Journal of Korea Trade Vol. 25, No. 6, October 2021, 105-125
https://doi.org/10.35611/jkt.2021.25.6.105
ISSN 1229-828X

A Study on the Effects That SMEs' Response to Non-Tariff Barriers Exerts on Export Performance: Focusing on Technical Barriers to Trade

JKT 25(6)
Received 18 August 2021
Revised 6 September 2021
Accepted 11 October 2021

Se-Hwan Joo
Department of International Trade, Gyeongsang National University, South Korea
Jae-Sung Lee†
Department of International Trade, Sangji University, South Korea

Abstract

Purpose – This study analyzes the effects that the response to the technical barriers to trade (TBT), which are used by various countries as means to restrict imports, exerts on exports at a time when protectionism is emerging in the face of a global economic downturn. TBT has been widely used in developed countries for the safety and protection of their people. Recently, the use of TBT as a tool of protectionism has increased considerably in developing countries as well. Therefore, this study analyzes the South Korean SMEs' response and export performance.

Design/methodology – To analyze SMEs' response to TBT and their export performance, this study conducted empirical analysis through statistical analysis. To this end, the research established a theory based on previous research and designed its hypothesis and research model. To verify the hypothesis and research model, factor analysis addressing validity and reliability was performed using SPSS 25 and AMOS 26, and the structural equation model was analyzed.

Findings – This study found the causal relationship between the independent variable, the mediating variable, and the dependent variable adopted against the theoretical background to have little or no effect, in contrast with previous studies. In a break from previous studies, all hypotheses were rejected for innovation strategic competencies, one of the sub-factors of the independent variable, which is believed to be a result of the lack of practical research related to TBT.

Originality/value – Previous studies performed analysis using trade statistics or macro data. A number of such studies analyzed the relationship between technical regulation and trade volume. This study differs from previous studies in some respects, because it analyzed the export performance of companies by establishing a hypothesis and implementing a research model with the factors analyzed in previous studies. In addition, a new attempt has been made by classifying the TBT response factors into technology competencies, human resource competencies, and innovation strategic competencies, and utilizing technology innovation and the export support system as mediating effects.

Keywords: Non-Tariff Barrier, SMEs' Export Performance, Technical Barriers to Trade
JEL Classifications: F1, F14, F18

1. Introduction

1.1. Background and Purpose of the Study

Since the World Trade Organization (WTO) was launched in 1995, the growing international trade has increased economic benefits for many countries and has had a significant

†**Corresponding author:** sj_trade21_js@sangji.ac.kr

positive impact on government revenue. Economic benefits have the advantage of exerting an impact on the growth of companies and the improvement of the quality of life for people. Therefore, many countries, led by WTO, have made efforts to expand trade and sought to solve the problems that may occur in international trade by establishing free trade agreements (FTAs) that can remedy the limitations and shortcomings of the WTO system. Trade agreements such as FTAs create trade diversion that makes trade expansion possible with trade created through the abolition and reduction of tariffs. The continuous expansion of free trade through negotiations has made it possible to remove trade barriers created by tariffs and ensure the free mobility of goods and services as well as factors of production such as capital, labor, and technology between countries. The efficient movement and distribution of goods and factors of production became a stepping stone to the increase in world trade volume and global economic growth.

However, the global economic downturn caused by the 2008 Global Financial Crisis had a negative impact on the expansion of free trade and led to a delay in economic recovery. This phenomenon served up an opportunity for advanced countries to turn to new protectionism under the pretext of protecting their own industries. In order to protect trade, countries are increasingly using non-tariff barriers in addition to tariffs in their trade policies. In other words, they tightened regulations on non-tariff barriers such as TBT and animal and plant sanitary quarantine instead of the tariff barriers that various trade agreements have sought to lower. In particular, after the Global Financial Crisis, countries began to actively use non-tariff barriers such as TBT as tools of protection all the while desisting from raising tariffs as a traditional trade barrier. The new trade restrictions do not strengthen traditional measures such as existing quantitative restrictions. They frequently refer to TBT such as technical regulations or conformity assessment procedures, which are the tools and customs and administrative procedures that must be prepared in advance. They are obstacles that burden and negatively affect trade facilitation.

In 2020, the number of WTO TBT notifications reached the highest with 3,354, and technological regulations in developing countries are also rapidly spreading (Korea Agency for Technology and Standards, 2021).

Against this backdrop, this paper intends to analyze the effects that TBT, one of the non-tariff barriers, exerts on the exports of SMEs. The expansion of high value-added industries of SMEs with the advent of the era of the 4th Industrial Revolution can secure international competitiveness through revitalization of the domestic market and job creation and respond to technological regulations caused by technological development. This study seeks to analyze and find ways to deal with TBT that can create export problems, especially from the standpoint of SMEs.

1.2. The Research Method

This study aims to analyze what effects the SMEs' response to TBT, one of the non-tariff barriers, exerts on their export performance. Therefore, this study performed an empirical analysis to extract and verify research hypotheses and factors from previous studies.

Currently, South Korea has yet to do a lot more research on the effects that TBT and firms exert on one another. Moreover, previous studies on TBT involved approaches from a legal or theoretical perspective. A look at the empirical studies suggests that many of those performed analysis using macro data such as trade statistics between countries and trade statistics by industry. In other words, there have been many studies that define the relationship between technical regulation and trade volume and describe how it affects trade when

technical regulation occurs as a TBT. Therefore, research is needed to identify important factors and explain the relationship between different variables.

An appropriate questionnaire was organized for the study, which verified reliability, validity, and coherence to test the verification of the suitability of the hypotheses and the research model. For the verification of the sample, SPSS Statistics 25.0 was used, and the analysis of the structural model was verified through AMOS 26.0.

2. The Concept of Non-Tariff Barriers and the Theoretical Framework for TBT

2.1. The Concept of Non-Tariff Barriers

In 1939, Percy W. Bidwell used the concept of a non-tariff barrier when he coined the term, 'the Invisible Tariff'. Afterwards, this expression was replaced by the term of non-tariff barriers, and international organizations and scholars began to study the broad and complex non-tariff barriers by dividing them into practical and theoretical aspects.

Non-tariff barriers refer to all trade policies other than tariffs created as barriers to trade among countries. Typically, they are divided into two categories. First, there are quantity restrictions, import permits, and import penalties that directly limit trade. Second, there are technical regulations, health and hygiene, etc. that indirectly limit trade. TBT refers to unnecessary barriers to trade between countries created by applying discriminatory technical regulations, standards, and certifications to imported goods.

Accordingly, more countries now use non-tariff barriers to regulate imports. Because non-tariff barriers serve as invisible tariffs, their characteristics can be divided into five categories.

First, it finds diverse and complex applications. Second, there are difficulties in accessing information because notification is not compulsory. Third, it is difficult to mitigate or abolish because rational regulation for unavoidable reasons is allowed. Fourth, its effectiveness and impact are difficult to quantify. Fifth, it can be used as a discriminatory trade policy tool (Han, 2009).

2.2 The Status of TBT

TBT has emerged as an important issue in world trade under the General Agreement on Tariffs and Trade (GATT).

A TBT agreement is composed of technical regulation, standard, and conformity assessment, and must promote the benefits of trade liberalization and the interests of member countries inasmuch as the standard and the certification system do not exercise negative effects on the trade activities.

Between 1995, when the WTO system was established, and 2020, 142 member states notified WTO of 39,000 technical regulations. Looking at the five countries with the highest number of notifications over the twenty-six years, the United States issued 4,106 notifications, Brazil 2,240, Uganda 2,092, the EU 1,731, and China 1,597. South Korea, which issued 71 notifications, was ranked 13th. In 2020, 2,043 notifications (61%) were issued by developing countries, and least developed countries accounted for 23%. Unlike in the past, when notifications were issued mainly by developed countries, more than 83% of the technical regulations are occurring lately in developing countries. These days, technical regulations are being used worldwide (Korea Agency for Technology and Standards, 2021).

The number of WTO TBT notifications (to TBT Committee)[1] was 2,336 in 2016, 2,585 in 2017, 3,065 in 2018, 3,337 in 2019, and 3,354 in 2020.

2.3 The Theoretical Framework for TBT

Technical regulation is about making specific requirements for specific products and services binding through laws, enforcement decrees, enforcement rules, and public notices to fulfill administrative purposes such as public safety, environmental protection, health, and consumer protection (Korea Agency for Technology and Standards, 2021).

According to Keith and John (2001), technical regulation is a compulsory or practically required procedure for imported goods to enter the market. It is expected to boost product reliability, facilitate transactions, intensify competition, and increase efficiency. However, when technology regulation is used as a trade policy tool, it can incur costs for many countries including developing countries. Certification or standards for technical regulations may incur indirect costs, but certification and standards open the market and promote trade. However, technical regulations with overlapping or excessive requirements cause obstacles to business activities and, if unreasonably out of line with international standards, become obstacles to trade. Technical regulations are spreading internationally, and new technical regulations are also increasing.

TBT is a non-tariff barrier that impedes the free mobility for trade in goods. TBT is characterized by development costs and time required to comply with technical regulations, additional costs, increase in commodity prices, and export restrictions among others (Seon and Ra, 2015).

Maskus, Otusuki, and Wilsom (2005) analyzed companies from seventeen developing countries, using the World Bank's data on TBT. They found that standards and technical regulations increased the fixed costs of enterprises in developing countries and contributed to a significant increase in production costs.

The study by Bao and Qiu (2012), which extracted and analyzed bilateral export data of 105 WTO member countries, found that the extensive margin in the export of the member countries decreased whereas the intensive margin increased. Although the TBT in developing countries did not have an impact on the extensive margin and the intensive margin of the export of developed countries, it decreased the extensive margin and increased the intensive margin among developing countries.

Yousefi and Liu (2013) analyzed the effects that TBT exerted on the trade between South Korea, the United States, Japan, and China. Their analysis used industry-specific data focusing on manufacturing and found that TBT negatively affected trade by causing problems in the long term.

A study by Jang and Suh (2014), which analyzed the effects of TBT on trade focusing on the characteristics of each industry, found that in industries with competitive or comparative advantage, TBT's impact on exports was relatively small. However, for industries with relatively high technology intensity, TBT had a negative impact on trade.

A number of previous studies showed that TBT exerted a negative effect on the export of companies. The reason is that fixed costs increased due to TBT, and export costs, which

[1] In principle, WTO member countries should follow international standards as the highest priority in accordance with the TBT Agreement. However, a country that wants to enact or amend any technical regulation, standard, or conformity assessment procedure that may have a significant impact on trade must notify the WTO so that other member states can shares their feedbacks. A notification must be written in the prescribed form, and the name, purpose, specifics etc. of the regulation are written and submitted to the WTO Secretariat, which is called a TBT notification.

increased significantly due to the increase in fixed costs rather than variable costs, had a great impact on export activities (Jang, 2013).

3. Previous Studies for Empirical Analysis

3.1. Previous Studies on TBT Countermeasures

Previous studies treated various factors involved in the response to different types of non-tariff barriers. However, there has yet to be much more empirical research on the countermeasures committed to addressing technical regulations that have recently become a hot topic such as TBT.

To understand the countermeasures, it is necessary to check whether the effect that the intensive margin among exporting companies exerts on exports has a causal relationship with TBT. In other words, cost should be divided into fixed cost and variable cost. In order for an exporting company to determine the extensive margin, it must satisfy the technical regulations required by the export destination country, and for this, the exporting company must consider additional fixed costs (Baller, 2007). Enterprises cannot survive by merely accumulating resources, and they need competency to gain competitive advantage in a rapidly changing market (Teece, Pisano, and Shuen, 1997). Therefore, an export strategy must be established in consideration of technology competencies, human resource competencies, and innovation strategic competencies to respond to technical regulations.

A study that analyzed technical regulations demonstrated that technological factors are crucial for resolving technical barriers and could be addressed by methods such as patents, certifications, and standards.

Thilmany and Barrett (1997) suggested that the certification system that facilitated the satisfaction of technical regulations had a positive effect on companies. This is because a product that has qualified through certification registers high reliability among consumers and is effective in inducing their purchase.

Kim Hee-Sung, Yang Hoe-Chang, and Kim Young-Jae (2019) explained that difficult procedures and certification processes of TBT act as obstacles to exports for SMEs. In particular, since SMEs pale beside larger companies in access to information and expertise, they need countermeasures for avoidance, elimination, or mitigation to secure international competitiveness.

According to a study by Hong Sung-Kyu (2019), WTO member states should use relevant international standards as the basis for their technical regulations if such standards are available or are to be created. Although the technical regulations and international standards do not have to be completely identical, the standards can be deemed important countermeasures, because provided no contradiction is found, they are recognized as the same.

In responding to TBT, factors as crucial as technology competencies are human resource competencies and innovation strategic competencies.

Zollo and Winter (2002) said that human resource competencies represent skills, processes, practices, and resources that make them feasible. Therefore, human resources boost the competitiveness of a company by continuing dynamic competency development in a virtuous cycle and in effect grow the company (Hsu and Wang, 2012).

Li, Zhao, and Liu (2006), who analyzed the effects of human management on technology innovation and organizational performance for high-tech companies in China, demonstrated that human resource management is related to innovation performance and is an important factor in enhancing the competitive advantage of a business.

D'Este, Amara, and Olmos-Peñuela (2016) examined 5,387 Spanish manufacturing occupations and demonstrated that the novelty of the R&D workforce could reduce the likelihood of failure.

Innovation strategic competencies constitute a strategic direction that motivates companies to take effective actions in order to continuously grow and deliver excellent performance. Therefore, strategic factors enhance a company's ability to adapt to changes in the trading environment, and furthermore, create and develop an environment that can cope with fierce competition. Strategic factors can be analyzed as distinguished into organizational structure and organizational culture.

The study by Keizer, Dijkstra, and Halman (2002) found through its analysis that structural characteristics of an organization had a greater influence on performance than personal or situational factors. This is because the organizational structure allocates the decision-making process related to the performance of the company and the functional roles within the organization.

Kim Young-Joe (2007) said that the creative behavior of employees varies with the organizational structure of a company. Access to information, the establishment of training support and system related to technology trade, the composition of response organizations etc. promote efficiency and promptness in decision-making and have a positive effect on corporate performance.

Organizational culture can be viewed as an act that encourages the participation of members in order to maximize the company's performance based on the values and beliefs shared by its members. It also refers to a system that supports job commitment, organizational immersion, and employee education and training (Choi Suk-Bong and Ha Gui-Ryong, 2011).

3.2. Previous Studies on Technology Innovation

Regulation induces technology innovation rather than induces corporate stagnation, eventually contributing significantly to productivity boost. Porter and Van der Linde (1995) used the concept of 'innovation offset'. Through their empirical analysis of US and Japanese companies, they explained that although environmental regulations imposed costs on companies, companies were oriented toward technology innovation in order to minimize the additional costs incurred by regulations.

However, technology innovation is an element that companies which seek to maximize profits while incurring high costs to cope with new regulations want to avoid. Environmental regulations were shown to have a negative effect on corporate profits but a positive effect on technology innovation (Bhatnagar, S, and Cohen, 1997).

The study by De Vries and Withagen (2005) performed panel data analysis by country on sulfur dioxide regulation and patents. The analysis found that regulation promoted technology innovation, and that technology innovation had a positive effect on both profit and productivity.

Kang Hee-Jea (2015) said that although environmental regulation has a positive effect on technology innovation, innovation does not occur as soon as the regulations are applied, and that time is needed for investment in technology innovation. And he suggested that while productivity increases, it takes time like technology innovation.

The study by Sohn Dong-Seop (2017) found through analysis that regulatory barriers, government support, and public information utilization affected product innovation. However, he found that government support does not affect all industries, but only high-tech industries.

The study by Ahn Seung-Ku, Lee Kwang-Hoon, and Kim Kwon-Sik (2018), found that companies which experienced more burden from technical regulations on their business activities made R&D and technology-related investments, and understood this as evidence of corporate growth. However, analyzing the effects that regulatory policies of manufacturing companies exerted on technology innovation suggested that regulation itself was a negative factor, and that the higher the level of regulation was, the lower the technology innovation became (Ahn Seung-Ku, Kim Kwon-Sik, and Lee Kwang-Hoon, 2018; Bassanini and Ernst, 2002; Prieger, 2000).

However, there are also a number of studies showing that technological regulation has a negative effect on technology innovation (Jeong Seung-Il et al., 2007; Seo Young-Woong, Choi Seok-Joon, and Lee Si-Wook Seo, 2012).

3.3. Previous Studies on Export Support System

The export support system is a representative form of resource deployment such as financial supports and supply of human resources. It cannot be consistently argued that the export support system directly promotes R&D investment by companies (Guellec and Potterie, 2003; Link and Scott, 2013). Nevertheless, various studies suggest that the government's export support system influences export growth.

Kotabe and Czinkota (1992) broke down the export support system into export activity support and overseas market development, and subdivided them into export operations, information and knowledge supply, and overseas market development according to the purpose of export support. This export support system also contributes to reducing the burden that companies face as exporters.

Gencturk and Kotabe (2001) analyzed export performance and the effects of the export support system. The export support system can be classified into direct support and indirect support, when focusing on its characteristics. The study demonstrated that both direct and indirect support could influence export growth, but that direct export support was more effective.

Chung Ja-Son (2007) defined the export support system as a system to support companies that have difficulties in exporting to overseas markets even though they produce differentiated and excellent products and goods due to their weak marketing capability or their lack of specialized export manpower.

3.4. Previous Studies on Export Performance

To assess a company's export performance, financial performance and non-financial performance are often analyzed. Financial performance refers to the data that shows objective figures and shows the actual status of export performance. Non-financial performance refers to the subjective data that measures corporate image, corporate goals, market share etc.

Barney (1995) explained that corporate strategic factors built the basis for a company's performance enhancement, and that when they were transmitted as an intangible culture to the company's senior management and other employees, they served as a source of continuous growth and performance of the company.

Leonidou and Leonidas (2002), who analyzed the decisive factors affecting export performance, defined export sales rate, export market share, and export growth rate as specific items of export performance.

Walker and Mullins (2014) suggested that in measuring corporate performance, maintaining the division between financial performance such as profitability and market share and non-financial performance such as service quality and customer satisfaction would not

completely serve the purpose of the analysis. Since product and service quality is being standardizing upward, it is necessary to make a comparative analysis on both financial and non-financial performance.

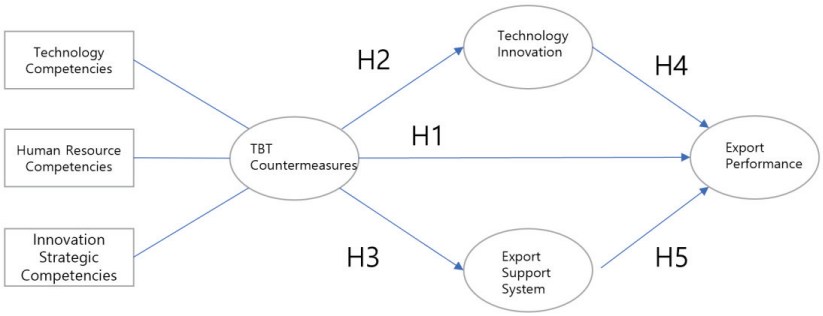
Jeon Byung-Young (2015) analyzed how export support systems influenced a company's image and recognition, success rate in overseas market entry, export growth rate, and overseas market share. Furthermore, he found that the use of the trade finance system had an impact on export growth.

4. Developing the Research Model and the Hypothesis

4.1. The Research Model

This study, which aimed to analyze the effects that the TBT countermeasures exert on SMEs' export performance, established a research model as shown in Fig. 1 to analyze and elucidate the causal relationship among the factors. In this study, the TBT countermeasures were set as independent variables, and sub-factors were set as technology competencies, human resource competencies, and strategic capability. With export performance as the dependent variable used as a factor to explain the relationship with the independent variable, the study analyzed the effects that the independent variable exercised on export performance. And by using technology innovation and export support system as mediating variables, the study analyzed and proved whether there were additional effects on independent and dependent variables.

Fig. 1. The Research Model



4.2. Hypothesis Setting and the Operational Definition of Variables

This study defined SMEs' TBT countermeasures as the independent variables of technology competencies, human resource competencies, and innovation strategic competencies. A number of studies have suggested that regulation is a risk factor for companies that increases costs, increases production costs, and hinders corporate performance. However, starting with Porter's research, studies that refuted existing negative views began to increase in earnest.

A company's unique technology competencies are key factors for entering and expanding overseas markets, and companies are investing a lot to develop their technology competencies. In addition, compliance with technical regulations and international standards can alleviate or eliminate increased regulations, which in turn has a positive effect on exports

(Hong Sung-Kyu, 2019; Kim Hee-Sung, Yang Hoe-Chang, and Kim Young-Jae, 2019; Lee Yang-Kee and Kang Bong-Ju, 2021; Oviatt and McDougall, 1995; Thilmany and Barrett, 1997).

Human resource competencies are defined as the knowledge, skills, know-how, and insight of employees or senior management, and when human resources with these competencies participate in corporate activities, they become competitive dynamic capabilities. And human resource competencies deliver performance when a company tries its luck in a new environment (D'Este, Amara, and Olmos-Peñuela, 2016; Hitt et al., 2001; Hsu and Wang, 2012; Hue, 2011; Li, Zhao and Liu, 2006; Zollo and Winter, 2002).

Innovation strategic competencies help efficient decision-making within the organization by analyzing the strategies necessary for a company in the rapidly changing international environment and the overheated overseas market. And this efficient decision-making makes a significant contribution to moving a company in a rapid and creative direction, and consequently has a direct effect on its performance (Choi Suk-Bong and Ha Gui-Ryong, 2011; Keizer, Dijkstra, and Halman, 2002; Kim Hee-Sung, 2020; Kim Young-Joe, 2007).

Hypothesis 1: TBT countermeasures will have a positive effect on export performance.
Hypothesis 1-1: Technology competencies will have a positive effect on export performance.
Hypothesis 1-2: Human resource competencies will have a positive effect on export performance.
Hypothesis 1-3: Innovation strategic competencies will have a positive effect on export performance.

Depending on their nature, technical regulations may have different effects on companies. For example, patent protection of a firm's technology can promote innovation, but if the market as a whole is considered, deregulation allows patented inventions to promote confidence in innovation (Besen and Rashnd, 1991). Research proving the causal relationship between regulatory response and innovation shows that regulation and innovation frequently generate positive synergies. And the regulatory response affects the supply and demand in the ecosystem, and at the same time, results in innovative outcomes such as productivity, technology, and investment (Pelkmans and Renda, 2014). The technological regulatory environment has an impact on the economy and society, resulting in regulatory responses. Regulations affect stakeholders such as managers, employees, consumers, and institutions, and in order to achieve the goal of responding to regulations, companies focus on technology, human resources, and corporate strategy, thereby gaining competitiveness (Ahn Seung-Ku, Lee Kwang-Hoon, and Kim Kwon-Sik, 2018; Besen and Rashind, 1991; Gatigon and Xuereb, 1997; Porter and Van der Linde, 1995). Strategic competence is an important factor in utilizing limited resources of SMEs in a rapidly changing international business environment. Acquisition of information on overseas technical regulations, acquisition of technical knowledge, and norms can be obtained through close cooperation with companies and institutions. And based on these experiences, they are reassigned to new competencies in the changing market environment, and strategies for re-convergence gain motivation for innovation activities (Chun Jai-Il and Yim Hyung-Rok, 2015; Kang Seok-Min and Kim Dae-Won, 2014; Rothaermel and Hess, 2007; Teece, Pisano and A. Shuen, 1997).

Hypothesis 2: TBT countermeasures will have a positive effect on technology innovation.
Hypothesis 2-1: Technology competencies will have a positive effect on technology innovation.

Hypothesis 2-2: Human resource competencies will have a positive effect on technology innovation.

Hypothesis 2-3: Innovation strategic competencies will have a positive effect on technology innovation.

The South Korean government supports various policies to encourage the export of SMEs. Especially, maximizing the utilization and efficiency of government-supported policies, active cooperation between the government and companies should serve as the basis (Ahmed et al., 2002). When a company responds to regulations, it is subject to demographic, socioeconomic, and political influences, which are factors of the external environment surrounding the company. Since it is difficult for SMEs to bear the shock caused by these factors, they turn to government support policies. In addition, SMEs often complain of difficulties in entering new markets and securing competitive advantage, citing the limitations in R&D activities due to lack of their own competencies. This problem can be solved by expanding technology and capital through government-supported projects (Choi Suk-Bong and Ha Gui-Ryong, 2011; Kotabe and Czinkota, 1992; Suh Chang-Juck and Lee Chang-Hyoung, 2007).

Hypothesis 3: TBT countermeasures will have a positive effect on the use of export support system.

Hypothesis 3-1: Technology competencies will have a positive effect on the use of export support system.

Hypothesis 3-2: Human resource competencies will have a positive effect on the use of export support system.

Hypothesis 3-3: Innovation strategic competencies will have a positive effect on the use of export support system.

According to the 2020 Survey on Technology of SMEs, 39.2% of technology development SMEs had a company-affiliated research center as a dedicated organization and the remaining 60.8% conducted technology development in the technology development department or production department in 2019. These R&D efforts suggest that businesses are making a lot of efforts both internally and externally. A company's productivity increase and profit increase are reinvested in R&D, and when this cycle is established inside the company, the technology orientation is perked up, so it can deliver a higher level of quality and service compared to competitors and ultimately boost the company's performance (De Vries and Withagen. 2005; Kang Hee-Jea, 2015; Porter and Van der Linde, 1995; Talke, Salomo, and Kock, 2011).

SMEs can improve their business performance if they cooperate with external entities or receive external support in any form. If companies receive support from or cooperate with government agencies, research institutes, and universities, efficient production is possible and costs can be reduced. And because it can lower the entry barriers for information and new markets, export volume and sales will increase (Chung Ja-Son, 2007; Kotabe and Czinkota, 1992; Moon Sung-Wuk, 2011; Park Kwang-Sep, Kim In-Kown, and Ahn Jong-seok , 2010).

Hypothesis 4: Technology innovation will have a positive effect on export performance.

Hypothesis 5: Utilizing export support will have a positive effect on export performance.

4.3. Operational Definition of Variables

A total of six variables were used in this study. Technology competencies, human resource competencies, and innovation strategic competencies were used as independent variables, technology innovation and export support system were used as mediating meters, and export performance was used as a dependent variable. Each of the variables and items was composed based on previous studies, and the operational definitions of the variables are summarized in Table 1.

Table 1.

Variable	Definition	Previous Studies
Technology competencies	It refers to the availability of the capability or a plan to satisfy the requirements of technical regulations (patents, standards, certifications, etc.) It refers to the availability of a production process that can respond to technical regulations and manage quality based on in-house standards.	Kim Hee-Sung, Yang Hoe-Chang and Kim Young-Jae, 2019; Lee Yang-Kee and Kang Bong-Ju, 2021; Thilmany and Barrett, 1997
Human resource competencies	It refers to the portion of technical manpower in the workforce, their education, the acquisition of technology and know-how, the innovativeness of the senior management, and the employees' effort to acquire knowledge.	D'Este, Amara and Olmos-Peñuela, 2016; Hsu and Wang, 2012; Zollo and Winter, 2002
Innovation strategic competencies	It refers to the importance of national support and strategic alliances for responding to market volatility that may arise from TBT, responding to new regulations, and enhancing international competitiveness.	Rothaermel, and Hess, 2007; Choi Suk-Bong and Ha Gui-Ryong, 2011; Kim Hee-Sung, 2020
Technology innovation	It refers to the ability to utilize technology for the development of competitive products or technology commercialization and refers to the ability to produce using internal and external resources.	Chung Yong-Woo, Jung Hun-Joo and Kim Byung-Gwi, 2012; Kang Hee-Jea, 2015; Porter and Van der Linde, 1995;
Export support system	The government's support policy for export promotion, support, and alleviation or removal of obstacles that describes the degree of use of support for testing and certification, technical standards, etc., the degree of use of technical regulatory consulting, and the degree of use of export insurance or finance.	Chung, Ja-Son, 2007; Gencturk and Kotabe, 2001; Link and Scott, 2013
Export performance	Export performance refers to export sales rate, export growth rate, export market share, export profit rate, corporate image, satisfaction level, number of complaints, etc.	Jeon, Byung-Young, 2015; Leonidou and Leonidas, 2002; Walker and Mullins, 2014

5. Empirical Analysis

5.1. Empirical Analysis

5.1.1. The Analytic Method and the Characteristics of the Sample

For analysis, this study selected 540 companies by referring to the Korea International

Trade Association (KITA), Korea SMEs and Startups Agency (KOSMES), and the Small and Medium Enterprise Information System (SMINFO). The survey was conducted from February to July 2021, and the questionnaire was distributed online, considering the situation caused by the COVID-19 pandemic. A total of 850 copies were distributed, and 155 copies were selected as samples for research analysis, excluding 37 copies with missing values.

Statistical analysis was performed to verify the sample. Descriptive statistics, validity, and reliability analysis were performed with SPSS Statistics 25.0, and the hypotheses of the structural model were verified with AMOS 26.0.

Table 2. Basic Statistics on the Sample

Category	Item	Frequency	Percentage
Type of Business	Manufacturing	60	38.7%
	Services	29	18.7%
	International trade	50	32.3%
	Other	16	10.3%
Education	High school	17	11%
	College	123	79.3%
	Master's	20	12.9%
	Ph.D.	5	3.2%
Export Item	Industrial goods	34	21.9%
	Petrochemical	13	8.4%
	Textile and clothing	30	19.4%
	Food	23	14.8%
	Bio	5	3.2%
	Finished cars and auto parts	13	8.4%
	Electrical and electronics	24	15.5%
	Steel and metals	10	6.5%
	IT	2	1.3%
	Finance	1	0.6%
Exporter History	Shorter than 5 years	33	21.3%
	Shorter than 10 years	20	12.9%
	Shorter than 20 years	68	43.9%
	20 years or more	34	21.9%
Major Export Destination	US	29	18.7%
	Brazil	5	3.2%
	India	4	2.6%
	Japan	11	7.1%
	China	41	26.5%
	Canada	7	4.5%
	EU	15	9.7%
	Other	43	27.7%
Export as a Portion of Sales	Less than 20%-30%	43	27.7%
	Less than 30%-40%	24	15.5%
	Less than 40%-50%	41	26.5%
	Less than 50%-60%	28	18.1%
	60% or more	19	12.3%

5.1.2. Feasibility and Reliability Analysis

Exploratory factor analysis and reliability analysis were performed to test the validity and

reliability of the variables. The purpose of exploratory factor analysis is to explore the relationship between variables when they are not established or theoretically systematized. The study used Varimax for factor extraction and interpretation. If the loading of the extracted factors is 0.4 or more and their dispersion is 0.5 or more, they are considered significant. 0.05 or less in Bartlett's test suggests correlation, and 0.5 or greater in Kaiser-Meyer-Olkin (KMO) is considered appropriate.

The probability of Bartlett's significance in this study is 0.000, indicating that the use of factor analysis is significant and that common factors exist. The KMO is 0.907, which sufficiently explains the correlation between the variables and the correlation between the variables. The loading values of the factors are all 0.5 or more, and Cronbach's α is 0.8 or more for all of them, which qualified them for reasonable acceptance.

Table 3. Exploratory Factor Analysis and Reliability Analysis

Concept	Components						Cronbach Alpha
	Factor	Variable Name	Factor Loading	Commonality	Eigen Value	Variance Explanatory Power	
TBT Countermeasures	Technology Competencies	TC2	.720	.732	6.61	18.90	.903
		TC1	.642	.733			
		TC3	.626	.759			
	Human Resource Competencies	HC1	.789	.726	7.27	20.78	.817
		HC2	.730	.759			
		HC3	.720	.817			
	Innovation Strategic Competencies	SC4	.826	.789	7.80	22.30	.901
		SC2	.817	.801			
		SC3	.816	.772			
		SC6	.788	.865			
		SC5	.773	.709			
		SC1	.695	.699			
Technology Innovation		TI5	.796	.791	4.14	13.26	.962
		TI6	.741	.823			
		TI2	.732	.795			
		TI4	.723	.842			
		TI7	.722	.790			
		TI1	.698	.806			
		TI3	.697	.778			
		TI8	.653	.810			
		TI9	.571	.777			
Export Support System		ESS4	.758	.760	3.57	10.19	.893
		ESS5	.691	.819			
		ESS1	.651	.726			
		ESS2	.631	.795			
		ESS3	.627	.796			
Export Performance		EP6	.796	.827	4.60	15.19	.951
		EP8	.791	.801			
		EP4	.774	.760			
		EP7	.743	.849			
		EP3	.741	.802			
		EP2	.719	.818			
		EP5	.647	.748			
		EP1	.620	.726			

5.1.3. Confirmatory Factor Analysis

Table 4 shows the results of the confirmatory factor analysis. The significance probability p=0.000 as the result of the analysis suggests that there is no difficulty in adopting the research hypothesis. If CMIN/DF is less than 2, it is suitable for the model. If RMR is less than 0.05, if GIF, AGFI, CFI, IFI is 0.9 or more, or if RMSEA is less than 0.05, it is acceptable. As a result of the confirmatory factor analysis in this study, all requirements were not satisfied. However, since there are various criteria for judging the fitness of the structural equation model and there are some differences among researchers, this study is deemed to have reached a certain minimum required level.

Table 4. Confirmatory Factor Analysis

Category		Number of Questions	CMIN	p	CMIM/DF	RMR	GFI	AGFI	CFI	IFI	RMSEA
TBT Counter-measures	Technology Competencies	3	116.652	.000	2.287	.035	.893	.936	.955	.955	.091
	Human Resource Competencies	3									
	Innovation Strategic Competencies	6									
Technology Innovation		9	39.407	.000	1.460	.027	.951	.918	.991	.991	.055
Export Support System		5	30.318	.000	6.040	.050	.927	.781	.944	.944	.181
Export Performance		8	59.63	.000	2.983	.032	.907	.833	.964	.965	.113

5.1.4. Correlation Analysis

Table 5 analyzes the correlation between the variables, and p value, which indicates significance probability, was found to be statistically significant as it was below 0.01 in all cases. Although different researchers define it differently, a correlation is considered as formed with the coefficient between 0.3 and 0.7. Generally, if it is 0.7 or more, the correlation is deemed high. This study has decided that there is no problem in the verification of the designed research model as it finds the correlation between the variables.

Table 5. Correlation Analysis

Factor	Technology Competencies	Human Resource Competencies	Innovation Strategic Competencies	Technology Innovation	Export Support System	Export Performance
Technology Competencies	1.000					
Human Resource Competencies	.755**	1.000**				
Innovation Strategic Competencies	.795**	.868**	1.000			

Table 5. (Continued)

Factor	Technology Competencies	Human Resource Competencies	Innovation Strategic Competencies	Technology Innovation	Export Support System	Export Performance
Technology Innovation	.720**	.607**	.581**	1.000		
Export Support System	.584**	.425**	.443**	.723**	1.000	
Export Performance	.676**	.500**	.486**	.791**	.793**	1.000

Note: * $p<.05$, ** $p<.01$

5.1.5. Verification of the Suitability of the Research Model

Table 6 shows the verification of the suitability of the research model. To confirm the causal coefficient, the study used C.R. value. If the C.R. is more than ±1.96, the causal coefficient is deemed meaningful. And to evaluate the verification of the suitability, the study used CMIN/DF, RMR, GFI, AGFI, CFI, IFI, and RMSR, some of which failed to satisfy the criteria. However, as long as the values do not cause errors or fall short of commonly used reference values, they can be used. Therefore, the model used in this study is deemed suitable.

Table 6. Verification of the Suitability of the Research Model

Concept	Components						Reliability
	Factor	Variable	Factor Loading	Standardized Factor Loading	S.E.	C.R.	
TBT Counter-measures	Technology Competencies	TC3	1.000	.859	-	.000	.903
		TC2	.949	.855	.063	14.949	
		TC1	1.016	.858	.068	15.038	
	Human Resource Competencies	HC3	1.000	.805	-	.000	.817
		HC2	.888	.718	.089	9.940	
		HC1	1.126	.816	.095	11.823	
	Innovation Strategic Competencies	ISC6	1.000	.584	-	.000	.901
		ISC5	1.143	.734	.158	7.241	
		ISC4	1.553	.846	.196	7.922	
		ISC3	1.323	.843	.167	7.907	
		ISC2	1.677	.890	.204	8.158	
		ISC1	1.258	.766	.169	7.448	
Technology Innovation		TI1	1.000	.843	-	.000	.959
		TI2	.961	.856	.069	13.846	
		TI3	.915	.873	.064	14.322	
		TI4	1.031	.894	.069	14.955	
		TI5	.802	.784	.067	11.965	
		TI6	.908	.870	.064	14.235	
		TI7	.872	.828	.067	13.068	
		TI8	.921	.889	.062	14.798	
		TI9	.889	.826	.068	13.011	

Table 6. (Continued)

Concept	Components						Reliability
	Factor	Variable	Factor Loading	Standardized Factor Loading	S.E.	C.R.	
Export Support System		ESS5	1.000	.787	-	.000	.893
		ESS4	.907	.702	.099	9.202	
		ESS3	1.083	.802	.100	10.863	
		ESS2	.933	.797	.087	10.771	
		ESS1	1.164	.872	.096	12.086	
Export Performance		EP1	1.000	.809	-	.000	.951
		EP2	1.067	.875	.081	13.240	
		EP3	.942	.816	.079	11.938	
		EP4	.962	.825	.079	12.141	
		EP5	1.089	.804	.093	11.698	
		EP6	.974	.871	.074	13.152	
		EP7	1.141	.901	.082	13.874	
		EP8	1.054	.841	.084	12.478	
Verification of the Suitability of the Measurement Model				P=0.000 CMIN/DF=2.934, GFI=.853, AGFI=.897, CFI=.924, RMR=.066 RMSEA=.108, IFI=.925			

5.2. Hypothesis Verification and Analysis Results

Table 7 shows the results of the research hypothesis verification. This study comprehensively analyzed the effects that SMEs' TBT response exerted on export performance. For Hypothesis 1, technology competencies and export performance were found influential as in the previous studies. Human resource competencies in Hypothesis 1-2 had an effect on export performance, but unlike in the previous studies, the effect was not significant. Although many SMEs have R&D teams or specialized departments, their human resources competencies register a low impact on export performance because they have difficulty in securing technology development manpower and the turnover of manpower possessing technology occurs frequently. Innovation strategic competencies and export performance in Hypothesis 1-3 were rejected due to the insufficient TBT response funding, the insufficient related information, and the high development cost.

For Hypothesis 2, all its hypotheses were accepted. In Hypothesis 2-3, however, the effect of innovation strategic competencies had on technology innovation was found small, unlike in the previous studies. The study found that the SMEs had difficulty in getting suitable technical cooperation partners, communicating with partners, and commercializing technology development for innovation strategic competencies.

It was found that technology innovation and export performance of Hypothesis 4 and export support policy and export performance of Hypothesis 5 all had impacts. According to the 2020 SME Descriptive Statistical Survey Report, the performance of SMEs through technology development in 2019 was categorized into 'product quality and performance improvement' (81.7%), 'market share increase' (71.7%), and 'production capacity increase' (45.2%), and the degree of performance showed in the order of 70.8 points for 'satisfying domestic and foreign certifications (quality, standards)' and 70 points for 'product diversifi-

cation'. In addition, the sales through technology development was 19.2%, and the export through technology development was 24.3%. Export support system and export performance in Hypothesis 5 was found to have a causal relationship. Last year, the South Korean government resolved 53 cases of TBT by negotiating with the parties on the 131 trade technical barriers that exporting companies complained about. In addition, the South Korean government is delivering export performance through various supports related to regulations, such as technology, manpower, finance, and insurance.

Table 7. Testing the Research Hypotheses

Hypothesis	Path	Path Coefficient	C.R.	*p* value	Result
1-1	Technology Competencies → Export Performance	.238	3.468	**	Accepted
1-2	Human Resource Competencies → Export Performance	-.241	-3.955	**	Accepted
1-3	Innovation Strategic Competencies → Export Performance	.050	.789	.430	Rejected
2-1	Technology Competencies → Technology Innovation	.871	10.309	**	Accepted
2-2	Human Resource Competencies → Technology Innovation	.366	3.799	**	Accepted
2-3	Innovation Strategic Competencies → Technology Innovation	-.278	-2.485	.013*	Accepted
3-1	Technology Competencies → Export Support System	.576	7.743	**	Accepted
3-2	Human Resource Competencies → Export Support System	.077	.887	.375	Rejected
3-3	Innovation Strategic Competencies → Export Support System	-.124	-1.203	.299	Rejected
4	Technology Innovation → Export Performance	.243	3.159	.002*	Accepted
5	Export Support System → Export Performance	.493	5.727	**	Accepted

Note: * $p<.05$, ** $p<.01$

6. Conclusion

6.1. Research Implications

This study has investigated the causal relationship between variables with a view to elucidating the effects that TBT countermeasures, currently an issue for SMEs, had on export performance. It is significant in that it analyzed the effects that exporting SMEs' ability to respond to regulations delivers at a time when uncertainty is increasing in the global business environment due to technological regulations and whether it is relevant under such circumstances. The study has the following implications for the industry.

First, this study confirmed the relationships with TBT countermeasures by adopting them

from previous studies. The study hypothesized that SMEs would deliver export performance based on human resources and innovation strategies with a view to overcoming the limitations of scarce resources. However, SMEs suffer from a shortage of manpower with a master's or doctoral degree related to technology development, and there are many obstacles to commercializing the innovation strategy.

Second, although many SMEs have their own research centers (39.2%) or technology development departments (24.5%), they suffer from a shortage of research professionals with a master's or doctoral degree. Moreover, even though they have a department in charge of technology development, companies are experiencing difficulty in delivering performance through bold investment due to lack of funds to respond to TBT, lack of sales market, and insufficient legal and institutional mechanisms.

Third, the study found that a company's innovation strategy for responding to TBT was not related to its export performance. Difficulties related to exports due to TBT are difficult to resolve unilaterally. In order to effectively respond to regulations, companies need to respond through cooperation with the government. Large corporations such as LG and Hyundai Motor Company recognize the importance of collaboration with the TBT Committee and are requesting support to respond to the tightening regulations. This way, they prevent side effects such as export delays and development cost increase caused by unnecessary technical regulations and product certification.

6.2. Research Limitations and Future Challenges

The limitations of this study are as follows.

First, it enjoys low reliability because samples were collected at random for analysis of the research hypotheses and the research model. Samples should have been collected and analyzed by industry and business category, but this task faced practical limitations. Therefore, when it was necessary to specify the questionnaire and hypotheses through in-depth interviews, they could not be carried out due to the COVID-19 pandemic.

Second, as theoretical concepts derived from previous studies were approached to implement the hypotheses and the model, the study failed to recognize the differences with the industrial practices. Because the international trade ecosystem registers such diversity and complexity, it is difficult to generalize the factors for the hypotheses and the model. Therefore, if the above limitations are recognized in conducting future research, more substantial research results will be derived and contribute to businesses and policy development.

EU's environmental regulations for products and barriers to digital trade are new types of technical regulation and are difficult to define precisely because the boundaries are vague. It will be of great help to SMEs if many studies with approaches with a view to industrial applications are conducted at a time when these regulations are spreading.

References

Ahmed, Z. U., O. Mohamed, J. P. Johnson and L. Y. Meng (2002), "Export Promotion Programs of Malaysian Firms: An International Marketing Perspective", *Journal of Business Research*, 55(10), 831-843.

Ahn, Seung-Ku, Kwang-Hoon, Lee and Kwon-Sik, Kim (2018), "Assessing the Relationship between Technological Innovation Regulation and Performance of Small and Medium Enterprises in Korea - Focusing on the Effects of Individual Regulations in a Firms Business Life Cycle", *Journal of Social Science*, 57(2). 159-195.

Ahn, Seung-Ku, Kwon-Sik Kim and Kwang-Hoon, Lee (2018), "The Impact of Technological Regulation on the Technological Innovation and Performance of Small and Medium Enterprises (SMEs): Evidence from a Survey Data of Korean SMEs", *Journal of Regulation Studies*, 27(1), 63-91.

Baller. S. (2007), *Trade Effects of Regional Standards Liberalization: A Heterogeneous Firms Approach*, World Bank Policy Research Working Paper, Vol. 4124, World Bank Publication.

Bao, X. and L. D. Qiu (2012), "How do technical barriers to trade influence trade?", *Review of International Economics*, 20(4), 291-706.

Barney, J. B. (1993), "Looking Inside for Competitive Advantage", *Academy of Management Executive*, 9(4), 49-61.

Bassanini, A. and E. Ernst (2002), *Labour market institutions, product market regulation, and innovation*, OECD Economics Department Working Papers No. 316.

Besen, S. M. and L. J. Raskind (1991), "An introduction to the law and economics of intellectual property.", *The Journal of Economic Perspectives*, 5(1), 3-27.

Bhanagar, S. B. and M. A. Cohen (1999), *The Impact of Environmental Regulation on Innovation: A Panel Data Study*, Vanderbilt Center for Environmental Management Studies Working Paper, Vanderbilt University.

Choi, Suk-Bong and Gui-Ryong Ha (2011), "A Study of Critical Factors for Technological Innovation of Korean Manufacturing Firms", *Journal of Industrial Economics and Business*, 24(1), 1-24.

Chung, Ja-Son (2007), *An Empirical Study on Performance of Export Assistance Programs for SMEs in Korea* (Unpublished Doctoral Dissertation), Seoul, Korea: Chung-Ang University

De Vries, F. P. and C. A. A. M. Withagen (2005), "Innovation and environmental stringency: The case of sulfur dioxide abatement", CentER for Economic Research Discussion Papers No. 2005-18, Tilburg University.

D'Este, P., N. Amara and J. Olmos-Peñuela (2016), "Fostering novelty while reducing failure: Balancing the twin challenges of product innovation", *Technological Forecasting and Social Change*, 113, 280-292.

Gatignon, H. and J. M. Xuereb (1997), "Strategic Orientation of the Firm and New Product Performance", *Journal of Marketing Research*, 34(1), 77-90.

Gencturk, E. F. and M. Kotabe (2001), "The Effect of Export Assistance Program Usage on Export Performance: A Contingency Explanation", *Journal of International Marketing*, 9(2), 51-72.

Guellec, D. and B. Van Pottelsberghe De La Potterie (2003), "The impact of public R&D expenditure on business R&D", *Economics of Innovation and New Technology*, 12(3), 225-243.

Han, Seung-Jun (2009), "A Study on the Technical Regulation in Korea to respond the mouvement of Technical Barriers to Trade", *Social Science Research Review*, 25(3). 43-66.

Harrigan, J. (1993), "OECD imports and trade barriers in 1983", *Journal of International Economics*, 35(1-2), 91-111.

Hitt, M. A., L. Bierman, K. Shimizu and R. Kochhar (2001), "Direct and Moderating Effects of Human Capital on Strategy and Performance in Professional Service Firms: a Resource Based Perspective", *Academy of Management Journal*, 44, 13-28.

Hong, Sung-Kyu (2019), The Practical Countermeasures on Technical Barriers to Trade(TBT) in the WTO System", *International Commerce and Information Review*, 21(1), 139-165.

Hue, Young-Ho (2011), Determinants of dynamic capabilities, and their relationships with competitive advantages and performances in overseas markets: Focusing on the Korean manufacturing SMEs engaging in exports (Unpublished Doctoral Dissertation), Seoul, Korea: Sogang University.

Hsu, L. C. and C. H. Wang (2012), "Clarifying the Effect of Intellectual Capital on Performance: The Mediating Role of Dynamic Capability", *British Journal of Management*, 23, 179-205.

Jang, Yong-Joon (2013), "Mutual Recognition Agreements and the Proximity-Concentration Trade-

off between", *Journal of World Trade*, 47(4), 783-812.

Jang, Young-Joon and Jeong-Meen Suh (2014), "The Impact of Technical Barriers to Trade (TBT) on Bilateral Trade: A Case of Korea", *Journal of International Trade and Industry Studies*, 19(1), 1-33.

Jeon, Byung-Young (2015), *A Study on Effects of International Trade Finance Supports on Exporting corporations* (Unpublished Doctoral Dissertation), Chuncheon, Korea: Kangwon National University.

Jeong, Seung-il, Byung-Woo Kim, Woo-Sung Lee, Soo-Jung Sohn, Pyoung-Yol Jang and Eui-Sun Yoo (2007), *Effects of Regulations on the Firm's Technological Innovation*, Science and Technology Policy Institute Working paper

Johnson, R. C. and N. Guillermon (2012), "Accounting for Intermediates: Production Sharing and Trade in Value Added", *Journal of International Economics*, 86(2), 224-236.

Kang, Hee-Jea (2015), "The effects of environmental regulation on the technological innovation and industrial competitiveness of Korea", Korea Environmental Economics Association Discussion paper, Vol. 2015 Summer, 1-22.

Keith E. M. and S. W. John (2001), *A Review of Past Attempts and the New Policy Context. in Quantifying the Impact of Technical Barriers to Trade: Can it be done?*, Michigan, USA: University Michigan Press.

Keizer, J. A., L. Dijkstra and J. J. M. Halman (2002), "Explaining Innovative Efforts of SMEs: An Exploratory Survey among SMEs in the Mechanical and Electrical Engineering Sector in the Netherlands", *Technovatio*, 22(1), 1-13.

Kim, Hee-Sung, Hoe-Chang Yang and Young-Jae Kim (2019), "Proposal of Research Methodology on Avoiding, Eliminating and Mitigating the Technology Barrier to Trade(TBT) of SMEs in Korea", *Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology*, 9(8), 903-913.

Kim, Hee-Sung (2020), *A Study on the Effect of Countermeasures of Technical Barriers to Trade on Management Performance* (Unpublished Doctoral Dissertation), Siheung, Korea: Korea Polytechnic University.

Kim, Young-Joe (2007), "Study on the Impacts of Strategic Leadership, R&D Investment, and Human Resource Management Practices on Innovation Performance", *Journal of Organization and Management*, 31(4), 49-83.

Korea Agency for Technology and Standards (2021), *2020 Technical Barriers to Trade Report*, Korea Agency for Technology and Standards.

Kotabe, M. and M. R. Czinkota (1992), "State Government Promotion of Manufacturing Exports: A Gap Analysis", *Journal of International Business Studies*, 23(4), 637-659.

Kwak, Soo-Hwan and Suk-Bong, Choi (2009). "Determinants of innovation in service industry: Resource based and industrial organization perspectives", *Journal of the Korea Service Management Society*, 10(2), 1-25.

Leonidou, L. C., C. S. Katsikeas, and S. Samiee (2002), "Marketing strategy determinants of export performance: a meta-analysis", *Journal of Business research*, 55(1), 51-67.

Li, Y., Y. Zhao and Y. Liu (2006), "The Relationship between HRM, Technology Innovation and Performance in China", *International Journal of Manpower*, 27(7), 679-697.

Link, A. N. and J. T. Scott (2013), "Public R&D subsidies, outside private support, and employment growth", *Economics of Innovation and New Technology*, 22(6), 537-550.

Maskus, K. E., T. Otsuki and J. S. Wilson (2005), *The Cost of Compliance with Product Standards for Firms An Econometric Study*, No, 3590, World Bank Publications.

Moenius, J. (2004), "Information versus Product Adaptation: The Role of Standards in Trade", Evanston, IL International Business & Markets Research Center, Northwestern University Working paper.

Pelkmans, J. and A. Renda (2014), "Does EU regulation hinder or stimulate innovation?", *CEPS Special Report* No. 96.

Porter, M. E. and C. Van der Linde (1995), "Toward a new conception of the environment-competitiveness relationship", *Journal of Economic Perspectives*, 9(4). 97-118.

Prieger, J. E. (2000), "Regulation, innovation, and the introduction of new telecommunications services", *Review of Economics and Statistics*, 84(4), 704-715.

Seo, Young-Woong, Seok-Joon Choi and Si-Wook Lee (2012), "How Does the Regulation of Location Affect Firm's Management and Innovation Performance?", *Journal of Korea Technology Innovation Scociety*, 15(3), 586-603.

Seon, A-Leum and Rang-Ra, Hee (2015), "The Impact of TBT on Trade: Focused on Korea`s Electrical and Electronic Product Export to the U.S.", *Journal of International Area Studies*, 19(1), 205-239.

Sohn, Dong-Seop (2017), *A study on the effect of government support and regulatory barriers on the technology innovation : focusing on Korean SMEs* (Unpublished Doctoral Dissertation), Seoul, Korea: Sungkyunkwan University.

Suh, Chang-Juck and Chang-Hyoung Lee (2007), "An Analysis on the Moderated Effects of National R&D program on Technological Innovation in the SMEs" *Journal of the Korean Production and Operations Management Society*, 18(3), 23-52.

Teece, D. J., G. Pisano and A. Shuen (1997), "Dynamic capabilities and strategic management", *Strategic Management Journal*, 18(7), 509-533.

Thilmany, D. D. and C. B. Barrett (1997), "Regulatory barriers in an integrating world food market", *Applied Economic Perspectives and Policy*, 19(1), 91-107.

Walker, O. C., and J. W. Mullins (2013), *Marketing strategy: a decision-focused approach*, 8th ed., New York: McGraw-Hill.

WTO (2012), "C. An inventory of non-tariff measures and services measures", World Trade Report.

Yousefi, A. and M. Liu (2013), "The Impact of Technical Barriers to Trade: The Cases of Trade Between China, Japan, Korea, and the US", Innovation in the High-Tech Economy, Springer, Berlin, Heidelberg, 23-34.

Zollo, M. and S. Winter (2002), "Deliberate Learning and the Evolution of Dynamic Capabilities", *Organization Science*, 13, 339-351.