

Article

# Forecasting the Competition of International Standardization Preoccupation

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**Abstract:** In the era of the Fourth Industrial Revolution, the establishment of a TBT system that utilizes the knowledge-based view as a means of overcoming the problems of scarcity of human resources and lack of technological capabilities faced by export companies that produce and supply products and services is being emphasized. The WTO TBT Agreement, which is based on the multilateral agreement of the GATT 7th Tokyo Round, consists of 15 articles and 3 annexes to ensure that technical regulations, standards, and conformity assessment systems do not act as technical barriers to trade. The transition to the digital economy (EDT) has been accelerating, and currently the EDT presents both a challenge and an opportunity. The US, which is at the center of the international standards competition, has accelerated standards competition by invoking supply chain executive order decoupling, and as China looks to implement the policy set out in the China Standards 2035 Plan, the relationship between the US and China is worsening in relation to the preoccupation with standards. Dreaming of a Chinese version of this US strategy, China, which is connected from 12.5 to 14.5 units, is accelerating its standardization strategy through the Made in China 2035 program. The “double cycle development strategy” and “technological innovation” are key mid- to long-term policy directions. Korea should develop a Korean-style conformity assessment development model based on the TBT system, which is a major element of non-tariff barriers, under the WTO/FTA system that promotes the flow of the KBV along with the establishment of a digital transformation system.



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**Keywords:** EDT; conformity assessment; crypto economy; digital data standards platform; official grades; mutual recognition agreement; G2; standardized normal conflict; technical capacity

## 1. Introduction

This study examines the process of building a digital crypto economy and the delivery of standard platform data via a blockchain-based cryptographic identification system and examines the impact of these economic cases on cross-border data transfer and Korea's standardization development plan. The key issue in the trade friction and technology standardization competition of the G2 powers is ultimately to “preempt the standardization” and to obtain economic and security benefits at the same time. This study emphasizes the need to establish and spread an independent Korean conformity assessment system in order to respond to the standardization competition between the US and China. As an example of EDT, we discuss the dataization and cross-border transfer of a digital encryption grade system based on blockchain and delivery services that are creating unmeasurable and infinite demands due to the coronavirus pandemic. In addition, the contribution of mutual recognition and expansion strategies of companies that require conformity assessment certification for trade and export due to the conclusion of the ICQ-MRA mutual reciprocity agreement are also discussed [1]. In summary, this paper presents Korea's diversified strategy in response to G2 standardization and the competition for technological supremacy and presents the implications of diplomatic efforts to reflect Korea's competitive advantages and opinions as much as possible in the context of European standardization, which involves many standards [2].

The flow of the global economy can be understood based on recent trends and interrelationships between the two great powers, the G2. In this study, we discuss international standardization according to the international conformity assessment system required for world trade export based on the KBV (Knowledge-Based View) and the RBV (Resource-Based View) for understanding international standards and competition in relation to the preoccupation with standardization and hegemony among advanced countries, including the US, European nations, and China. The study aims to identify strategies connected with the preoccupation and localization and to suggest future countermeasures. Non-tariff trade technical barriers are aggravated by each country's policies and regulations, as well as complex systems and terminologies. Therefore, this study aims to present countermeasures for each country by identifying and predicting standardization and preoccupation strategies in the post-COVID-19 era. Based on the KBV and RBV theories, international conformity assessments, international mutual recognition agreements, and digital encryption processes are used as research methods in this study.

Recently, International Certification and Qualification (ICQ) has emerged as a non-tariff barrier issue for international export expansion and domestic industry development. In 2010, China overtook Japan to become the world's second largest economy. This was the first achievement in the 10 years that followed China's joining of the WTO in 2001, and, ironically, China's accession to the WTO at that time was the result of the support of former US President Bill Clinton. Paradoxically, unlike in the past, the US's supposition that it will be able to convince China of the value of democracy has developed into a single global keyword in the war for hegemony between the US and China in various fields, such as money, trade, the economy, the military, and technology. Among the non-tariff measures, TBT has the most weight and the possibility of controversy is high, making the WTO/FTA TBT problem serious throughout world industry [3]. The competition over international standards is accelerating as the G2 powers of the United States and China seek to rapidly spread their own standards in the European international standardization market, which was the first to occupy the international standards market and the system that has achieved the broadest reach. The ultimate purpose of this study is to address the "preoccupation with standardization" and to clearly identify the expected flow of international standardization in the future. Non-tariff barriers should be removed through Mutual Recognition Agreements [4], which constitute strategies for achieving the spread of international standardization. In addition, this study aims to present strategies for and consider the implications of the preoccupation with standardization through digital transformation (establishing a digital encryption system for data, such as accredited certification, inspection, testing, and calibration) in order to prepare for and respond to each country [5].

TBT can be summarized as "technical regulations, standards, and conformity assessment procedures". At the beginning of WTO trade, standards were of such low importance that they could be expressed as technical specifications; nowadays, however, they have a broader and more important role. With various functions, they impede the free movement of goods and services adopted by trading partners and influence other technical regulations, standards, certification procedures, and inspection systems. The WTO/FTA TBT agreement also plays a role in the recognition of and the making of adjustments in advance to regulations on imports and exports that are generated through the international certification system and inspections conducted according to a given country's technical standards and standards and conformity assessment systems [6]. It is an agreement to promote international trade and export by promoting the mutual unification, integration or harmonization of technical standards, specifications, and conformity assessment systems of different countries so that such regulatory policies and practices do not emerge as technical barriers to non-tariff trade. Along with TRIPS, an agreement on trade-related aspects of intellectual property, the WTO/FTA TBT is also the most comprehensive multilateral agreement on intellectual property [7]. It plays a central role in facilitating trade in knowledge and creativity, resolving trade disputes over intellectual property rights and ensuring opportunities for WTO members to achieve their domestic policy goals [8]. This agreement

is a legal recognition of the importance of the link between intellectual property rights and trade and the need for intellectual property rights.

In 2015, Chinese Premier Li Keqiang announced “Made in China 2025”, which aims for China to enter the ranks of global manufacturing powerhouses by 2025 to revitalize China’s manufacturing industry, which caused America to feel threatened. In China, the period of “Dogwangyanghoe”, which means “to wait patiently until you have enough strength”, has passed since then, and the active call for the revival of the Chinese nation was initiated. In response, to inhibit China from 2018, the United States began to impose high tariffs on about 1300 core products used in Made in China 2025 and sanctions on semiconductors, and also limited Chinese investment in the United States, which intensified the supremacy competition between the United States and China. It can be said that the war for hegemony between the United States and China began in earnest from this period. In addition, the “new cold war” between the United States and China has been accelerated due to the spread of Coronavirus Infectious Disease-19 (COVID-19), which has hit affected the world since 2019. In this situation, many experts forecast a war for hegemony in the new digital economy between the United States and China, and at the center of it are the national standardization strategy, the digital crypto economy, and finally the establishment of a digital data economic system, and the cross-border transfer of big data [9].

How should Korea respond to China, which is challenging the global leader that the United States has led since World War II, and the United States, which is trying to defend it? How will China change in 10 or 20 years, which is accelerating the transition to a digital economy with the introduction of the digital yuan through the One Belt and Road Project? The main purpose of this study is to present a strategic plan to respond to the WTO TBT and FTA TBT wars for hegemony between the United States and China, focusing on Korea’s digital suitability expansion plan [1,10].

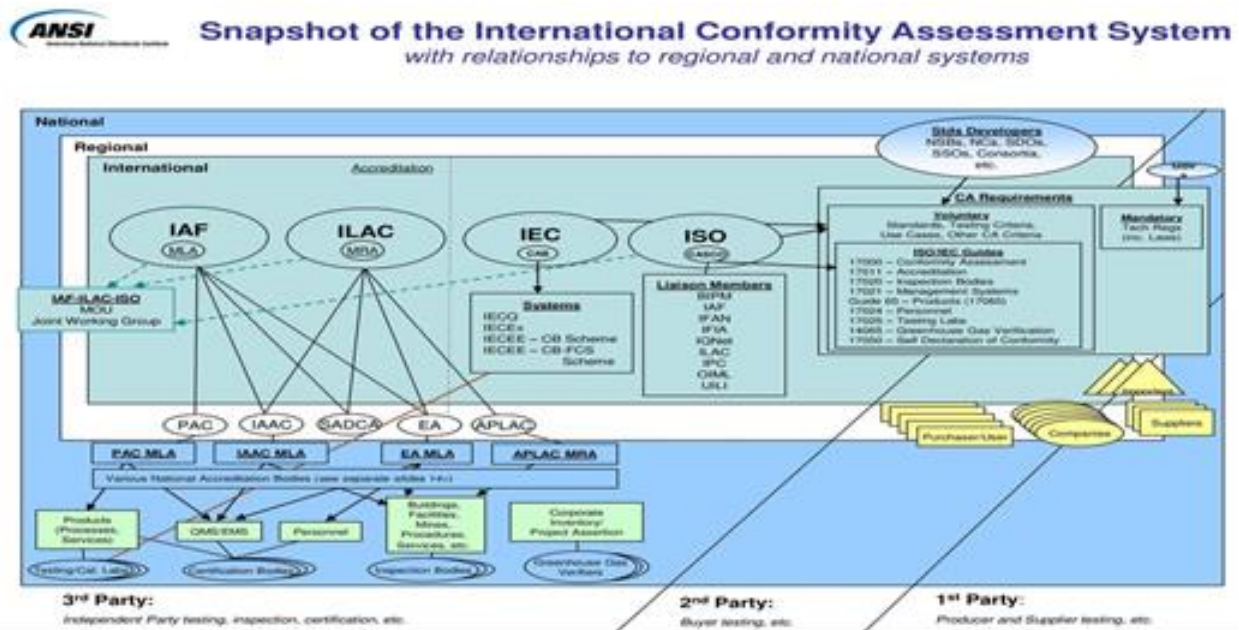
## 2. Theoretical Considerations

### 2.1. WTO/FTA TBT Agreement and Conformity Assessment System

Most of the basic norms and legal system of the GATT TBT Agreement, which is the parent of the WTO TBT Agreement applied nowadays, have been inherited and used (Ahn Deok-geun, Kim Min-jung, 2018) [11]. The WTO (World Trade Organization) TBT Agreement (Agreement on Technical Barriers to Trade) is one of the nine multilateral trade agreements established at the GATT Tokyo Round that came into force in 1980. The WTO/TBT Agreement consists of technical regulations, standards, and conformity assessments, and consists of a preamble, 15 articles, and 3 annexes. The basic concepts and terms used in the TBT Agreement follow the definition of Article 3 of Annex 1 [12]. The concepts based on goods are dealt with in the TBT Agreement, while those relating to services are dealt with in the WTO Trade Agreement on Services (GATS). All concepts and terms in the TBT Agreement have the same meaning as defined in ISO/IEC Directive 2 (1991). In the TBT Agreement, conformity assessment is sometimes described in terms of conformity assessment procedures [13].

As shown in Figure 1, international mutual recognition and unification of conformity assessment procedures in the WTO/TBT agreement plays a significant role in revitalizing international trade and exports. The biggest barriers in revitalizing trade between countries are different assessments and product certifications, which in turn is a loss to the company in terms of costs. In addition, opaque and discriminatory conformity assessment procedures act as technical barriers to trade (TBT) in each country. The WTO/TBT Agreement ensures the establishment of technical standards, technical barriers and regulations, and conformity assessment systems that do not create unnecessary barriers to international trade and export activities. In Korea, the Conformity Assessment Procedure was promulgated by Presidential Decree in April 2021. As WTO/FTA TBT accounts for the largest portion of non-tariff barriers and has the highest possibility of being controversial, and as the problem becomes more serious in the overall flow of the industry, a control tower that

can remove non-tariff barriers to conformity assessment and international standards is desperately needed.



**Figure 1.** International Conformity Assessment System Source: American National Standards Institute (2022).

## 2.2. Digital Transformation Economy

The Economy of Digital Transformation (EDT) is an agenda that is frequently discussed in the technological environment and economic field that departs from the traditional way of commerce; however, it has actually been in use for a long time. In the global trend of digital transformation throughout the industry, due to the global spread of COVID-19, the Fourth Industrial Revolution and non-face-to-face economic revitalization [14], even the best companies in the world can become obsolete if they fail to change their existing businesses or create new ones based on digital transformation [15]. As the digital-related industry for untact rapidly changes, the speed of innovation in data-based technology is emerging as a key factor in competition in the industrial ecosystem. Data-based companies, such as Google and Airbnb, are leading market innovation by collecting and accumulating data from their countless customers, and it becomes difficult for latecomers to enter the market. Meanwhile, the ability of Korean companies to utilize data is poor. Korean companies lack the infrastructure for building, distributing, and utilizing data in the domestic industry. In particular, it is difficult to innovate in the entire cycle due to closed data accumulation, standardization, and accessibility restrictions throughout the industrial ecosystem. Therefore, there is a need for a platform that enables domestic companies to access private and public data and increase their ability to utilize the data, and to lead the digital industry innovation, such as changing existing businesses or creating new businesses (Jonghyun Kwon, 2021).

## 2.3. International Certification and Qualification (ICQ)

ICQ is closely related to the WTO/FTA TBT norm, which consists of technical standards established through compulsory and rigorous international review, internationally accepted standards based on voluntary characteristics, and conformity assessment that manages inspection, testing, and certification. When it comes to finding the origins of certification and qualification, the government operated conformity assessment activities (certification, inspection, test, calibration, etc.) in the ancient and medieval times, and private institutions began to conduct conformity assessment activities in modern times. The government frequently evaluates them and designates and announces private institution CABs (Conformity Assessment Organizations) as the regulatory authority for

control. Additionally, in the most recent modern era, as “certification” requires the reliability of conformity assessment and as “international trade” requires equality through the spread of reciprocity around the world, ICQ-MRA is essential for this relevance. In 1949, NATA (Australia) was registered as the first laboratory accreditation body, and in 1980, the well-known QMS (Quality Management System) certification system was implemented. Furthermore, a conformity assessment system was developed in the 1990s, and accreditation was defined as “Assessment of Conformity Assessment”. With the conclusion of the WTO-TBT Agreement in 1995, the government of the importing country began to implement regulations using international standards and specifications, and conformity assessment results. If the conformity assessment is recognized as equivalent to that of the importing country, it is recommended that the accreditation be used for the equivalence assessment of the conformity assessment. The purpose of this study was to explain the theoretical purpose of what the contents of MRA mean and why ICQ-MRA is needed. Accreditation refers to “certification by a third party (5.2) related to the conformity assessment body (2.5) that formally certifies the ability to perform specific conformity assessment tasks”. Under the WTO conformity assessment system, a mutual recognition agreement through the international certification system requires multi-national agreement. This clause, which corresponds to Clause No. 9.5 of ISO/IEC 17000:2020, is about the accreditation of the validity of the results of the conformity assessment provided by other persons or organizations. In other words, to facilitate international trade, the expansion of ICQ-MRA is essential and recommended worldwide [16].

Figure 2 shows the system of the International Mutual Recognition Agreement.

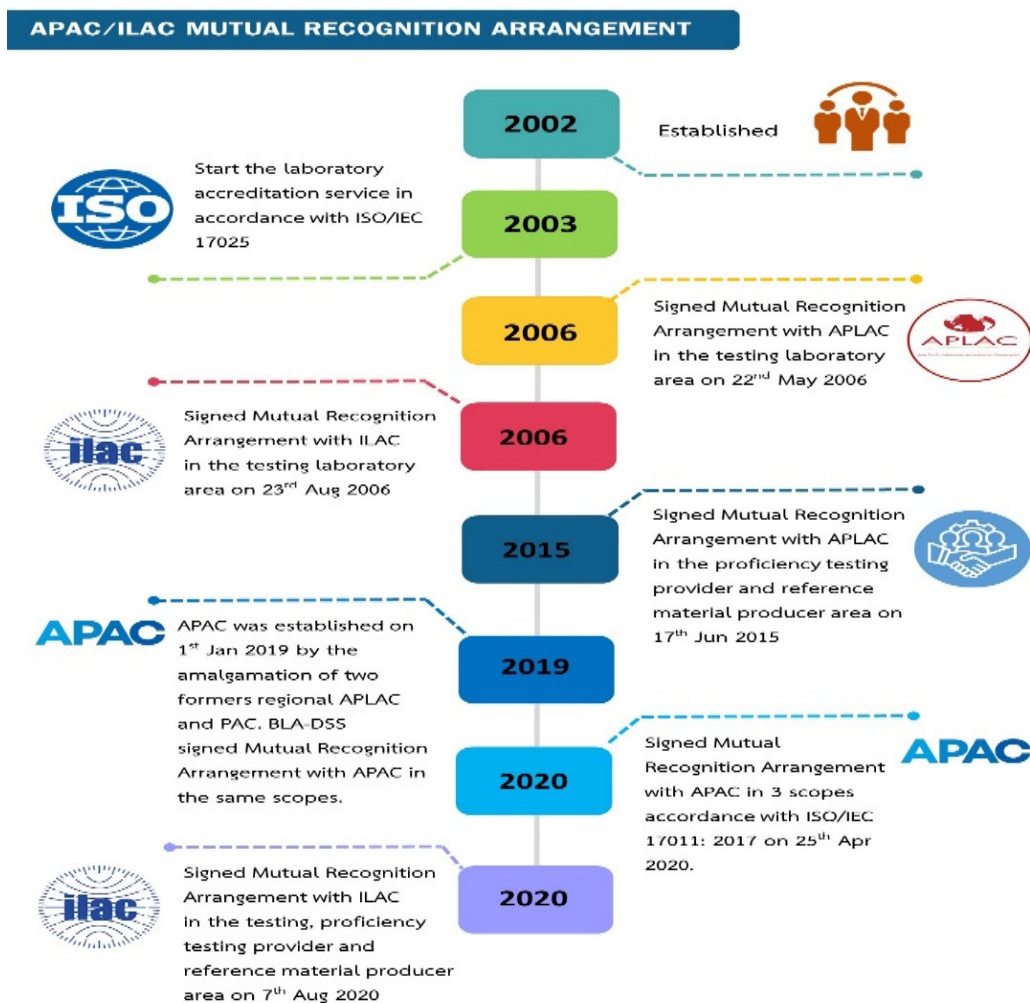


Figure 2. ICQ-MRA Mutual Recognition Agreement Status. Source: MHESI (2022).

#### 2.4. Mutual Recognition Agreement

The essential purpose of ICQ-MRA research is to strengthen trade competitiveness by directly resolving cost, time, and international trade regulations, and to secure the safety of products, qualifications, and system for both exports and imports through the spread of effective international trade relations. Under the WTO/FTA TBT conformity assessment system, the number of countries with mutually beneficial recognition agreements related to product certification, qualification certification, and management system certification has continuously increased [3]. Despite the fact that import and export trade volumes have been increased due to the expansion of trade and the elimination of import and export regulations through the acquisition of international certification, as the actual feeling of import and export companies to the needs for acquiring ICQ international certification is relatively low, it is essentially required to create and secure a system that allows export companies to directly experience the benefits of ICQ-MRA. For this purpose, the research from academic, policy, and practical perspectives is urgently required to secure Korea's national competitiveness as well as to allow many Korean exporting companies to flow into the ICQ-MRA system. The promotion of ICQ-MRA between countries has now become an essential element, not an option, in the change of the international trade environment. Korean exporting companies should actively participate in the MRA system so that they do not suffer disadvantages such as cost, time, and penalties in international transactions to which the ICQ-MRA system is applied. While there are prior studies on AEO-MRA in Korea, relatively little research in the literature on ICQ-MRA has been conducted [17,18].

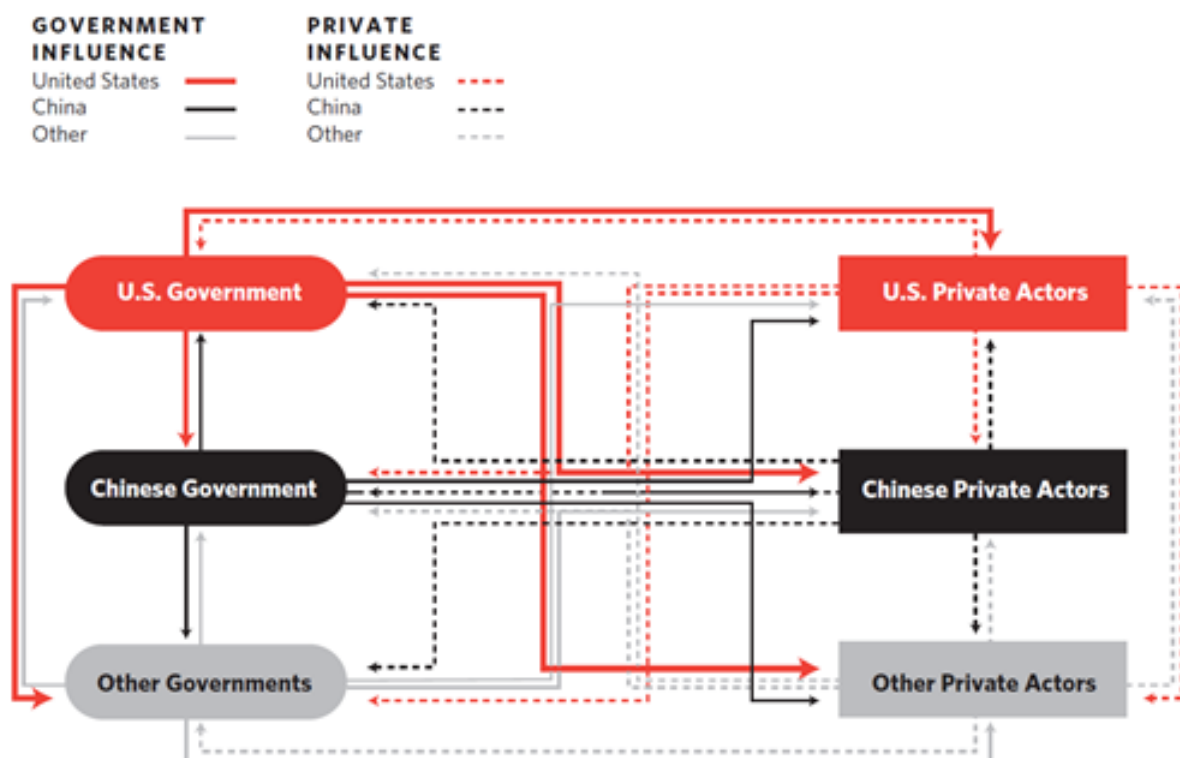
Suwa-Eisenmann and Verdier (2002), Kim Chang-Bong, Kim Jae-il (2020) and others argued that the MRA system should be introduced as the paradigm of international trade and export changes [6,19,20]. Imbert and Lewis (2004) reviewed the mutual recognition of CARICOM's engineering qualifications in their research on MRA [21]. This study logically developed the need to conclude mutual recognition agreements with major exporting countries in Korea in order for the AEO system to support the improvement of internal and external competitiveness of Korean exporting companies and to quickly establish them [22]. Technical barriers to trade refer to technical regulations in each country that have a significant impact on trade, and WTO member countries must implement it after notifying the WTO TBT Committee when enacting or revising it. As a result of the review and analysis of previous studies [23], the establishment and institutionalization of the ICQ-MRA system can confirm the importance of FTA and MRA as an effort to easily establish TBT and to remove obstacles and promote TBT regulation, which is a major issue of non-tariff barriers. As MRA is an STC (Specific Trade Concern) related to TBT, all member countries comply with international standards according to technical regulations. However, since each country has its own areas and measures for conformity assessment, it must have various situations, and MRA can be activated through mutual recognition with international organizations, such as certification bodies, accreditation bodies, and STC [18,24]. This has various meanings that impede the free movement of goods and services adopted by trading partners, and applies to other technical regulations, standards, certification procedures, and inspection systems. As specifically described in the TBT Agreement, the results of tests and certifications conducted in exporting countries may be obtained through various channels.

### 3. Issues and the Current State of the Digital Transformation Era

#### 3.1. G2 WTO/FTA TBT War for Hegemony and Standardization Trade Conflict

While international standards, technical regulations, and conformity assessment are emerging as issues in world trade, trade conflict and trade technical barriers in the era of digital transformation have emerged as important topics of debate. With the global trade environment changing rapidly due to COVID-19 and the resurgence of protectionist policies, the Biden administration is maintaining the Trump administration's tough policy stance toward China. In other words, the United States recognizes China as a representative country that continues to engage in unfair practices in manufacturing and exchange rates,

and illegally steals advanced technology from the United States. What differs between the Biden administration and the previous Trump administration is that it works “with its allies” to combat unfair Chinese practices and puts “values” at the center of US diplomacy, including the US–China relationship. The Biden administration is expected to adopt a two-sided strategy of cooperation and confrontation with China. They are expected to cooperate with China on global-level infectious diseases, such as COVID-19, which requires cooperation at the global level, and in coping with climate change caused by global warming, while they are expected to fight fiercely for the supply chain in the global market and advanced technology, such as 5G. In particular, as shown in (Figure 3), by accelerating supply chain executive order decoupling, the US–China relationship worsened and the paradigm for the national standardization strategy was completely changed.

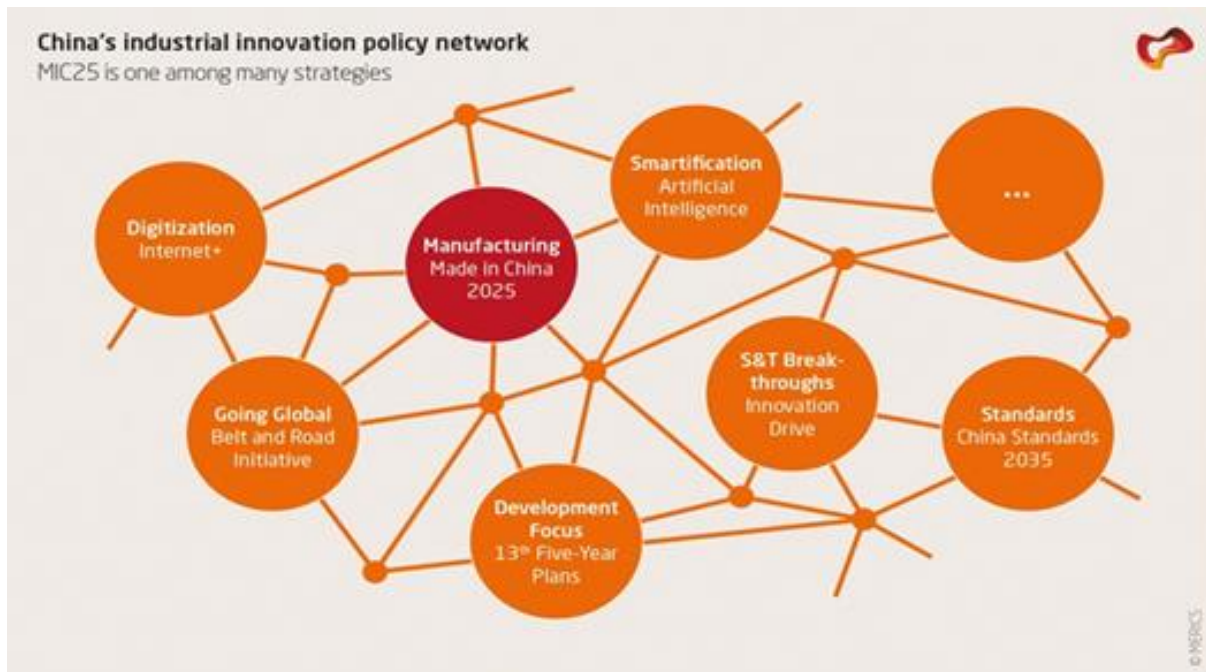


**Figure 3.** The US government is just one of many actors shaping technological decoupling. Source: US–CHINA TECHNOLOGICAL “DECOUPLING”—A STRATEGY AND POLICY FRAMEWORK (2022).

In response to the strategy of the United States, China set the “Dual Circulation strategy” and “technological innovation” as mid- to long-term core-policy directions in their “14th Five-Year Plan” and “China Standards 2035”. The purpose of the Dual Circulation strategy is to build an independent value chain that does not depend on the United States, and “technological innovation” aims to secure core source technology against the United States’ technological decoupling strategy, and to achieve double the GDP of 2020 by 2035 through technological innovation.

China’s national standardization strategy, which continues from the 12.5th to the 14.5th, is an example of the accelerating digital transformation. China has declared the formation of the National Semiconductor Technology Committee, and SMIC, Huawei, and Han Silicon are accelerating the digital transformation to independently form a standard system [25]. In addition, China created Made in China 2025 to reorganize its standard system; however, as has become more controversial, they are spurring their standardization strategy by creating China Standards 2035 (Figure 4) as an issue, which they are promoting on a large scale. As China pursues an aggressive and strong policy in the standard field, concerns from the United States are bound to grow. Accordingly, a new strategy was

needed for the United States to maintain the world's No. 1 leadership, and they implemented the "Huawei regulation" measures in September 2020. As such, the central field in which the United States and China are currently in intense conflict is the international standardization strategy.



**Figure 4.** China Standards 2035. Source: Merics Twitter.

### 3.2. Digital Standard Platform Problem in the Data Economy Era

Few issues are as frequently mentioned in various media nowadays as the data economy. The data economy is mentioned in most government policies, and companies do not leave out the data economy when explaining the new driving force of industry for companies. The data economy refers to an economy that creates new products and services by using data as a catalyst for industrial development. With the advent of the Fourth Industrial Revolution era, data are being treated as more important than any other type of resource; information or data were regarded as lubricants that help the production and trade of tangible goods in the past; however, datum itself has value and is the object of transaction nowadays. Above all, with the rapid development of related technologies, datum, which is incomparable to the past in terms of quantity and quality, is being formed and distributed, and technological innovation is occurring around this, which leads to further changes in the social structure. The definition of a digital platform is slightly different by reports; these are defined as "a digital service that facilitates interaction between two or more distinct and interdependent user groups through Internet-based services (OECD)", or as "an application that serves multiple groups of users at once, providing value to each group based on other users (Australia Competitive and Consumer Commission)". Existing digital platforms focus on the collection and opening of vast amounts of data. However, since the simple accumulation of information has no meaning unless it is utilized, it is difficult to lead to the creation of added value. Therefore, there is a growing interest in linking, combining, and utilizing the collected and accumulated data according to the purpose and use of the consumer. To promote linkage and combining between data and to secure higher quality data, it is important to establish a common standard in advance and apply it from the initial stage, which is called "standardization". Building a standard platform is also important to secure data reliability. Data, to which standardization has been successfully applied, allow consumers to make an objective evaluation, and thus, the data can have

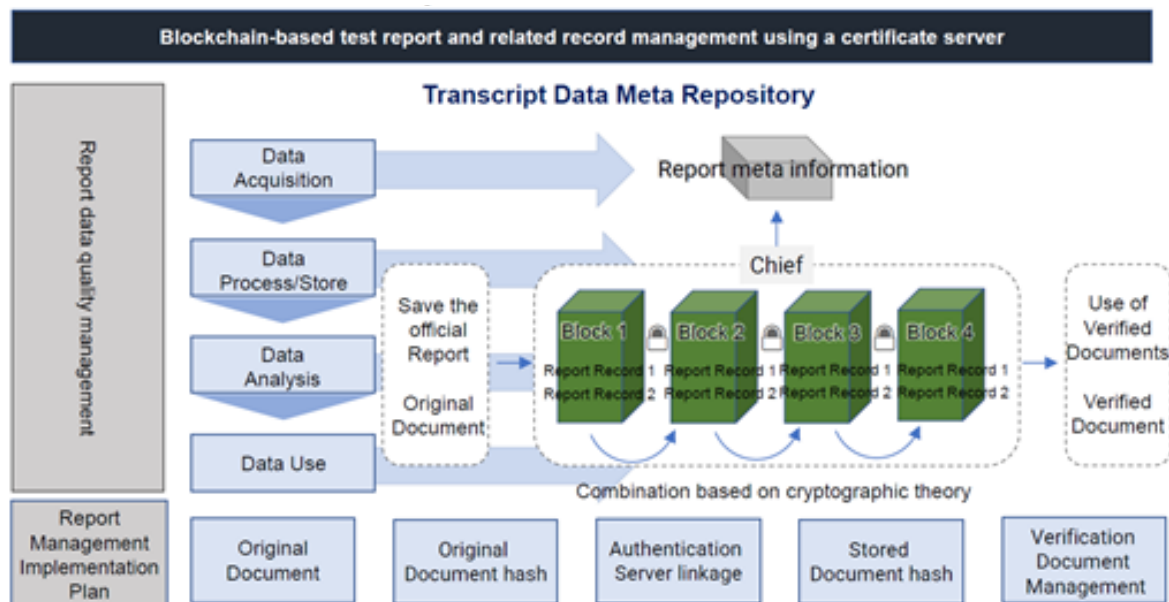


high reliability. Therefore, the growth of the data economy will inevitably be limited if the objective evaluation and reliability of data fails, and this is the reason why many countries and companies put a lot of effort into building a standard platform. Although there are differences in the specific status of each country, it is commonly observed that a public–private partnership is formed to establish policies and form related systems. In the case of China, public–private partnerships or privately led data trading platforms are being operated in each region, and behind this are the data economy-related policies led by the Chinese government [26]. The size of China’s data market has grown by more than 23% (as of 2020). The United States also makes great efforts to open the data market, both in the public and private sectors, along with a particularly prominent federal government policy. Starting with the opening of public data at the federal level in 2009, the United States announced the “Federal Data Strategy” for data standardization of all federal public institutions and developed the capability related to this in 2018, and they have continued to develop and utilize concrete tools and action plans for this strategy. Korea also established the “Fourth Industrial Revolution Committee” under the direct control of the President and announced the “Fourth Industrial Revolution Response Plan” in 2017. Since then, data economy-related policies and budget injection projects have been established and implemented.

### 3.3. Digital Crypto Economy

Although there is currently no clear definition worldwide, the central bank digital currency CBDC (Central Bank Digital Currency) refers to financial transactions using ICT, such as Fintech. The International Monetary Fund (IMF) has defined CBDCs as “a new form of money digitally issued by a central bank to be used as a fiat currency”. According to the Payment and Market Infrastructure Commission (CPMI) under the Bank of International Settlements, legal digital currencies are divided into central bank digital accounts and central bank digital currencies, depending on whether they are based on central bank accounts. Since 2014, China has been preparing to issue DCEP (Digital Currency Electronic Payment), a CBDC led by the People’s Bank of China, and is about to commercialize it soon. DCEP in China is the digital currency of the Central Bank of China, a legal digital currency issued by the Central Bank of China and protected by law. China’s digital yuan, DCEP, is similar to a blockchain-based cryptocurrency; however, the subject is not the private sector, but a centralized power group. The system operates as follows: rather than issuing and exchanging digital currencies directly to people by the Central Bank of China, it is instead permitted for them to exchange DCEPs at designated operating institutions and then convert them [27]. As many customers are already familiar with Alibaba’s Alipay and Tencent’s WeChat Pay, the spread of the digital yuan in China is expected to be rapid. In addition, as the use of the digital yuan increases, the Chinese government will be able to easily monitor the flow and detailed routes of its currency. According to the report, “Global Trends and Prospects for Central Bank Digital Currency”, recently released by the Federation of Korean Industries, the Chinese government is known to have started researching digital currency in 2014. Due to the impact of the COVID-19 pandemic in 2020 and the border closure caused by the COVID-19 variants in 2021, the expansion of non-face-to-face payment methods has become a great opportunity for the use of digital currency. China has been conducting “digital currency” experiments in certain big cities, such as Beijing, Shenzhen, and Shanghai, since April 2020. The People’s Bank of China, which is promoting the commercialization of the digital yuan, is also actively promoting global cooperation, such as the Multilateral Central Bank Digital Currency Bridge Project (m-CBDC Bridge Initiative). This project is an Inthanon-LionRock Project jointly promoted by the Hong Kong Department of Finance, the Hong Kong Center under the Bank of International Settlements Innovation Hub, the Central Bank of Thailand, the Digital Currency Research Institute under the People’s Bank of China, and the Central Bank of the United Arab Emirates, according to the Chinese media Securities Times. The project explores the possibility of real-time international settlement of digital currency and the

application of Distributed Ledger Technologies (DLT) to which blockchain technology is applied. Figure 5 shows the data process of the test, standard, and inspection reports using the digital encryption blockchain process required for MRA application, and shows the authenticity and copy management.



**Figure 5.** Verification of electronic document management system for public records using blockchain.

### 3.4. Problems in the Domestic Digital Transformation Economy

In this study, the analysis of and research on the problems of Korea's digital transformation economy were conducted based on the management problems of raw data and the report of the conformity assessment system for the domestic digital transformation economy. The digital transformation economy, represented by the Internet of Things and Artificial Intelligence (AI), is rapidly leading the flow of change, including digital electronic commerce and e-business technologies. This digital transformation economy is expected to change the size, scope, and structure of existing industries. The digital transformation of testing, certification, inspection, and calibration work based on domestic and international standards throughout the industry must be accompanied by changes in an all-round transformation of the economic and industrial infrastructures linked with new technologies, such as artificial intelligence information. On 6 March 2020, the "Conformity Assessment Management Act" (hereafter referred to as the Conformity Assessment Management Act) was approved at the Cabinet Meeting after being reviewed by the National Assembly Industry, Trade and Resources Small and Medium Venture Business Committee. It took effect from 8 April 2021. In Article 5, Paragraph 1 of the Conformity Assessment Management Act, accredited institutions are required to take technical and administrative measures to prevent the forgery or falsification of reports. Article 5, Paragraph 2 requires that accredited institutions maintain and manage related data on issued reports for a certain period of time; however, more than 90% of 900 domestic accredited institutions and testing and certification institutions in Korea do not have and operate a well-organized system that manages report cards, authenticity verification of raw data, and data integrity. In addition, many institutions are aware of the importance of management of reports and raw data; however, the burden of cost and technical problems to establish the management system has also been an obstacle to system establishment.

## 4. Digital Standardization Strategy and Diffusion Plan for Domestic Conformity Assessment

### 4.1. Digital Conformity Assessment System Implementation Strategy

In this study, the results of the conformity assessment system for the digital crypto economy and the management system for raw data were analyzed for the impact on the global digital crypto economy by applying the blockchain-based distributed ledger system technology. The digital crypto economy is an economic system that operates with cryptocurrency as an economic model formed by the development of blockchain services. Bitcoin, a representative blockchain-based cryptocurrency, is a virtual currency that is operated by design based on the transfer of ownership. These cryptocurrencies are being traded through exchanges around the world, despite the controversy over the value of money, and are also used as a target for speculation. However, the advantage should also be considered that the blockchain technology used can be used as a storage technology for documents and data in various fields. The potential of cryptocurrencies as a means of an exchange of new values in the digital crypto economy is found in many examples, such as the case of international aid organizations, including the United Nations (UN) and UNICEF (United Nations International Children's Emergency Fund), using coupons to which Ethereum-based blockchain technology is applied to receive cryptocurrency and provide food and record and manage related records in a distributed. This blockchain technology can also be used as a basis for distributed ledger technology that requests tests from an authorized institution for testing and certification of products produced by companies and managing product test reports [28]. The conformity assessment system report and raw data management technology, in which the report and related data are managed with encrypted technology that guarantees forgery and falsification and data integrity, must be one of the keys that Korea can appropriately respond to in the WTO/FTA TBT standardization competition of the United States and China in the flow of the digital crypto economy. The government and local governments have established a "basic plan for a carbon-neutral strategy" and have been reviewing industrial restructuring to achieve zero carbon emissions by 2040. As non-face-to-face economic activities and corporate digitalization have been accelerating due to government environmental policies and COVID-19, it is necessary to introduce an electronic report management system in a digital environment.

The KOLAS electronic document management system using blockchain enables the integrity of documents with the participation of stakeholders. The KOLAS Content Management System (Figure 5) built on the basis of a digital document editor can save vast sums of money compared to the existing document security system, which requires continuous maintenance costs. This also has the advantage of maintaining the integrity of the document and ensuring transparency by tracing the document movement path so that the report and raw data can be systematically managed. In order to verify the strategy for the establishment of this digital conformity assessment system, through requesting this system for the Digital Forensic Testing Laboratory of the Digital Forensics Cooperative in Gwacheon, Korea, the data quality management system of the KOLAS Content Management System was verified by applying this to the management of raw data and reports of digital forensic tool samples received for verification tests of digital forensic tools (28 May 2021–6 June 2021). The digital electronic document management system (Kolas Content Management System) is divided into the following four types. First, the standard interworking API supports the Restful API for standard interworking for linking with various applications, and can be connected to various systems. Second, the dynamic metadata field enables an administrator to dynamically manage the metadata field by easily adding, deleting, or changing additional information (metadata) constituting the content. Third, as the integrated site management environment is a structure that can operate and manage multiple sites in an integrated manner, even if the platform for each site is different (Java, NET, Node.js, etc.), it manages the appropriate file for each and grants each one permission. Fourth, as a service support case optimized for security, contents registered

in KCMS are transmitted safely by encrypting files through the KCMS receiver program installed on the service server side.

#### *4.2. Strategies for Establishing Domestic Digital Data Standardization*

A balance between supply and demand is necessary for digital innovation and vitalization of the platform industry. In order to realize the domestic digital transformation economy and to establish standardization in Korea, since stakeholders in each process related to encryption and digital data platforms must be able to thrive on their own, a win-win growth service through mutual cooperation between the government, the private sector and public institutions is required to materialize a new digital business model. In addition, an environment in which services and products can be developed more easily should be created so that consumers who participate in digital platforms, such as large, medium-sized, and small- and medium-sized enterprises, and finally startups and venture companies can easily access them [29]. To maximize the digital data economy, including the crypto economy, distribution transactions, and data transfer, by implementing a micro-service architecture that is flexible, independent, and combined with small functions, application services based on large-scale data should be transformed so that many applications can be connected and operated regardless of its scale. As empirically analyzed in this study, the openness of data should be maximized in digital platforms. Additionally, in order to vitalize the distribution and commerce of digital data, it is necessary to actively analyze and exemplify excellent field cases using digital data and apply them to the conformity assessment procedure and the WTO/FTA TBT system. Digital Data Story shares analysis reports and insights using data within the digital transformation economy and industrial innovation platform. In addition, as a strategy to respond to the standard war of great powers, for digital standardization through big data collection, we accumulated intellectual property (IP) rights, such as international certification; inspection and testing should be performed for digital standardization through big data collection. Based on this vast collection of information, standardization should be conducted through digital dataization and encryption, and furthermore, an innovation service (PatentPia) that analyzes patents for intellectual property rights should be provided. Digital standardization will play a key role in promoting exports by quickly analyzing and sharing product and buyer information as digital data as a way to support exporting companies.

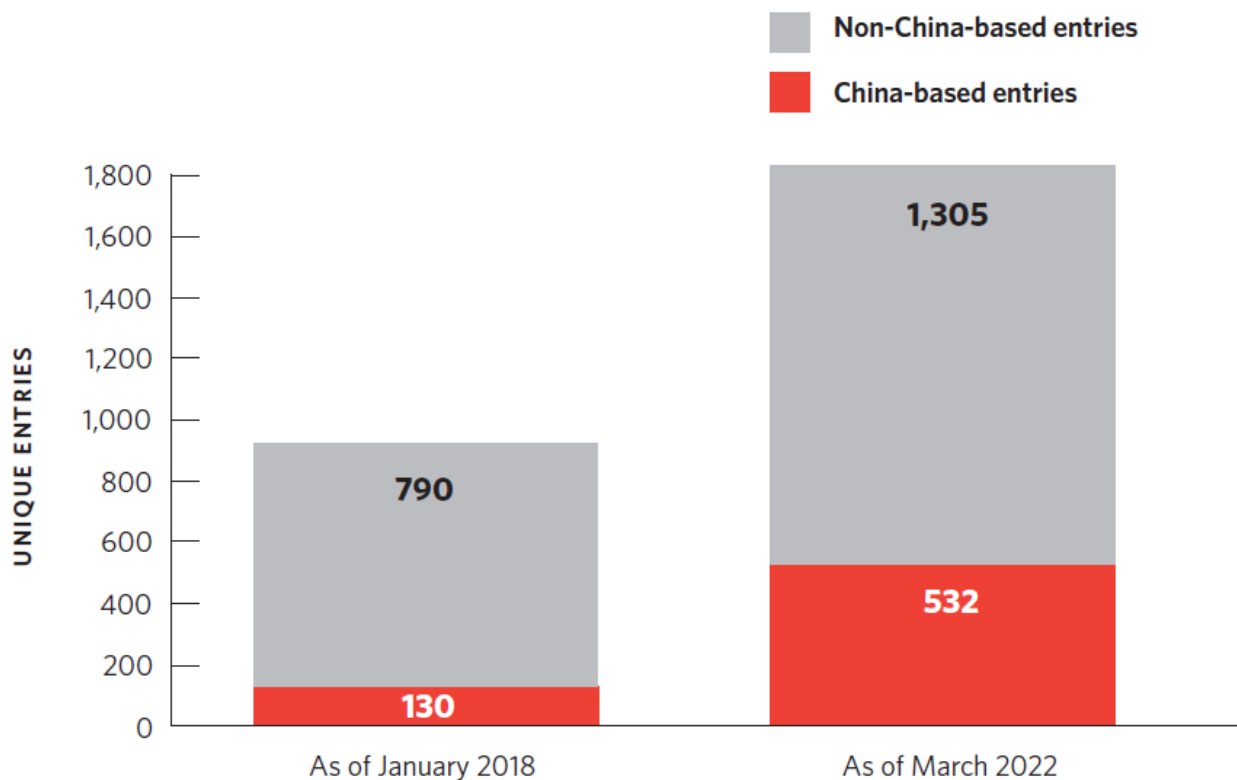
#### *4.3. A Plan to Spread the Domestic Official Score System Based on Digital Encryption*

The system used in KOLAS (Korea Laboratory Accreditation Scheme) records and shares related documents, such as test, certification, inspection, and calibration reports, in the distributed ledger so that users can directly inquire or modify information. The blockchain encryption technology applied to the system encrypts document information or attributes information with a public key to ensure confidentiality so that only the person concerned can observe it, and the digital signature guarantees security and integrity recorded in the blockchain. The report quality management system guarantees the integrity of the entire process of issuing a certificate through the following system: raw data are recorded in a domestic accredited institution, and reports and related documents are recorded in the KOLAS electronic document management system based on the blockchain, and report metadata information is recorded in the authentication server. By operating the KOLAS electronic document management system (Kolas Content Management System) based on this digital encryption by KOLAS (Korean Accreditation Organization), it is expected that it will acquire global competitiveness through the digital standardization of Korea's conformity assessment system in the era of the digital transformation economy: reports and raw data from domestic testing and certification, inspection, and calibration institutions are issued and managed through the Kolas electronic document management system based on the blockchain, and make anti-counterfeiting prevention and verification of authenticity mandatory when the reports of 900 accredited institutions and testing

and certification institutions are issued, in order to prevent the misconduct of tests and certifications, and standardize and manage the related documents [5,15,25].

#### 4.4. Measures to Spread the International Mutual Recognition Agreement

The WTO/FTA TBT agreement recommends signing an agreement for mutual recognition of conformity assessment results. As shown in Figure 6, international companies are increasingly connected in CHINA.



**Figure 6.** The entity list is increasingly focused on China. Source: US–CHINA TECHNOLOGICAL “DECOUPLING” A STRATEGY AND POLICY FRAMEWORK (2022).

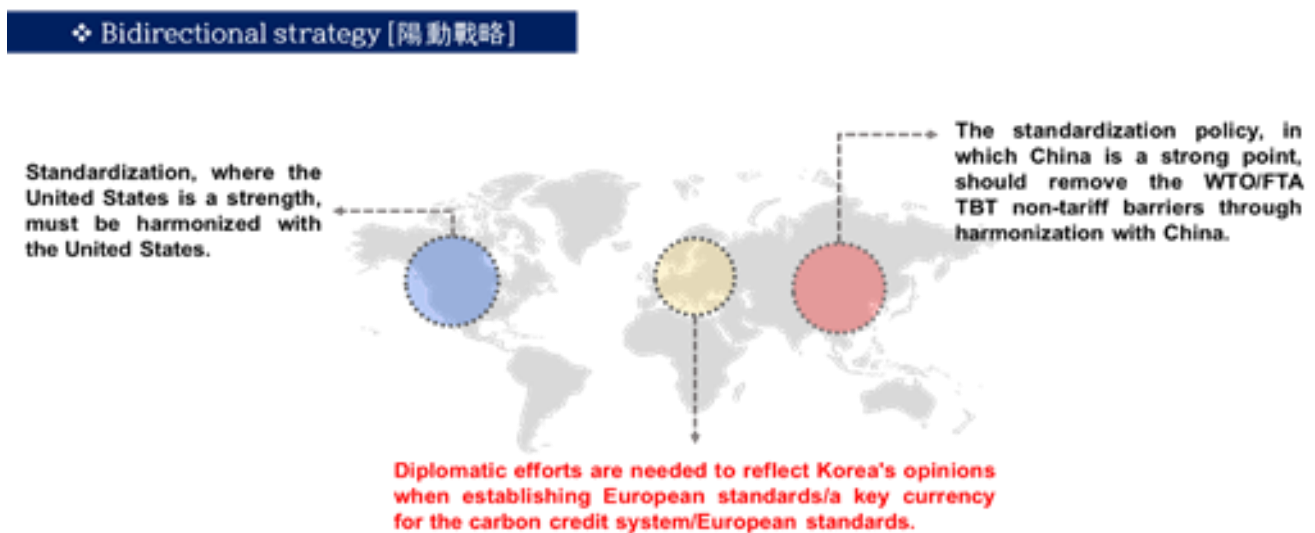
For the development of ICQ-MRA under the WTO/FTA TBT conformity assessment system, it is necessary to utilize the mutual recognition agreement between countries. Therefore, the following ways to spread ICQ-MRA are suggested in four specific aspects.

First, it is most important to unify the MRA system among countries that have signed WTO/FTA. The advantage of MRA is that by unifying the certification systems for different industries by country on an international level, it enables cost savings and time reduction by eliminating duplicating procedures, removal of non-tariff barriers, and efficiency, safety, and predictability according to standardization. To increase the effectiveness of ICQ-MRA to the level of the AEO-MRA accreditation system and to strengthen international responsiveness, a unified accreditation system should be introduced at the international level [17,24].

Second, in order to efficiently utilize ICQ-MRA, cooperation should be promoted after selecting an appropriate target country in consideration of the trade scale and technology level of major countries. More specifically, after comparing the accreditation and conformity assessment systems of the countries with which the mutual recognition agreement is to be concluded, and analyzing the strengths and weaknesses in detail, a standardization model should be established to reach a level of MRA that both countries are satisfied with. It is reasonable to conclude mutual recognition agreements for each FTA destination country, region with a common economic zone, or economic cooperation organization, or it is also reasonable to conclude a mutual recognition agreement in connection with similar systems implemented by international organizations, such as the International

Electrotechnical Commission (IEC), the International Organization for Standardization (ISO), and the International Maritime Organization (IMO).

Third, international cooperation should be strengthened and trust relationships should be built. There is a high concern that MRA will eventually adopt international standards and conformity assessments that are favorable to major powers, such as the United States, China, and the EU, and it is impossible to prevent the influence of these countries in practice. Therefore, Korea should actively participate in the activities of international standardization organizations, such as ISO and IEC, and make every effort to reflect Korea's opinion on the MRA. Institutional support measures to strengthen the international activities of domestic experts should be prepared so that they can advance to the international organization committee and participate in the working group in the ICQ-related field, an institution dedicated to responding to each field should be established, and experts should be discovered and nurtured. In particular, as shown in (Figure 7), Continuous cooperation is essential for each standard preemption field, which is a strength in the United States, China and Europe, a standardization powerhouse.



**Figure 7.** Bidirectional strategy.

In this study, based on the theories of knowledge-based and resource-based views, technical competence and relational competence were identified as important in the international standard process, and it was found that it is absolutely necessary to expand and implement them. As part of the construction of the digital conversion system, it is required to establish an encryption system for data, such as accredited certification, inspection, test, and calibration [30]. The significance of the preemption of international standardization mediated by dynamic capabilities by re-illuminating the role of exogenous variables under the WTO/TBT global conformity assessment system has become an important means of improving national, social, and economic efficiency and effectiveness. In the international economy and trade that is biased towards globalization, it is important to protect the interests of its citizens in the international export environment, as well as to establish a dimensional system [31]. In addition, it is necessary to establish a link with national measurement standards to secure the international reliability of the measurement results of test and analysis institutions operated by department, which is directly related to the preemption of standardization.

## 5. Conclusions and Implications

In the era of limitless competition in which the G2 trade dispute changes into a standard and technological war beyond trade competition, international standards and technical regulations have become a source of competitive advantage. In the era of free competition where the war for hegemony and digital trade conflict between the United States

and China has been accelerating, as a solution to trade technology regulatory measures for trade in goods, intellectual property rights, and services, response strategies that reflect the provisions of the WTO/FTA TBT, such as non-discrimination, national the treatment, transparency, the principle of minimum trade restrictions, and the spread of standards and harmonization, identified in this study are as follows: (1) Korea's response strategy based on the conformity assessment system under the WTO/FTA TBT system, (2) case analysis of digital grade encryption system based on KOLAS' blockchain, (3) measures for the establishment and development of a Korean standardization system through data transfer cases of delivery services, and (4) possibility of expanding the Korean conformity assessment system through the spread of mutual recognition agreement for international certification and qualification. This study differs from other studies in that (1) it expanded the scope of research to include importing companies, going one step further from the previous studies that dealt with trade regulations of Korean manufacturing and exporting companies through AEO-MRA, and (2) that it suggests a solution to the ICQ-MRA trade regulation measures for technology trade, which is the core of the Fourth Industrial Revolution. In summary, this study examined the specific categories of international certification acquisition first, and determined that digital standardization activities under the conformity assessment system described by the WTO/TBT agreement have a considerable impact on the preoccupation of national standardization. The current status of the international certification system and acquisition of international certifications was reviewed at the academic, practical, institutional, policy, and technical levels related to the reliability of conformity assessment results.

Noting that different international standard technical regulations and conformity assessments are another trade barrier to international commerce, this study suggested a development plan for the international certification system based on the principles of the WTO/FTA TBT system as a preventive measure for unfair trade regulations, and the main contents are as follows.

First, in the context of free trade that expands the volume of international trade and protectionism that protects domestic industries first, countries should remove non-tariff technical barriers to trade by opening their markets to each other, and as a measure that can contribute to promote export and to improve international relations capabilities, it is necessary to establish and spread an official grade system through digital encryption.

Second, it is necessary to build and continuously manage Korean-style digital data suitable for Korea's conditions as well as collecting big data information through the free transfer and diffusion of the digital data economy.

Third, it is necessary to spread ICQ-MRA reciprocity and introduce a unified accreditation system at the international level so that the time and cost required for the conformity assessment process be dramatically reduced, and this will lead to the expansion of Korea's export performance and the enhancement of competitiveness of key products of Korea [1,3,7].

Fourth, in order to strengthen international cooperation and build a trusting relationship, institutional support measures to strengthen the international activities of experts should be prepared, and the experts should be encouraged to enter the international committees related to standardization in Korea, and experts and specialized institutions should be discovered and nurtured. Mutual trust can be enhanced by harmonizing multilateral or bilateral technical standards and international standards in potential fields, such as technical standards, standards, application standards, and conformity assessment procedures, and by exchanging information to reinforce the transparency of the WTO/FTA TBT system.

Fifth, it is necessary to change the competitive structure of conformity assessments and international accreditation systems, and to improve operating systems, such as accreditation system integration. In line with the international trend of rapidly increasing the demand for conformity assessment industries related to new industries, energy, and eco-friendly regulations, the competitiveness of domestic testing and certification institutions should be strengthened through the expansion of the ICQ-MRA system.

By spreading TBT policies based on harmonization and reciprocity, which are essential issues that are no longer an option for all import and export companies in international trade, it is expected that global and Korean trade will continue to grow through the establishment of an objective and up-to-date database related to the benefits of exporting companies, and through the resolution of non-tariff technical barriers to trade in the digital commerce field and international standards through additional research.

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