabilities. The process of formulating technical standards is inherently a process of technological innovation. Enterprises with advanced R&D capacities can complete technical standard development more efficiently, accelerate product updates, and maintain the advancement and utility of new standards, thereby gaining a competitive edge in standards competition. However, for enterprises lacking independent innovation capabilities, their capacity for technology absorption and collaborative R&D becomes critical. An increasing number of firms are building proprietary R&D systems through technology acquisition and partnerships, thereby gaining standard-setting capabilities and advancing the internationalization of their technical standards [8,9]. Thus, higher innovation-related capabilities accelerate the internationalization of technical standards. Second, standard-related capabilities include opportunity identification capacity, resource integration capacity, and standardization talent. Opportunity identification is the prerequisite for standard internationalization, enabling enterprises to seize momentum and initiate internationalization efforts. Resource integration capacity ensures the efficiency of standard development by aligning corporate resources with internationalization goals. Standardization talent serves as a critical pillar for the internationalization of technical standards. Due to domestic enterprises' lack of familiarity with international standards, project costs and risks escalate. To address this, enterprises must establish a high-caliber talent system by recruiting professionals with international standardization expertise through internal training, external hiring, industry-academia collaboration, or international recruitment. Additionally, hiring locals or overseas Chinese familiar with target countries' contexts can further strengthen capabilities in navigating the internationalization of technical standards.

5. Relationship between technological innovation and technical standards

Throughout the entire innovation process, one of the primary goals of innovation is to establish influential standards, while the main purpose of developing standards is to elevate innovation capabilities. Through empirical analysis, some scholars demonstrate a strong bidirectional influence between technological innovation systems and technical standard systems. Some scholars argue that standards within a specific technical category may negatively impact innovation performance in that field. In other words, the existence of standards can suppress innovation due to the inherent contradiction between the monopolistic nature of technical standards and the public-sharing nature required for innovation, necessitating government intervention to mitigate this adverse effect. Conversely, other scholars highlight the positive role of technological innovation in shaping standards: technical standards guide the direction of innovation activities and enhance R&D efficiency, while technological innovation drives the formation of new standards. Thus, in the context of corporate internationalization of technical standards, technological innovation and technical standards exhibit a mutually influential relationship.

6. Literature review

In recent years, scholars have conducted extensive research and in-depth exploration on the internationalization of technical standards from various perspectives, providing both theoretical support and practical guidance for addressing related challenges.

6.1. Challenges and countermeasures for the internationalization of technical standards

Existing studies analyze the challenges and countermeasures for the internationalization of technical standards from macro (national), meso (industry), and micro (corporate) perspectives. Governments, industry associations, and enterprises each have distinct roles: governments can provide multi-level support based on industry standard development; industry associations can undertake international standardization tasks aligned with domestic industry conditions; enterprises can engage in industry-specific standardization based on their technological innovation and technical standard capabilities. The interplay among governments, industry associations, and enterprises highlights the limitations of single-dimensional research. Future studies should explore how these three stakeholders can synergize to advance the internationalization of technical standards.

6.2. Influencing factors for the internationalization of technical standards

Existing literature thoroughly examines the influencing factors for corporate internationalization of technical standards, analyzing government policies, market environments, standards organizations, and internal corporate capabilities. These factors can be categorized into innovation-related capabilities (e.g., R&D investment, technology absorption) and standard-related capabilities (e.g., opportunity identification, resource integration). The corporate internationalization of technical standards is a complex, dynamic process shaped by the interplay of these factors. Isolated analysis of individual factors is insufficient. Future research should integrate external factors (e.g., government policies, industry associations) with internal corporate factors to better understand their combined impact.

6.3. Research on the relationship between technological innovation and technical standards

Current studies on the synergy between technological innovation and technical standards only outline basic collaboration forms without specifying how these forms and their depth vary across different stages of corporate internationalization of technical standards. As this process evolves, the synergy between innovation and standards should dynamically adapt, with varying forms and depths exerting distinct effects at each stage. Further exploration is needed to clarify how synergy models (e.g., government-led vs. market-led collaboration) and synergy depth (e.g., strategic alignment, resource integration) influence outcomes at different phases of internationalization.

Disclosure statement

The author declares no conflict of interest.

References

[1] Dong Q, 2022, From a Large Manufacturing Country to a World Manufacturing Power: New Mission and Strategic Adjustment of China's Standardization Strategy. Economist, (01): 86–95.

[2] Han S, Wang T, 2024, Blazing the Path through Legitimacy: Process Mechanisms of Latecomer Enterprises' Standard Catch-up from a Legitimacy Perspective. Science & Technology Progress and Policy, (17): 64–75.

[3] Robert H, Ram D, 2000, The Role of Standards in Innovation. Technological Forecasting and Social Change, 64(2–3): 171–181.

[4] Zhou Q, Chen J, Yang W, et al., 2023, How Can Latecomer Enterprises Broaden Their Influence on International Technical Standard Setting: An Exploratory Case Study of CRRC Zhuzhou Institute. Journal of Management World, 39(07): 82–100.

[5] Cui S, 2022, The Global Clean Energy Transition and the Construction of China's Discourse Power in Technology

Standards. People's Tribune, (09): 50–54.

[6] Xie Z, An X, Ling H, et al., 2022, Exploring a National Innovation System of Innovation Driven Standardization in The Manufacturing Industry of China: A Study based on International Comparison. Journal of Chongqing University (Social Science Edition), (03): 142–154.

[7] Gu X, Wei H, 2022, The Influencing Factors of Promoting International Right of Speech of Standard-multi-case Exploration Based on Grounded Theory. Social Scientist, (05): 80–87.

[8] Blind K, Lorenz A, Rauber J, 2021, Drivers for Companies' Entry into Standard-Setting Organizations. IEEE Transactions on Engineering Management, (68): 33–44.

[9] Zhang L, Jiang B, Zhang J, 2024, The Key Elements of Technology Standard Internationalization-An Empirical Analysis Based on Global Communication Enterprises. China Science and Technology Forum, (03): 168–176.