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# SMEs' Digital Transformation Competencies on Platform Empowerment: A Case Study in South Korea

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## Abstract

Small- and medium-sized enterprises (SMEs) are strengthening their digital transformation strategies with new values on creative technologies and reorganized business models and processes in the ever-changing digital economy. In line with the changes in business environments based on digital platforms' ecosystem, they put forth efforts into strengthening corporate platforms. Accordingly, the study aims to clarify the effects of SMEs' digital transformation competencies on platform empowerment with platform development strategy and envelopment strategy as mediating factors. Notably, among the four platform factors that enterprises require, namely, unique competency strengthening, shared value creation, cost-saving effect, and network effect, this study analyzes which factors are more significantly affected by digital transformation competencies and platform strategies. To this end, study hypotheses were tested based on the survey conducted among 361 SME executives and employees in South Korea. In conclusion, it turned out that SMEs' digital transformation competencies positively affected both platform development strategy and envelopment strategy. However, platform envelopment strategy affected all of the factors of platform empowerment, while development strategy did not affect them. Thus, it was verified that SMEs' digital transformation competencies could affect platform empowerment through envelopment strategy more than platform development strategy.

**Keywords:** Digital Transformation, Platform Empowerment, Development Strategy, Envelopment Strategy, SMEs

**JEL Classification Code:** M15, M21, O14, O33

## 1. Introduction

Since 2016 when the 4th Industrial Revolution drew keen attention globally as conceptualized in the Davos Forum, digital technology has been discussed actively. When the concept of "untact" became a new global issue in 2000 due to COVID-19, the adoption of innovative technologies such as big data, AI, machine learning, robotic process automation (RPA), and AR/VR has been accelerating. In such changes, Huarng and Rey-Marti (2019) asserted that if enterprises and organizations failed to find a way to adopt new digital technology, 40% of them would

disappear within 10 years. In line with such changes, several enterprises are restructuring themselves and changing their working and business operation to accept digital technology that is advancing rapidly. They are competing in finding opportunities to create new business models and values. As defined by Ustundag and Cevikcan (2018), the age of digital transformation has come where the industrial ecosystem itself is reorganized with digital technology (Vial, 2019).

As key competencies for such a new business management paradigm, enterprises are being suggested such concepts as flexible response-ability, a new idea, and a tolerant approach (Nambisan et al., 2019; Warner & Wager, 2019). In the context of critical competencies, enterprises are required to digitalize assets, improve experiences of interested parties, customers, and employees, and utilize the technologies required to lead changes as a brand new organization. In addition, platforms are expected to play new roles in facilitating technological innovation in the entire ecosystem, making it possible to integrate enterprises. After all, the spread of the paradigm of platform-centered business management and the digital transformation of innovative business management will create opportunities to secure

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productivity and added values among SMEs and transform their business models from traditional ones to future-oriented ones (Priyono et al., 2020; Ahmed & Ahmad, 2021).

Particularly in SMEs' case, it is necessary to create and digitalize high added values in line with the industrial structure for efficient response to environmental changes (Davenport & Westerman, 2018; Berezhnoy et al., 2021). It is more important than at any time before to practice platform-based cooperation and improve the competitive edge over the general corporate value chain from design to production, logistics, and sales to survive in the new competition system of global corporate environments (Berry, 2014; Alawaqleh, 2021).

However, SMEs' acceptability of related technologies for digital transformation is lower than that of large enterprises. According to Thomas et al. (2021), while the weight of new technologies such as cloud computing, big data, IoT, AI, and 3D printing is increasing among SMEs, open businesses and big data platforms are still insignificant in the digital ecosystem. Previous studies on digital transformation or platform strategies are limited to global leading enterprises in terms of research. In contrast, there have been few studies on the effects and relevance of SMEs' digital transformation strategies and platform strategies (Oettmeier & Hofmann, 2016).

Accordingly, the objective of this study is to clarify the relevance between digital transformation competencies and platform empowerment factors among SMEs and, particularly, the difference between platform development strategy and envelopment strategy as mediating effect variables will be investigated empirically. Based on its findings, this study will present specific implications on how digital transformation competencies and platform empowerment need to be considered and implemented among SMEs and how platform strategies need to be developed.

## 2. Literature Review and Hypothesis Development

### 2.1. Digital Transformation Competencies and Platform Strategy

'Digital transformation' modifies business models and establishes a new direction for the industry by integrating digital and physical elements (Westerman et al., 2014). In other words, this is a corporate activity to enhance the current businesses' competitive edge drastically or pursue new growth through new businesses by proactively responding to changes in business environments that are initiated by new digital technologies (Kohnke, 2017; Brettel et al., 2014).

Yablonsky (2018) define digital transformation as a strategic organizational routine to integrate various processes such as product development, strategic decision-making, and partnership and coordinate new resources to secure new resources in line with market changes.

The key to such digital transformation is to realize innovations by strategically utilizing digital technology. While traditional enterprises realize a new leap for productivity in utilizing such digital technology, start-ups may dissolve the existing industrial order by using digital technology in a destructive manner (Wade et al., 2014). Therefore, to induce digital transformation, it is necessary to coordinate new resources according to environmental changes and develop internal coping processes or competencies accordingly. Teece (2012) presents the three following dynamic competencies required for an enterprise's digitalization and innovation: first, opportunity identification is a competency related to technology's potential and development; second, business model design regulation and resource deployment are a competency to cope with competitors and protect intellectual property rights; third, business organization and corporate culture regulation is understood in developing new competencies in coordination with other existing competencies. For an enterprise's digital transformation in line with rapid changes in business environments, dynamic digital transformation competencies need to be secured so that competencies in and out of the organization are integrated, built up, and reconfigured adequately.

Such enterprises' efforts for design transformation are connected to platform strategy, which are, in fact, a cluster of digital technologies. The work process should not be limited to the transition from offline to online information provision in a platform. Instead, the platform should be the central axis of businesses as it changes the enterprise's strategic direction and business models innovatively (Geoffrey et al., 2014). Furthermore, as platform strategies combine various operating systems, organizational systems, and services, enterprises seek to achieve market differentiation and business competitiveness through platform strategies in response to digital transformation (Boudreau, 2010).

As an enterprise strengthens its digital transformation competencies, it is correlated to platform strategy activities, and in order to induce platform strategies effectively, digital transformation competencies need to support such strategies inside the organization. Accordingly, this study suggests the following hypotheses:

**H1:** *Digital transformation competencies of an SME will have a positive effect on platform development strategy.*

**H2:** *Digital transformation competencies of an SME will have a positive effect on platform envelopment strategy.*

## 2.2. Platform Strategy and Empowerment

### 2.2.1. Types of Platform Strategy

A platform strategy is to create network effects and establish a new corporate ecosystem by gathering different groups of participants in one platform (Hagju & Wright, 2015). In general, previous studies explained platform strategies from the perspectives of platform providers and users. In the perspective of providers, platform strategies are emphasized in terms of platform-opening strategies (Rong et al., 2013; Koufteros et al., 2005) and price strategies (Rietveld et al., 2019; Dinertin et al., 2018). In contrast, from the users' perspective, platform strategies may be explained in terms of participants who use a platform and not being involved in a platform operation, as Hsieh and Wu (2019) suggested. In this regard, Kung and Zhong (2017) indicated four types of strategies based on the indirect network effects of a two-sided market platform: cross-subsidization strategies, platform envelopment strategy, multi-homing preventive strategies, and data analytics strategies.

In terms of corporate management strategy, the direction of platform strategies may be analyzed, focusing on the possibility of standardization and envelopment into another platform (Rochet & Tirole, 2003). Based on previous studies (Wang & Cardon, 2019; Lim, 2013), it was divided into two: internal platform strategy and external platform strategy. The former is an enterprise's independent development of a platform, and the latter is a joint development in cooperation with an external partner. As for internal platform strategies, independent development may be efficient for products that require evident differentiation and uniqueness (Jacobides & Knudsen, 2006).

As for external platform strategies, enterprises may look for entities to share critical components outside themselves as part of their business management activities. It is expected that rather than making innovative products utilizing their platforms, enterprises sell their critical components to external business entities and the purchasing entities develop innovative products (Laurie et al., 2006). Because of such previous studies, this study suggests that platform strategies may be classified into two: respective enterprises' internal platform development strategy and external strategies based on collaboration with an external partner.

### 2.2.2. Platform Empowerment Factors

Corporate platform strategy may affect platform-strengthening factors that contribute to the success of platform strategies. Yun (2017) presented the three following success factors for enterprises that seek platform strategies: 1) the "value-creating ability" to create new values for every participant by addressing one or more key problems; 2) the

"connectivity" to approach the platform easily or form a relationship through a high level of openness; and 3) "key competencies" that make it difficult to replace the platform business operator with another. Ben and Lenfle (2010) pointed out that, in order for platform strategies to be successful, it is essential 1) to maintain a balance between commonality and differentiation in the step of platform designing; 2) to reduce development expenses through modularity; to improve the quality and durability of products; and 3) to enhance the flexibility of manufacturing. Lee et al. (2010) suggested the following five critical factors to platform strategies' success: innovation ability, complementarities for users to help one another, efficiency to reduce transaction expenses between participants, connectivity for high openness and straightforward approach, and, finally, network effects.

Summarizing such previous studies (Chang et al., 2016; Ye & Yang, 2020), factors to corporate platform empowerment are classified as the following four: 'unique competency reinforcement', 'creation of shared values', 'cost-saving effect', and 'network effect'. Such platform empowerment factors depend on how the enterprise realizes and implements platform strategies.

### 2.2.3. SME's Platform Strategy and Empowerment

SMEs must develop new platforms and digital platform strategies for differentiated business models such as venture business and start-up. In terms of production, on the other hand, independent development of a platform is also emphasized. As IT is applied to the manufacturing execution system (MES), SMEs that develop e-BES-based independent platforms for production optimization and real-time activity report are increasing (Karandikar & Nidamarthi, 2007). Such key operation platforms need to be reconfigurable for each module in line with the enterprise's roles, depending on its type, level, and function. In addition, execution plans need to be developed based on the company-wide information utilization's maturity level (Meyer & Mugge, 2001).

In this regard, platforms need to be developed with their promotion strategies in this particular area of SMEs. Accordingly, the emphasis is on developing a platform independently as a solution for manufacturing information utilization. Against this background, this study suggests the following hypotheses based on the idea that platform development strategy of SMEs affect corporate platform strengthening positively:

**H3:** Platform development strategy of an SME will have a positive effect on the unique competency reinforcement.

**H4:** Platform development strategy of an SME will have a positive effect on the creation of shared values.

**H5:** Platform development strategy of an SME will have a positive effect on cost saving.

**H6:** Platform development strategy of an SME will have a positive effect on the network.

Platform envelopment may be defined as an act of one platform to develop, internalize, and bundle the other platform’s functions or to acquire a new two-sided (Rysman, 2009). Platform envelopment strategy is advantageous because platform suppliers can enter another market and combine platform functions and other supplementary functions to leverage the shared user relationship. It is possible to increase the market share and envelop a leading entity’s network effects (Jeong et al., 2014; Vial, 2019). In this sense, the following hypotheses are suggested based on the idea that platform envelopment strategy of SMEs can affect platform-strengthening factors positively:

**H7:** Platform envelopment strategy of an SME will have a positive effect on the unique competency reinforcement.

**H8:** Platform envelopment strategy of an SME will have a positive effect on the creation of shared values.

**H9:** Platform envelopment strategy of an SME will have a positive effect on cost saving.

**H10:** Platform envelopment strategy of an SME will have a positive effect on the network.

### 3. Research Methods

#### 3.1. Research Model

This study’s conceptual model was designed as shown in Figure 1 based on previous studies’ research hypotheses. This study empirically analyzes the effects of SMEs’ digital transformation competencies on the four following platform

empowerment factors: unique competency reinforcement, shared value creation, cost-saving effect, and network effect, with platform development strategy and envelopment strategy as mediating effect.

In this study, ‘digital transformation competencies’ indicate internal competency factors and activities pursued to accelerate SMEs’ digital innovation. ‘Platform development strategy’ represents the strategic approach for SMEs to develop platforms required directly for digitalization. ‘Platform envelopment strategy’ represents the strategic approach to envelop external platforms required for SME digitalization. Finally, ‘platform empowerment’ indicates the enterprise’s strengthened competencies due to SMEs’ digitalization and successful platform strategy.

#### 3.2. Measurement Variables and Analytic Method

As shown in Table 1, each variable’s organizational definition and measurement items were designed based on previous studies. First of all, for digital transformation competencies, nine items in total were designed, including three from each of the following factors suggested by Teece (2012): opportunity identification, business design and resource deployment, business organization, and corporate culture regulation. As for the two parameters, platform development and envelopment, six items were designed, including three for each of the following previous studies: Lim (2013), Karandikar and Nidamarthi (2007), Meyer and Mugge (2001). Finally, as for platform strategies, 12 items were designed based on the four following factors stated in previous studies of Cusumano and Gawer (2002), Mahmoud-Jouini and Lenfle (2001): unique competencies reinforcement, shared value creation, cost-saving effect, and

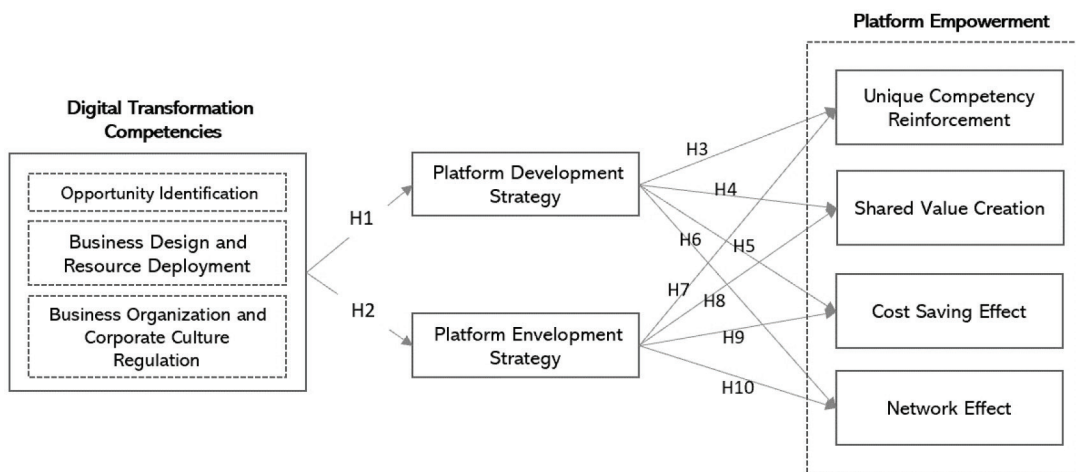


Figure 1: Research Model

**Table 1:** Variable Definitions and Measurement Items

Factors		Survey Items	References
Digital transformation competencies	Opportunity identification	<ul style="list-style-type: none"> <li>• Digital technology competencies are sufficient to strengthen digital businesses.</li> <li>• Original digital technologies to strengthen digital businesses are secured.</li> <li>• Differentiated digital business models to strengthen digital businesses are secured.</li> </ul>	Teece (2012)
	Business design and resource deployment	<ul style="list-style-type: none"> <li>• The enterprise has established policies to strengthen digital businesses.</li> <li>• Proper budgets (expenses) are invested in strengthening digital businesses.</li> <li>• Professional workforce and teams to strengthen digital businesses have been secured.</li> </ul>	
	Business organization and corporate culture regulation	<ul style="list-style-type: none"> <li>• The proper governance and decision-making should be secured to strengthen digital businesses.</li> <li>• The enterprise promotes changes/innovations in the organizational culture to strengthen digital businesses.</li> <li>• Leadership is exercised actively to strengthen digital businesses.</li> </ul>	
Platform development strategy		<ul style="list-style-type: none"> <li>• If a platform is required, independence is preferred.</li> <li>• Platform development is a priority for a new business.</li> <li>• Developing a platform independently is a common tendency when a new technology is to be applied.</li> </ul>	Im (2013), Karandikar and Nidamarthi (2007), Meyer and Mugge (2001)
Platform envelopment strategy		<ul style="list-style-type: none"> <li>• A platform most preferred in the market is utilized.</li> <li>• Utilizing and enveloping a platform that adopts the latest technology is a common tendency.</li> <li>• Our company merges other platform-related business entities if necessary.</li> </ul>	
Platform empowerment	Unique competency reinforcement	<ul style="list-style-type: none"> <li>• Maintaining corporate competitiveness in the industry through platforms.</li> <li>• Improving business competencies through platforms.</li> <li>• Securing business differentiation through platforms.</li> </ul>	Cusumano and Gawer (2002), Mahmoud-Jouini and Lenfle (2001)
	Shared value creation	<ul style="list-style-type: none"> <li>• Designing innovative business models through platforms.</li> <li>• Collaborating with new interested parties through platforms.</li> <li>• Creating a new market through platforms.</li> </ul>	
	Cost-saving effect	<ul style="list-style-type: none"> <li>• Saving costs for new product development through platforms.</li> <li>• Saving production costs through platforms.</li> <li>• Saving marketing costs through platforms.</li> </ul>	
	Network effect	<ul style="list-style-type: none"> <li>• Conducting collaboration with partners efficiently through platforms.</li> <li>• Securing more customers through platforms.</li> <li>• Taking care of internal affairs through platforms.</li> </ul>	

network effect. 27 factors in total were selected as the final measuring factors after being analyzed significantly.

The 5-point Likert scale (1 = not at all, 5 = very much) was applied to measurement items designed for the survey. The descriptive statistics and regularity of variables and demographic characteristics were analyzed employing SPSS 26.0. A structural equation model was applied to analyze the causality, regression, and path through AMOS 26.0.

### 3.3. Survey and Demographic Information

An online survey was conducted using the Google Forms questionnaire among organization managers and higher executives in charge of business management strategies and digital business affairs at SMEs in Korea. 405 questionnaires were collected, with 44 of them excluded due to response incompleteness and missing items, and

361 questionnaires used in the final analysis. Among survey respondents, 88.1% were male and 11.9% were female. 6.6% were in their 30s, 25.5% were in their 40s, 67.9% were in their 50s, and 67.9% were in their 50s. It turned out that the majority were in their 50s. As for positions, 9.1% were managers, 13.9% directors, and 77.0% executives and employees. Thus, most of them were executives and employees. As for business types, manufacturing and production took the largest portion, 35.5%, and then finance/insurance accounted for 3.4%, distribution 18.1%, service/R&D 34.5%, and IT/information and communication 8.5%. Finally, as for business scales, enterprises with 50 employees or less accounted for the largest portion, 56%. Those with 50–100 accounted for 15%, 100–300 21.5%, and 300 or more 7.5% respectively (see Table 2).

**Table 2:** Demographic Information of Survey Participants

Classification		Frequency	Percentage
Sex	Male	318	88.1
	Female	43	11.9
	Total	361	100
Age	30–40	24	6.6
	40–50	92	25.5
	50 or older	245	67.9
	Total	361	100
Position	Manager	33	9.1
	Director	50	13.9
	Executive	278	77.0
	Total	361	100
Business type	Manufacturing /Production	129	35.5
	Finance and insurance	11	3.4
	Distribution	65	18.1
	Service/R&D	125	34.5
	IT/Information and communication	31	8.5
	Total	361	100
Business scale	Less than 50	202	56.0
	50–100	54	15.0
	100–300	78	21.5
	300 or more	27	7.5
	Total	361	100

## 4. Results

### 4.1. Results of Reliability and Validity

As shown in Table 3, the reference value of factor loading is 0.4, and that of Cronbach's Alpha ( $\alpha$ ) is 0.6. The analysis result shows that the actual factor loading is between 0.659 and 0.941, and the  $t$ -value is at least 10.0. Thus, the results are statistically significant. The average variance extracted (AVE) is between 0.612 and 0.881, and Cronbach's Alpha ( $\alpha$ ) is between 0.784 and 0.957. Thus, the convergent validity is secured. As the measurement model's fitness was analyzed,  $\chi^2$  (df) was 482.342, and  $\chi^2$ /degree of freedom was 6.694. The Goodness-of-Fit-Index (GFI) was 0.830, the Adjusted Goodness-of-Fit-Index (AGFI) 0.848, the Normal Fit Index (NFI) 0.928, and the Root Mean Square Error of Approximation (RMSEA) 0.024. Thus, values of model fitness measurements were statistically significant.

To verify the discriminant validity, the AVE value of each latent variable and correlation coefficients were analyzed. About the criteria of Fornell and Larcker (1981), each latent variable's AVE square root was larger than the values of the corresponding variable and other ones. Thus, the measuring tool proved to secure discriminant validity (see Table 4).

### 4.2. Results of the Structural Model

As shown in Table 5, the fitness of the structural model was verified. About the fitness criteria, it turned out that  $\chi^2$  (df) was 675.410 ( $p = 0.000$ ),  $\chi^2$ /degree of freedom was 4.020, GFI was 0.856, and AGFI was 0.802. The value of RMSEA was 0.090, that of NFI 0.923, and that of CFI 0.941. Thus, the explanation power was proven appropriate.

As the hypotheses were tested based on the path coefficient of the final structure model, it turned out that digital transformation competencies affected both platform development strategies ( $t = 11.478$ ,  $p < 0.001$ ) and envelopment strategies ( $t = 11.141$ ,  $p < 0.001$ ). Platform envelopment strategies affected unique competency strengthening ( $t = 10.885$ ,  $p < 0.001$ ), shared value creation ( $t = 11.266$ ,  $p < 0.001$ ), cost-saving effect ( $t = 10.277$ ,  $p < 0.001$ ), and network effect ( $t = 10.912$ ,  $p < 0.001$ ) positively. Particularly, shared value creation was affected most significantly. In contrast, platform development strategies failed to affect all factors: unique competency strengthening, cost-saving effect, and network effect. Only the factor of shared value creation ( $t = -2.112$ ,  $p < 0.05$ ) showed a negative effect (–), and thus the relevant hypothesis was rejected.

**Table 3:** Results of Reliability and Convergent Validity Test

Variables	Measurement Item	Standard Loading	Standard Error	t-value	CR	AVE	Cronbach's $\alpha$
Digital transformation competencies	DTA1-3	0.864			0.901	0.753	0.925
	DTA4-6	0.909	0.057	22.366***			
	DTA7-9	0.828	0.052	20.639***			
Platform development strategy	PD1	0.647			0.823	0.612	0.821
	PD2	0.837	0.092	13.069***			
	PD3	0.846	0.089	13.145***			
Platform envelopment strategy	PA1	0.846			0.820	0.611	0.784
	PA2	0.897	0.121	11.741***			
	PA3	0.659	0.119	11.427***			
Unique competency reinforcement	OA1	0.936			0.957	0.881	0.957
	OA2	0.939	0.028	35.933***			
	OA3	0.941	0.029	36.271***			
Shared value creation	SV1	0.909			0.922	0.798	0.920
	SV2	0.904	0.031	28.659***			
	SV3	0.866	0.038	25.649***			
Cost-saving effect	CR1	0.902			0.902	0.754	0.899
	CR2	0.864	0.039	24.240***			
	CR3	0.837	0.04	22.654***			
Network effect	NE1	0.922			0.918	0.790	0.917
	NE2	0.882	0.036	27.562***			
	NE3	0.861	0.033	25.852***			

Measurement model fit:  $\chi^2$ (df) 482.342, DF 71,  $\chi^2$ /degree of freedom 6.694, RMR 0.032, GFI 0.830, AGFI 0.848, NFI 0.928, TLI 0.921, CFI 0.938, RMSEA 0.024. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

**Table 4:** Correlation Matrix and AVE

Classification	AVE	DTA	PDs	PES	UCR	SVC	CSE	NE
Digital transformation competencies (DTA)	0.753	0.868						
Platform development strategy (PDS)	0.612	0.696***	0.782					
Platform envelopment strategy (PES)	0.611	0.779***	0.814***	0.782				
Unique competency reinforcement (UCR)	0.882	0.924***	0.765***	0.858***	0.939			
Shared value creation (SVC)	0.798	0.894***	0.742***	0.878***	0.950***	0.893		
Cost-saving effect (CSE)	0.754	0.743***	0.680***	0.773***	0.803***	0.890***	0.868	
Network effect (NE)	0.79	0.821***	0.728***	0.859***	0.864***	0.943***	0.946***	0.889

\*\*\*Significant at the 0.05 level.

**Table 5:** Results of Hypothesis Test

Hypothesis		Standardized Factor Loading	t-value (p)	Status of Acceptance	R <sup>2</sup>
H1	Digital transformation competency → platform development	0.778	11.478***	Supported	0.861
H2	Digital transformation competency → platform envelopment	0.928	11.141***	Supported	0.797
H3	Platform development strategies → unique competency strengthening	0.085	1.838	Rejected	0.605
H4	Platform development strategies → shared value creation	-0.099	-2.112*	Supported	
H5	Platform development strategies → cost-saving effect	-0.108	-1.806	Rejected	
H6	Platform development strategies → network effect	-0.089	-1.704	Rejected	
H7	Platform envelopment strategies → unique competency strengthening	0.884	10.885***	Supported	0.906
H8	Platform envelopment strategies → shared value creation	1.065	11.266***	Supported	
H9	Platform envelopment strategies → cost-saving effect	0.967	10.277***	Supported	
H10	Platform envelopment strategies → network effect	1.014	10.912***	Supported	

1) Structural model fit:  $\chi^2$ (df) 675.410,  $p$  0,00, DF 168,  $\chi^2$ /degree of freedom 4.020, RMR 0.043, GFI 0.856, AGFI 0.802, NFI 0.923, TLI 0.926, CFI 0.941, RMSEA 0.090.

2) \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

## 5. Conclusion

This study examines the effects of SMEs' digital transformation competencies on platform strategies and competencies in line with the digital transformation era. In conclusion, this study is of significance as it verifies the importance of strengthening digital transformation competencies and establishing effective platform strategies for an enterprise to strengthen and develop its platforms.

First of all, it turned out that SMEs' digital transformation competencies positively affected both platform development strategy and envelopment strategy. This finding indicates that SMEs' digital transformation competencies – opportunity identification, business design and resource deployment, and business organization and corporate culture regulation – can affect the promotion of platform strategies. After all, an enterprise's digital transformation strategy and platform strategy are strategic issues to be considered collectively in technology management rather than being treated as separate strategy. Also, as previous studies pointed out (Leong et al., 2019; Wang & Cardon, 2019) this study verifies that SMEs as well need to take into account business strategies in terms of corporate organization as well as digital transformation competencies for internal resources such as organizational innovation and environmental innovation to achieve successful digital transformation, rather than merely discussing technical digitalization or platform establishment.

Second, it turned out that as for SMEs, envelopment strategies affected digital transformation competencies and

platform empowerment more significantly than platform development strategy. Now that open innovation and open platform environments are developed, SMEs can likewise strengthen their platforms more effectively by practicing platform strategies through envelopment strategy based on joint development with external partners in line with changing business environments rather than focusing on their platform development only for internal key competencies or differentiated strategy.

Finally, it turned out that with envelopment strategy as a mediating factor, digital transformation competencies affected 'shared value creation' and 'network effect' factors more significantly than 'unique competency reinforcement' and 'cost saving effects' among platform empowerment factors. As pointed out by previous studies (Trabucchi & Baganza, 2020; Mehta et al., 2021), SMEs can strengthen their corporate platforms more meaningfully by creating shared values based on envelopment strategy. This point also suggests that cooperation and co-prosperity with other interested parties or partners are the most critical success factors for digital transformation among SMEs.

Based on the findings stated above, this study's implications are presented as follows: First, for SMEs to achieve future-oriented organizational innovation through digital transformation, emphasis should be put on open innovation and cooperation strategies. As pointed out by Lim (2013), SMEs may share critical competencies concerning the market through independent platform development as part of their corporate platform strategy.



However, as the level of sharing increases, the level of differentiation inevitably decreases gradually. Therefore, it is advantageous to develop and share various platforms in line with external platform strategy to adjust strategy flexibly according to environmental changes and save development expenses, among others. Enterprises must strengthen external platform envelopment strategy based on cooperative relations in the ecosystem to seek corporate digitalization competencies rather than insist on the traditional mechanism solely based on the enterprise's internal platforms (Parket & Marshall, 2016).

Second, SMEs need to be more active in promoting business integration and organizational innovation. As mentioned above, digitalization and platform establishment are not merely technical matters for corporate success. As for the digital transformation of traditional production systems or manufacturing platforms, approaches rely on IT experts to address problems (Rogers, 2016). However, for SMEs' digital transformation today, various technologies such as AI, big data, and IoT, as well as various business models, need to be considered. Accordingly, enterprises need to adopt organizational, company-wide, and strategic approaches. It is noteworthy that successful digital transformation can be achieved by managing repeated combinations of continually-growing data science technologies and related businesses.

Finally, it is necessary to understand the importance of platform advancement for survival in big data platforms' competitive ecosystem. In the rapid advancement and development of big data and AI, enterprises continue to proliferate in various sections, from the smart factory to smart distribution and smart customer management. In this digital industry innovation age, such factors are directly linked with changes in the platform ecosystem's business environments (Munum et al., 2020). Therefore, SMEs must seek faster and more flexible innovation in business organizations by utilizing various platforms based on big data and AI and establishing strategies for their platform development.

However, this study has the following limitations: First of all, it was based on a survey conducted among SME executives and employees in Korea. Thus, Korean SMEs' characteristics are involved, and there is a limitation in generalizing this study's findings to a broader range. Future studies need to expand the scope of research subjects to cover global SMEs so that its verified hypotheses could be generalized more widely. Second, this study does not consider SMEs' general characteristics while referring to digital transformation competencies and platform strengthening factors as research variables.

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