International Journal of u- and e- Service, Science and Technology
Vol.8, No. 9 (2015), pp.217-230
http://dx.doi.org/10.14257/ijunesst.2015.8.9.23

Technology Information Sharing and Technology Innovation Performance: An Empirical Study of the Mediating Role of Technology Development Capability

In Tae, Lee[1] and Youn Sung, Kim[2]

[1]*Department of Business of Administration, Sogang University (First Author)*
intaelee@sogang.ac.kr
[2]*Department of Business Administration, Inha University (Corresponding Author)*
keziah@inha.ac.kr

Abstract

To verify the effects of technology information sharing between Korean parent firms and their foreign subsidiaries on the latter's technology development capability, technology introduction capability, and technology innovation performance, the study proposes a research model and provides a survey of 195 foreign subsidiaries in the manufacturing sector. Data was analyzed using a structural equation model. The effects of technology development capability were empirically verified through mediating effects of technology introduction capability and technology innovation performance with Sobel test. According to the results, technology information sharing between Korean parent firms and their foreign subsidiaries had a significant effect on the latter's technology development capability, technology introduction capability, and technology innovation performance. The results have practically important implications for firms interested in strengthening the competitiveness of manufacturing subsidiaries and suggest fundamental data for prioritizing strategic decision making on increasing their technology capability by verifying the mediating effect of technology development capability.

Keywords: *Technology Information Sharing, Technology Development Capability, Technology Introduction Capability, Technology Innovation Performance*

1. Introduction

Enterprises now must remain competitive by effectively and flexibly responding to their rapidly changing environments and needs of customers. To survive this fierce competition, manufacturing firms pursue R&D activities in diverse areas to develop new technologies and products, improve existing product lines, and enhance the efficiency of production processes, among others. They strive to gain a differentiated competitive advantage through such means, and this applies not only to firms that are active domestically but also to those entering unlimited competition with many firms across the world in overseas markets. Because of various motives such as limited growth opportunities in the domestic market, the deepening of global competition in the domestic market, decreases in international launching costs as a result of IT development, and additional profits through the extension of growth seasons, many firms, particularly domestic ones, have increasingly pursued overseas opportunities, but their overseas success has been limited. Domestic manufacturing firms pursuing overseas markets face a high level of uncertainty in securing sufficient competitiveness and may experience substantial difficulty in competing with local firms because of limited management resources. In business management, technology is an important factor influencing not only short-term performance but also long-term survival. Therefore, securing competitiveness through technological innovation is necessary to strengthen a firm's

ISSN: 2005-4246 IJUNESST

competitiveness. For successful technological innovation, a firm's own R&D efforts are necessary, and there is a need to make effective use of external technologies and information. In the case of firms in overseas markets, the supply of management resources for strengthening their technology development capability is limited because of relatively low level technological retention and a lack of professional human resources [1]. Because there is a limit to the self-development of new technologies, there is a need to acquire technological resources through technology-related activities [2]. Technology-related networks with external agencies can promote learning through interactions, which can help accumulate knowledge and information within a short period of time and improve a firm's innovation performance through the sharing of resources [3]. In this situation, manufacturing subsidiaries participating in technology transfer and IT sharing with their headquarters can strengthen their competitiveness [4].

This study identifies the important factors that can strengthen the competitiveness of manufacturing subsidiaries in overseas markets. In this regard, the study examines the effects of active technology information sharing between parent firms with headquarters in Korea and their manufacturing subsidiaries on the latter's technology innovation performance. The results have important practical implications for firms interested in strengthening their manufacturing subsidiaries' competitiveness in overseas markets and thus can be used as fundamental data for determining the priority of technology capability and related strategic decision making to improve the performance of manufacturing subsidiaries.

2. Theoretical Background

2.1 Technology Information Sharing

Information sharing refers to the official or unofficial sharing of meaningful, timely, and appropriate information between firms and can be defined as parties favorably providing helpful information to their partners [5]. This expectation of collecting a diverse range of information enables the partner to better respond to internal processes and external market conditions [6]. Accordingly, the sharing of accurate, timely, and appropriate information enables reasonable decision making and the improved effectiveness of the process [7]. It can also reduce the level of uncertainty a firm faces in its decision-making process [8]. If a firm has incomplete information or lacks it, it is likely to have difficulty making decisions under a high level of uncertainty. In particular, in the case of manufacturing firms located overseas, they are placed in high-uncertainty situations, which make reasonable management difficult. Technology information sharing with parent firms is important in this context. Technological cooperation for information sharing on technologies can be defined as more than two firms engaging in activities to create, acquire, exchange, and use technology [9]. It can also be defined as those firms building partnerships by participating in joint R&D or technology transfer activities with the objective of strengthening their market positions [10].

There are various types of strategic technological cooperation, including joint ventures, joint research corporation, joint R&D cooperation, technology exchange agreements, direct investment, subcontracting systems, and unilateral technical support, among others. However, in the case of manufacturing subsidiaries in overseas locations with relatively poor resources, the sharing of technology-related information with parent headquarters can be defined as technology information sharing, and given this definition, technology development capability and technology introduction capability can be expressed. In particular, from the research-based theory perspective, the sharing of technology-related information that can have considerable influence on the competitiveness of the firm is likely to be an important factor strengthening the competitiveness and capability of its manufacturing subsidiaries from their perspective. Therefore, this study identifies

technology information sharing, a type of technological cooperation, as a factor influencing the technology capability of subsidiaries.

2.2 Technology Capability

Technology innovation in business management is considered a key factor in having crucial influence not only on the short-term performance of a firm but also on its long-term survival [11]. The technology capability of a firm can be defined as an activity that can strategically administrate all cyclical innovation processes such as the development of new technologies to strengthen the firm's competitiveness. A firm's technology capability is a key capability in securing its competitiveness [12], and this capability can be formed through the firm's self-development or external introduction [13]. Technology development through a firm's own R&D institute is a representative example of self-development, and representative methods of acquiring external technologies include R&D alliances, mergers and acquisitions, foreign direct investment, and the employment of technical professionals, among others [14]. Therefore, this study identifies technology capability, a resource in a firm can use to strengthen its competitiveness in view of the resource-based view, as technology development capability and technology introduction capability.

The technology development capability of a firm generally refers to its ability to build its critical capability by developing products distinct from those of competitors [15]. Also a firm's technology development capability as its internal R&D investment to build its knowledge assets [16]. Here patents, technology development employees, and the complexity and implicitness of production techniques, among others, can be used. Based on the resource-based view from the theoretical side of business management, a firm is a collective of correlated tangible and intangible assets that produce the ability of the firm, and it can be defined to possess relatively superior skills if that firm can acquire superior resources in comparison to its competitors [17]. In this context, the technology development capability of a firm is observed as an important factor that can not only strengthen the firm's short- and long-term performance but also sustain its competitive advantage. In this regard, a firm's technology development capability can be defined not only as its product development but also as its overall technological ability concerning its production capability [18] and its comprehensive knowledge and skills for the choice, acquisition, modification, and use of technologies [19]. In addition, a firm's technology-related capability can be formed through the level of its technology, the life cycle of its technology, the number of its new products, its R&D investment share and patents, and the scale and weight of its R&D workforce, among others [20].

Firms can acquire external technologies through various sources, including R&D alliances, mergers and acquisitions, foreign direct investment, and technology-oriented employees, among others [14]. The absorptive capability of knowledge, the type of resource, the ability of partners, harmony between firms, partnership quality, administrative capability, networking capability, trust, and commitment, among others, can be considered as factors that can successfully facilitate the exchange of knowledge between firms [21]. All these factors except for absorptive capability are important external factors influencing trade between firms, and this absorptive capability can be understood as a firm's internal technology-related activities. Therefore, this study examines the technology introduction capability of a firm from the perspective of absorptive capability. Absorptive capability as the ability to recognize the value of new information, learn it, and then apply it for business purposes [22]. Also it is defined as the strategic processes and routines for the acquisition, assimilation, conversion, and use of necessary information for firms and defined it as the dynamic capability to secure strategic change and flexibility in such processes [23].

Given these findings, this study identifies manufacturing subsidiaries' technology capability as their ability to develop technologies on their own and acquire external

technologies, particularly the absorptive capability of learning technology-related information from their parent firms as their technology introduction capability.

2.3 Technology Capability and Technology Innovation Performance

The technology capability of a firm is closely related to its technology innovation performance [16, 24]. Because of the uncertainty in technology innovation itself, there are cases in which the results are ambiguous, but technology capability not only works as a development source of superior products and production priorities in fiercely competitive environments in comparison to competitors but also serves as a key factor that can improve firm performance through the continuous development of new products. Based on studies of effects of a firm's technology capability on its technology innovation performance, Chinese firms' technology innovation performance may change through the process of acquiring external technologies [25]. Also the R&D capability of a firm affects its technical learning, which in turn has a positive effect on its innovation performance [26]. With circumstantial factors appropriately controlled for, the technology capability of a firm is likely to have a positive (+) relationship with its technology innovation performance. In particular, technology-related networking with external agencies promotes learning through interactions and enables the accumulation of knowledge and information within a short period of time, and it can also improve the innovation performance of firm through resource sharing [3].

Based on these findings, this study examines the effects of the technology capability of overseas manufacturing subsidiaries in terms of their technology development capability and technology introduction capability on their technology innovation performance

3. Research Methods

3.1 Research Model and Hypotheses

Based on the literature review, this study examines the effects of technology information sharing between Korean parent firms and their overseas manufacturing subsidiaries on the latter's technology development capability, technology introduction capability, and technology performance. <Figure 1> shows the research model.

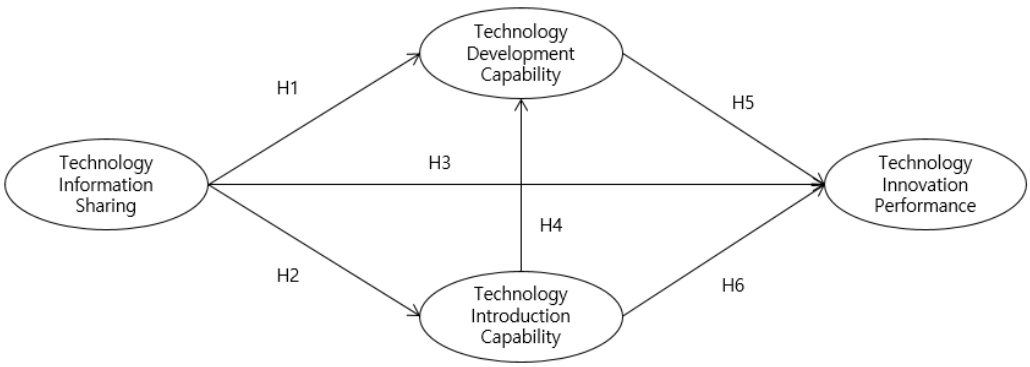

Figure 1. The Conceptual Framework

Overseas manufacturing subsidiaries of Korean parent firms enter overseas markets through internationalization. A strategic network is a good method for overcoming limits such as disadvantages of being foreign firms or start-ups and limited resources [27, 28, 29]. From the perspective of the resource-based view, to overcome resource limitations, a firm can pursue R&D cooperation and reinforce its resources by acquiring and using complementary resources or capabilities of its partners [30]. To secure a new capability

through cooperation, a firm's learning capability plays an important role in absorbing its competitors' technologies or capabilities and creating new value for the firm [31].

Hypothesis 1: Technology information sharing between Korean parent firms and their manufacturing subsidiaries has a significant positive (+) effect on the technology development capability.

Hypothesis 2: Technology information sharing between Korean parent firms and their manufacturing subsidiaries has a significant positive (+) effect on the technology introduction capability.

From the perspective that technology innovation is a knowledge-intensive activity, technology sharing is an important factor influencing the success of technology innovation. Technology sharing affects technology innovation performance because a firm can collect and process a diverse range of information on new technological trends, technology development activity outcomes, and the obsolescence of certain technologies, among others [3]. Technology information sharing can affect performance by increasing the accessibility of information and reducing the level of uncertainty during the R&D process [32]. Given the findings of previous studies, the following hypothesis is proposed:

Hypothesis 3: Technology information sharing between Korean parent firms and their manufacturing subsidiaries have a significant positive (+) effect on the technology innovation performance.

The interaction effect of technology development efforts and the introduction of external technologies [33]. In this regard, the following hypothesis is proposed:

Hypothesis 4: Manufacturing subsidiaries' technology introduction capability has a significant
positive (+) effect on their technology development capability.

A firm's technology capability has considerable influence on its technology performance [16, 24, 33]. Also a firm's technology development capability has a positive effect on its technology-learning activity and innovation performance [26]. In addition technology acquisition through the acquisition of external technologies and cooperation for external technologies can have positive effects on firm performance [33]. In this regard, the following hypotheses are proposed:

Hypothesis 5: Manufacturing subsidiaries' technology development capability has a significant positive (+) effect on their technology innovation performance.

Hypothesis 6: Manufacturing subsidiaries' technology introduction capability has a significant
positive (+) effect on their technology innovation performance.

3.2 Measures

This study defines technology information sharing as the sharing of technologies related to products and production processes between parent firms and their manufacturing subsidiaries. For this, the study revises the measurement categories [34, 35], and measures three categories based on a seven-point Likert-type scale.

The study defines technology development capability as a subsidiary's capability to develop its own technologies related to product development and production processes. For this, the study revises the measurement categories [22, 36], and measures four categories based on a seven-point Likert-type scale.

This study defines technology introduction capability as a firm's capabilities to collect, internalize, and apply external technologies. For this, the study modifies the measurement categories [37], and measures four categories based on a seven-point Likert-type scale.

The study defines technology innovation performance as the extent to which a firm improves by introducing new technologies. For this, the study modifies the measurement categories [38], and measures three categories based on a seven-point Likert-type scale. Table 1 shows the specific construction of the questionnaire.

Table 1. Construct Items and Sources

Variable	Item	Sources
Technology information sharing	The extent to which product development technologies are shared. The extent to which production technologies are shared. The extent to which new technologies and skills are shared.	[34], [35]
Technology development capability	The level of the subsidiary's technology related to product development. The level of the subsidiary's technology related to production processes. The level of the subsidiary's R&D investment.	[22, 36]
Technology introduction capability	The capability to collect information on external technologies. The capability to understand and internalize external technologies. The capability to use external technologies for product development. The capability to apply external technologies to production sites.	[37]
Technology innovation performance	The extent to which technology introduction contributes to productivity improvements. The extent to which technology introduction contributes to quality improvements. The extent to which technology introduction contributes to product development and reform.	[38]

4. Analysis

4.1 Data Description and Collection

This study examines the effects of technology information sharing between parent firms and their subsidiaries on the latter's technology capability and technology innovation performance by considering manufacturing subsidiaries of Korean parent firms. The sample included 1,024 Korean firms that had overseas operations and were listed in the <2011/2012 Directory of Korean Business Launched Overseas> by KOTRA (Korea Trade-Investment Promotion Agency). The sample extracted those subsidiaries that were not part of joint ventures or join investment with a foreign firm meeting the research purposes. The analysis target was the foreign subsidiary involved in overseas manufacturing activities. Therefore, in the survey process, subsidiaries were asked to complete the questionnaire with the following two cases in mind: the development of

flagship products of overseas subsidiaries and the sharing of information on representative technologies and production processes from parent firms. The analysis focused only on those individuals who were above the administrator level in management, development, and production departments with sufficient work experience and previous knowledge related to the sharing of technology information with parent firms. A proactive analysis was conducted with respondents, and various literature reviews were conducted to ensure the validity of data. Finally, the questionnaire was finalized based on interviews with practitioners from manufacturing firms, and the adequacy of categories was measured through a 30-part pilot test.

A survey was conducted online with a total of 1,024 manufacturing subsidiaries. As a result, data were collected from 210 subsidiaries in 17 countries. Among these, 15 were excluded for missing data, leaving a total of 195 respondents for the final analysis. Based on the characteristics of the respondents, a majority were from China (47.7%), followed by Vietnam (30.8%) and Indonesia (6.2%). In addition, textiles and clothing accounted for 23.6% of the sample; electronics, 23.6%; automobile parts, 13.8%; and equipment and machinery, 13.3%. In addition, the respondents' responsibilities included managers (46.7%), corporate executives (32.3%), production/quality employees (15.4%), and development employees (5.6%). Table 2 shows detailed information on the respondents.

Table 2. Demographic Characteristics

	Division	Frequency	%
Regional distribution	China	93	47.7
	Vietnam	60	30.8
	Indonesia	12	6.2
	America	6	3.1
	Mexico	4	2.1
	India	3	1.5
	Slovakia	3	1.5
	Others	14	7.4
	Aggregate	195	100
Industry	Textiles/clothing	46	23.6
	Electric/electronic	46	23.6
	Automobile components	27	13.8
	Machine/equipment	26	13.3
	Chemicals	20	10.3
	Others	30	15.4
	Aggregate	195	100
Department	Planning	63	32.3
	Management	91	46.7
	Manufacturing	30	15.4
	Development	11	5.6
	Aggregate	195	100
Status	Senior manager	66	33.8
	Director	32	16.4
	Executive	97	49.8
	Aggregate	195	100

4.2 Scale Purification and Construct Validation

Before the main hypotheses were verified, the question of whether the categories showed sufficient consistency and stability was addressed through a reliability analysis, and the sufficient discriminant and convergent validity of the categories was secured through a factor analysis.

Reliability means the internal consistency of measurement instruments. In this study various items were measured in the basis on operational definitions. Accordingly, reliability was verified through internal consistency based on Cronbach's α. According to the results, Cronbach' α for technology information sharing was 0.909; that for technology development capability was 0.895; that for technology introduction capability was 0.956; and that for technology innovation performance was 0.900. Therefore, all exceeded the minimum threshold of 0.7 [39], indicating sufficient internal consistency.

Validity refers to whether a given notion or attribute is appropriately measured. Validity is verified based on context validity, criteria validity, and construct validity. Here context validity indicates the extent to which the context of constructs measuring the notion as a research objective is reflected in the measurement. High criteria validity is ensured when the measurement result is highly correlated with the notion even afterward [40]. In this study, two types of validity were ensured based on previous studies to verify the relationship between context and measurement. In addition, to ensure convergent validity and discriminant validity as notion validity, SPSS 18.0 was employed, and a confirmatory factor analysis was conducted. Convergent validity is ensured when there is a high correlation between values measured through two different measurement methods developed to measure the same notion. Categories to be measured are identified as having a high level of representation for each notion if the composite reliability for discriminant validity exceeds 0.7 and the average variance extracted exceeds 0.5. In this study, composite reliability values for all notions exceeded 0.7, and AVE values all exceeded 0.5, indicating sufficient convergent validity Table 3.

Table 3. A Confirmatory Factor Analysis and a Construct Analysis

	Item	Unstandardized coefficient	Standard error	Standardized coefficient	CR*	AVE**
Technology information sharing	IS_1	1.000		0.877	0.913	0.779
	IS_2	1.016	0.055	0.955		
	IS_3	0.769	0.052	0.811		
Technology development capability	DC_1	1.000		0.907	0.905	0.761
	DC_2	0.935	0.048	0.936		
	DC_3	0.901	0.065	0.766		
Technology introduction capability	IC_1	1.000		0.920	0.951	0.829
	IC_2	1.039	0.05	0.945		
	IC_3	1.072	0.049	0.877		
	IC_4	0.987	0.042	0.900		
Technology innovation performance	IP_1	1.000		0.831	0.906	0.765
	IP_2	1.197	0.073	0.971		
	IP_3	1.055	0.076	0.814		

** CR: Composite reliability; **AVE: Average variance extracted.*

When measuring different notions, correlations must be low to ensure sufficient discriminant validity. There is sufficient discriminant validity if items share common variance more with their respective constructs than with others [41]. In this study, the

AVE values for each construct exceeded the squared correlation between that construct and each of the other constructs, indicating sufficient discriminant validity Table 4.

Table 4. Discriminant Validity

Construct	AVE	*r*	r^2	Support
TIS ↔ TDC	TIS=.779, TDC=.761	.413	.170	Yes
TIS ↔ TIC	TIS=.779, TIC=.829	.337	.113	Yes
TIS ↔ TIP	TIS=.779, TIP=.765	.443	.196	Yes
TDC ↔ TIC	TDC=.761, TIC=.829	.630	.396	Yes
TDC ↔ TIP	TDC=.761, TIP=.765	.387	.149	Yes
TIC ↔ TIP	TIC=.829, TIP=.765	.344	.118	Yes

4.3 Hypothesis Testing and Results

A confirmatory factor analysis (CFA) and a structural equation model (SEM) were employed to test and measure the conceptual framework based on survey data. A descriptive analysis was conducted using SPSS 18.0, and the CFA and SEM analyses were conducted using AMOS 18.0. Here a two-step approach was taken to analyze the data.

The hypothesized model was tested by an SEM. The final SEM with standardized regression weights (Figure 2) provided the following fit values: CMIN/ DF = 1.661(≦2), p = 0.001(⟨0.05), GFI = 0.933(≧0.9). AGFI = 0.893(≦0.9), NFI = 0.960(≧0.9), TLI = 0.977(≧0.9), CFI = 0.983(≧0.9), RMR=0.069(≦0.08), RMSEA = 0.05(≦0.05). The suitability of the model was evaluated as satisfactory because GFI, AGFI, NFI, TLI, and CFI values were generally greater than 0.9, thereby satisfying recommended thresholds, and the RMR and RMSEA values also satisfied standard thresholds. Some of the hypotheses were supported at $p < 0.01$, whereas others, at $p < 0.05$.

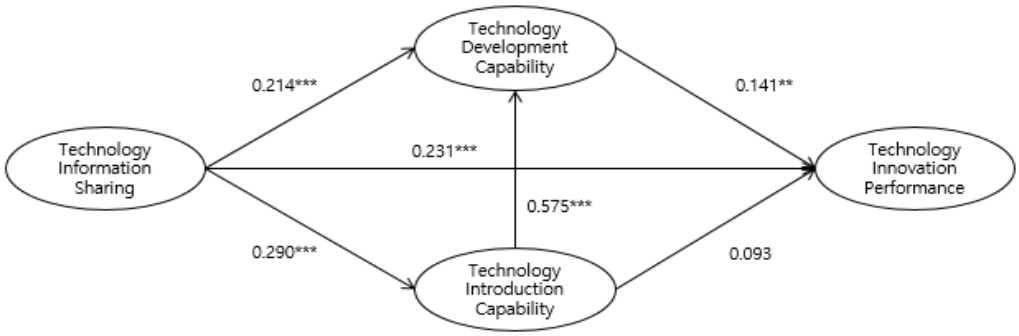

Figure 2. The Final Structural Model

**p < 0.05, ***p < 0.01.

As shown in Figure 2, Hypothesis 1, which addressed whether technology information sharing between Korean parent firms and their manufacturing subsidiaries would have a significant positive (+) effect on the latter's technology development capability, was supported. More specifically, the path coefficient was 0.214 ($p < 0.01$), indicating that technology information sharing with parent firms improved manufacturing subsidiaries' technology development capability. Hypothesis 2, which addressed whether technology information sharing between Korean parent firms and their manufacturing subsidiaries would have a significant positive (+) effect on the latter's technology introduction

capability, was accepted. More specifically, the path coefficient was 0.290 ($p < 0.01$), indicating that active technology information sharing with parent firms induced manufacturing subsidiaries to introduce and accept shared information and thus make more effort to engage in the self-development of technologies. Hypothesis 3, which addressed whether technology information sharing between Korean parent firms and their manufacturing subsidiaries would have a significant positive (+) effect on the latter's technology innovation performance, was accepted. More specifically, the path coefficient was 0.230 ($p < 0.01$), indicating that technology information sharing between parent firms and their manufacturing subsidiaries influenced the latter's technology innovation performance through their accumulated knowledge and further technology development based on that knowledge. Hypothesis 4, which addressed whether overseas manufacturing subsidiaries' technology information introduction would have a significant positive (+) effect on their technology development capability, was accepted. More specifically, the path coefficient was 0.575 ($p < 0.01$), indicating that these subsidiaries did not have sufficient business resources for technology development. This suggests that a firm's technology development capability can be strengthened through knowledge and information accumulated through its technology introduction capability, including the introduction and use of external technologies. Hypothesis 5, which addressed whether overseas manufacturing subsidiaries' technology development capability would have a significant positive (+) effect on their technology innovation performance was accepted. More specifically, the path coefficient was 0.141 ($p < 0.05$). Hypothesis 6, which addressed whether overseas manufacturing subsidiaries' technology introduction capability would have a significant positive (+) effect on their technology innovation performance was not accepted. That is, the path coefficient was not significant, and this result is inconsistent with the findings of previous studies suggesting positive effects of technology introduction capability on technology performance. This suggests that a firm's technology development capability based on technology introduction has a more favorable effect on technology performance. Therefore, technology introduction capability can be identified to have a positive effect on technology innovation performance through technology development capability.

For a better understanding, the mediating effect of technology development capability on the relationship between technology introduction capability and technology innovation performance and that of technology development capability on the relationship between technology information sharing and technology innovation performance were examined using the standard error formula for the z-value, and the Sobel test was conducted to evaluate the statistical significance of the mediating effect [43]. In general, if the z-value from the Sobel test is greater than 1.96 or less than -1.96, then the null hypothesis is rejected, and the mediating effect is evaluated as significant [44]. The Sobel test revealed the z-value to exceed 1.96, indicating a significant mediating effect Table 5.

Table 5. The Sobel Test of Mediating Effects

Path	Standardized coefficient	S.E	Sobel-Z score	Result
TIS → TDC	.232	.059	2.605	Accepted
TDC → TIP	.185	.071		
TIC → TDC	.556	.07	2.475	Accepted
TDC → TIP	.185	.071		

5. Discussion and Conclusions

Today's firms are exposed to various environmental uncertainties in increasingly competitive business environments. Firms may centralize their capability and make many strategic attempts to respond to such uncertainties in diversified demands of costumers and their rapidly changing needs, but many are not likely to realize effective outcomes. A firm's technology capability is particularly important for its overseas manufacturing subsidiaries in securing differentiated competitiveness in overseas markets because of their relatively limited management resources. In these situations, the results of this study have the following theoretical and practical implications.

First, the study proposes a framework for strengthening the competitiveness of overseas manufacturing subsidiaries. The study examines the structural causality between technology information sharing, technology development capability, and technology introduction capability as technology capability and technology innovation performance. In this regard, the results empirically suggest that technology information sharing with parent firms plays an important role in strengthening the competitiveness of overseas manufacturing subsidiaries with limited business resources through their technology introduction and technology development. This can be used as an important strategic tool for strengthening the competitiveness of manufacturing subsidiaries in overseas markets not only from the perspective of parent firms but also from that of these subsidiaries.

Second, the study verifies the mediating effect of technology development capability on the relationship between technology introduction capability and technology innovation performance. Many studies have identified technology introduction capability to have a positive effect on technology innovation performance. However, this study's results reveal that technology introduction capability has this effect through the subsidiary's own technology development capability instead of directly influencing technology innovation performance. This suggests that technology innovation performance can be improved not only by improving performance simply by introducing technology information but also by developing and applying new technologies based on the accumulation of external knowledge and information. In addition, a subsidiary's own technology development capability may be strengthened by sharing technology information and developing and strengthening manufacturing subsidiaries' technology introduction capability.

Third, the analysis was conducted using Korean manufacturing firms operating in various regions across the world, including China, Vietnam, Indonesia, the U.S., Mexico, and Slovakia. In addition, the sample included firms in a wide range of manufacturing-oriented industries. Therefore, this study's results may be generalizable to a variety of contexts.

The results offer some interesting avenues for future research. First, it was not possible to measure financial performance as an objective indicator in measuring a firm's technology innovation performance. In this regard, future research should make use of various subjective and objective indicators to measure this performance. A financial indicator is a representative objective indicator. However, it was difficult to determine the financial performance of firms from a wide range of overseas manufacturing subsidiaries. Accordingly, future research should improve its reliability by measuring financial indicators as objective ones. Second, the sample size was somewhat small. It was difficult to conduct a survey of overseas manufacturing subsidiaries. The recommended sample size is usually more than 200 in the case of using the maximum likelihood method to estimate SME coefficients to ensure sufficient reliability. However, the analysis employed a sample of 195 firms, which is less than the recommended number. In this regard, future research should increase the level of reliability by considering a sample of sufficient size.

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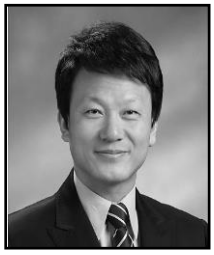
Authors

In Tae Lee (First author), received the PH. D degree from Sogang University of Business Administration in 2014, and is now a lecturer in business administration department of Sogang University. Research interests include supply chain management, flexible management system, modularity, technology and so on.



Youn Sung Kim, He studied management at Seoul National University (BA. MBA. Ph.D); Director of Small & Medium Business Research Center at Kookmin Bank Research Institute; Visiting Professor in Graduate School of Business Administration at USC, USA; Advisory Professor for Incheon Techno Park Strategic Technology Planning Group; Professor at Inha University since 2001 appointed as Dean of Research Division & Industry-University Partnership and Dean

of Strategic Planning & Budgeting. He published 20 books and 30 articles on service quality, customer satisfaction management, service performance evaluation and improvement strategy, service design innovation, value creation through production; Engaged in management consulting and dedicated education for professionals in management on service quality improvement measures in public enterprises and agencies. **Corresponding author, E-mail: keziah@inha.ac.kr*

