Research on New Generation of Information Technology Innovation Promoting the Reform of Standardization Activities

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Abstract. The deepening of the new round of scientific and technological revolution and the uncertainty of global politics and economy made standardization as an important component of the national innovation system. Therefore, it is necessary to pay attention to the trend of the interaction between the new generation of information technology innovation and standardization, and the trend of how the world is responding. This paper summarizes the characteristics of the measures taken by international and foreign countries to deal with the trend of standardization and information technology innovation through combing the relevant literature, and analyze these characteristics and put forward suggestions for China.

Keywords. Information technology; innovation; standardization.

1. Introduction
The deepening of the new round of industrial revolution and the uncertainty of global politics and economy made competition among countries intensified. National innovation capability is essential for a country’s development and participation in international competition, and standardization is an important component of the national innovation system. As China enters a new stage of development and realizes innovation-driven processes, the role of standardization has become increasingly prominent. Especially in the field of cutting-edge technology, the interaction between standards and innovation has also become more and more closely linked. Relevant international organizations and developed countries have actively responded to this trend by implementing a series of measures such as standardization strategies and technical standards layout, and compete for the commanding heights of technological innovation and lead the formulation of future global technological rules. Therefore, it is necessary to sort out and analyze this phenomenon, and put forward corresponding policy recommendations based on the possible impact on China. The structure of this article is first to sort out the new trends in the interaction between standards and technological innovation, review the existing literature on the relationship between standards and innovation at home and abroad, and sort out three trends in the interaction between standards and innovation; The measures taken by foreign countries under this trend are classified and analyzed; based on the previous literature review and country analysis, a full text summary and suggestions are made.

2. New Trends in the Interaction between Standardization and Information Technology Innovation
Early literature often believed that standards mainly hindered innovation, and this has gradually been clarified for new research. In their research on the relationship between standards and innovation, Pan
and Jin (2003) pointed out that standards actually play a “double-edged sword” effect on innovation. That is, standards hinder technological innovation in some aspects, and they also have benefits for technological innovation [1]. Blind (2013) divides the role of the standard into four categories: compatibility/interface, minimum quality/safety, variety simplification, and information according to the functional categories of the standard, and examines the different mechanisms and possible effects of different types of standards on innovation [2]. Therefore, although standards have complex effects on innovation, Swann (2000) reviewed the literature on the relationship between existing standards and innovation and pointed out that standards play an important role in promoting innovation. This includes standards that promote the acceptance of innovative technologies by the market. That is, to establish attention in the market and form a critical mass that can be marketed; at the same time, to solve the problem of information asymmetry in innovation, that is, to establish a detection method for the declaration of innovative product characteristics through standards, and to ensure that innovation meets consumers and supervision. In addition, the latest technology and best practices are encoded through the standardization process to promote the rapid dissemination of innovation; at the same time, the standardization process itself is also a process of competition among various innovative ideas. Through the platform of standardization organizations, Competition promotes the further deepening of innovation [3]. Therefore, Swann (2010) believes that these promotion effects make standardization an important component of the national innovation system [4]. This specific argument was also supported by Tassey (1992) [5], Branscomb and Kahin (1995) [6], Krechmer (1996) [7]. In this regard, Shin et al. (2014) believed that even if the role of standards conflicts with innovation, the positive effects of standardization on national innovation policies that promote economic growth have been widely recognized [8]. With the new generation of information technology innovation, standardization has shown an increasingly important trend for the national innovation system, which is mainly reflected in the following three aspects:

2.1. The Development of a New Generation of Information Technology Makes Standards Play an Increasingly Important Role in Innovation

The change of word technology has become an important feature of the new round of technological revolution. In the fields of artificial intelligence, industrial Internet, virtual reality, and 5G, standards have become a key factor in these technological innovations. Because innovations in these cutting-edge technology fields have greater complexity and uncertainty, and there are issues of compatibility between new and old technologies, standards may “lock” technologies to a certain extent due to their characteristics, thereby restricting innovation. In this regard, on the one hand, Swann (2010) believes that the restrictive effect of standards does not necessarily impede innovation. Reasonable constraints on innovation through the process of standardization will make innovative technologies more reliable and facilitate the formation of appropriate in the scale of market, thereby reducing the cost of conversion. At the same time, combining the standard’s information dissemination function for innovative technologies, this will jointly promote the application and promotion of innovative technologies. On the other hand, Wang et al. (2014) combed the process of standardization of innovative technologies in emerging industry standardization through patent forms, and found that innovation achieved patent technology sharing through the industrialization process by relying on standards, and finally in the marketization process. Obtained patent benefits and realized the improvement and improvement of standards in market feedback [9]. Due to the close connection between standards and patents in technological innovation in emerging industries, excessive protection of patents in the activities of standardization organizations may cause technology lock-in and inhibit innovation, while lower protection of patents will reduce innovation incentives. Therefore, through the appropriate intellectual property policy arrangements of the standardization organization and ensuring the wide participation of stakeholders, the possible lock-in effect of the standard on innovation will be transformed into a greater promotion effect.
2.2. The Trend of Increasing Market Uncertainty Requires More Standards to Regulate Innovation
An important trend brought about by the new generation of information technology innovation is the increase in market uncertainty, which is mainly reflected in the continuous emergence of disruptive technologies, the continuous reduction of technological change cycles, and the obvious trend of cross-field technology integration. Its social impact is becoming more and more important. This is all for the government. Normative innovation posed challenges. The traditional tools of government supervision, such as the establishment of laws and regulations, and administrative intervention have been difficult to respond to the current dynamic changes in innovation in a timely and effective manner, and even have a negative impact on innovation. For example, DTI (2005) found through the analysis of British entrepreneur survey data that some entrepreneurs believe that standards are the source of information on innovation activities, but at the same time government regulation restricts corporate innovation. Further research by Swann and Lambert (2010) found that this part of entrepreneurs has the characteristics of actively engaged in innovative activities, which shows that for those enterprises that actively carry out innovative activities, government supervision often has a restraining effect, while standards have a promoting effect [10]. Although in theory, both the government and standardization organizations face the risks of being “captured” by the industry and information asymmetry, the research of Blind (2016) found that in a highly uncertain market, due to technological changes Diversity and uncertainty make the industry not have a stable technological prospect, making it more difficult for voluntary standardization organizations to be captured by a certain type of technical route, and is in fierce competition due to the diversification of technical routes in practice. From the perspective of being "captured" by industrial interests or overcoming the lack of information on the direction of technological progress, standardization organizations are more conducive to regulating technological innovation than government’s top-down control, rather than creating new restrictions on innovation [11]. Therefore, it can be seen that in some frontier areas where there is a large amount of innovation, it is the most appropriate choice for the government to use standards to regulate innovation, and actively carry out standardization activities to ensure that the country participates in technological innovation in this field. For example, the European Union pointed out in COM (2018) 237-“Artificial Intelligence Communication” that standardization helps to ensure the safety of artificial intelligence technology, reduce risks, and increase social trust. Therefore, the European Organization for Standardization CEN and CENELEC established an artificial intelligence key working group to coordinate the work of affected technical committees, liaise with the European Commission, clarify artificial intelligence standardization requirements, and promote European participation in the International Organization for Standardization on artificial intelligence standards. The European Commission responds to possible regulatory issues of artificial intelligence technology through active interaction with the European Organization for Standardization, thereby promoting the European Union’s innovative activities in this field.

2.3. The Acceleration of Technological Innovation Promotes the Transformation of the Organization and Standard Forms of Existing Standardization Activities
Zhang (2019) pointed out that the key is to seek changes in the organizational model to cope with this changing trend in the context of the current acceleration of social operations and social changes, and the high degree of complexity and uncertainty of society [12]. The drive of a new generation of information technology innovation and the emergence of a new type of standardization organization promote the fragmented development of the international standard system and also promote the transformation of existing standardization organizations. Compared with formal standardization organizations, alliances, and societies as independent legal entities, it has flexibility operational procedures and diversified output results enable it to adapt to technological changes more quickly and establish de facto standards in this field. In some areas of the digital economy, such as the Internet of Things technology, with the extensive participation of vertical industries, the traditional form of standardization organization can no longer cope with the needs of technological changes. Lin et al. (2017) believes that open source, as a way to break monopoly and quickly share technology, prompts
relevant standardization organizations to take it as the focus of their work, and promote the rapid development of the industry through the combination of standards and open source [13]. Regarding the standard formulation process and deliverables, the changes in some new technologies have made the traditional standardized formulation procedures and deliverables unable to meet their needs, requiring a faster standard formulation process and more choices and diverse delivery. The results show diversified paths to the governance principles and intellectual property policies of standardization organizations.

3. Global Measures to Respond to Trends in the Role of Standards and Information Technology Innovation

The current technological competition situation is increasingly reflected in standard competition. The formulation of standards in some key information technology fields determines the development direction of the industry and also determines the future position of relevant international organizations and countries in this field. At the same time, standardization, as an important component of the national innovation system, and the "double-edged sword" effect of standards on scientific and technological innovation has led relevant international standardization organizations and countries to take many strategic measures.

3.1. Promoting Standardization to More Easily and Quickly Respond to Technological Advances

In order to meet the challenges of rapidly changing new technologies, new market demands, and more severe global competition, standardization needs to meet the requirements of technological progress more simply and quickly. The "ISO Strategy 2030" proposes that ISO should speed up the time for standards to be put on the market while ensuring the quality of standard formulation and the rigor of the process. To this end, improvements should be made in all aspects of standard formulation and implementation, including ensuring the capacity building and support of ISO members. Committee leaders and experts use new technologies to participate in standard setting, including improving project management in standard setting, investing in and using technology to simplify the standard setting process, and promoting the use of ISO deliverables, especially those that are quickly developed. CEN and CENELEC Strategic Objectives 2020 point out that CEN and CENELEC's processes, structures, and deliverables will continuously meet changes in demand and technological opportunities to reduce the time to market, ensure the mutual promotion of increasingly integrated departments, and promote the adoption of new technologies. To build CEN and CENELEC into a natural way for innovators, so that innovators' ideas can enter the development process of standards, and facilitate innovative products to enter the market and increase relevance, and provide new and old products, services, systems and processes interoperability and compatibility. The German standardization strategy emphasizes the market-driven standardization and is more market-oriented. Government support to strengthen the link between R&D and standardization has become a necessary element of research plans and technological upgrading, including continuing to promote innovation plans that have demonstrated the role of standards in promoting innovation. At the same time, make better use of networks and platforms, and promote market participants to participate in standardization activities through the establishment of open platforms. Information and opinions can be exchanged on the early issues of standard formulation, and consensus on joint actions can be promoted. And standardization agencies not only provide traditional consensus standards, but also provide various demand-oriented deliverables. Such deliverables are more targeted at new and innovative products, and their formulation cycle is very short. In this way, with the support of the government, the standardization agency promotes standards to quickly transform innovative ideas into market products through efficient procedures and tools, and promotes innovation in products, processes, and services in the global market. It can be seen that both at the International Organization for Standardization and at the national level, they are promoting the standardization process and deliverables to better meet the needs of technological progress, with more convenient procedures, more advanced tools, and more
diverse achievements and closer inter-departmental integration to promote the transformation and promotion of technological innovation.

3.2. Building A Standardization Agency into a Transparent, Open and Inclusive Technology Exchange Platform

How can standardization organizations not be “captured” by some interest groups? Thereby reducing the “lock-in” of standards to technical routes, it is necessary to build a transparent, open and inclusive technology platform to ensure that the organization serves as a platform for the exchange, collision and deepening of innovative ideas. ISO takes “listening to all opinions” as ISO’s new strategic goal to ensure the inclusiveness of the ISO organization. It requires that everyone is encouraged to express their opinions and listen when setting standards or when making decisions as an organization. All voices, and by paying more attention to the trends of technological innovation, absorbing the new needs of users, strengthening the capacity building of developing countries, and promoting diversity within the system to ensure ISO as an open and inclusive technology exchange platform. The German standardization strategy requires that the amplification effect of the network should be better used in standardization work, and an open standard exchange platform should be established to promote the participation of all parties in the market. Strengthen publicity through the government, standardization agencies, and associations, and make use of the important role of industry associations, trading companies and trade associations in increasing the participation of small and medium-sized enterprises in standardization work, so as to ensure that German small and medium-sized enterprises’ competitiveness. Simplify participation in standardization activities through appropriate rules, procedures, and tools, and ensure non-discriminatory and continuous participation in all aspects, including the use of effective information and communication technologies, increasing the openness and transparency of standards committees, and in all aspects of standardization activities. Expand public participation in the field. The U.S. standardization strategy takes transparency, openness, unbiased, and consensus as the basic principles of the U.S. standardization system to ensure that all stakeholders can obtain the necessary information in the standardization activities, participate in the standardization activities, and ensure that the standardization process does not Will be controlled by a certain interest group or produce inequality. This enables the standard to maintain a close and effective response to the development of science and technology. For the standard-setting process, the United States believes that it should be flexible, timely, and balanced. The government will take actions to promote the development of cross-departmental and cross-domain technical standards, improve the ability of the standards system to respond to consumer opinions and needs, and use the country's technological advantages to promote the formulation of standards through online methods and the dissemination of standards through electronic means. Through these measures, standardization activities on the one hand promote the spread of innovation in participation, and on the other hand, they also select innovations that are more acceptable to members. The performance of this function is guaranteed.

4. Summary and Recommendations

The trend of change arising from the interaction between standardization and information technology innovation and the characteristics of the measures taken by international and foreign countries to respond to this trend, combined with the current international political and economic situation, will have a profound impact on China’s standardization work and require China to adopt corresponding measures. Standardization activities in the frontier innovation field need to establish the decisive role of the market. There is high-intensity technological innovation in the frontier technology field, and there is great uncertainty in the future of technological development in the next step. It is difficult for administrative directors and technical experts to judge the next innovation and application direction of related frontier fields. There are a lot of incomplete information and the possibility of "regulatory capture". This requires the use of market competition to determine the choice of innovative technologies and their standards. Relevant international and national standardization agencies
guarantee the participation and expression of appeals of stakeholders, and seek to expand broader participation through forums, seminars and other forms. This is also the essence of ensuring standardization organizations as a platform for the exchange, competition and dissemination of innovative ideas. Taking market as the basis of standardization organizations to make standardization activities in line with the spirit of fairness and openness can ensure that stakeholders have confidence in the standardization agency’s ability to protect their own demands. At the same time, standardization activities that adapt to relevant technical characteristics can be carried out through diversified forms. Realize the common development of standardization and information technology.

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