

Critical Factors on Firm's Digital Transformation Capacity: Empirical Evidence from Korea

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Abstract

Digital transformation affects many areas within an organization, and many stakeholders such as marketing, IT, product development, strategy or HR are involved in defining transformation strategies. This study suggests that related factors with human, technology, strategic linkage of IT and business, and digital leadership of CEO are influential factors of IT governance, and establish research model based on this relationship. It aims to propose a method to increase the capability of digital transformation by testing hypotheses. In order to accomplish the purpose of research, human factors and technological factors which are influential factors of IT governance utilize the results of previous studies. Strategic linkage of IT and business, CEO's digital leadership, and digital transformation capacity are employed by related literatures. In order to empirically analyze the causal relationship among these factors, it presents a research model and hypotheses and conduct a survey on firms' employees and use empirical analysis using structural equation model based on data collection.

Keywords: Digital Transformation; IT Alignment; Digital Leadership; PLS; IT Governance

INTRODUCTION

Innovative technologies such as Mobile, Cloud computing, Internet of Things (IoT), Artificial Intelligence (AI), and robots have revolutionized the automation and intelligence of digital technology over the last decade, helping the society to leverage existing management approaches more effective [1]. In the blurry industry boundaries, innovative companies rapidly apply digital new technology in each industry field to provide innovative customer value and efficient process to create new alternative market and customer needs and to erode the role of existing business. Companies such as Netflix and Uber are rapidly emerging as a digital transformation, creating new business models or restructuring existing business models. On the other hand, companies such as Kodak and Nokia have failed

to respond to digital trends and have lost market due to failure of their businesses [2].

Firms can survive when new technologies can be developed to meet user expectations and levels in line with rapid technological change [3]. Digital transformations include digitization, but there are important differences between digitalization and digital transformation. The former refers to the conversion of information from the analog to the digital world, or the automation of processes through information and communication technology (ICT). But digital transformation is a complex issue that affects many parts of the company. Digital technology can lead to fundamental changes in business models, products, processes and organizational structures. There are a variety of options and factors to consider, such as the organization's agility, which is a prerequisite for successful change, and a balanced approach to securing corporate resources, capacity building, and development. These conditions, however, have characteristics that are not clearly perceived, which can lead to difficulties in business management within a few years if a company overlooks it or chooses a different direction.

Corporate IT governance is crucial to transform a company into a digital enterprise. IT governance is a system that establishes the responsibility and authority of decision making to induce desirable IT use within an organization and contributes to maximizing the strategic value of IT because it is well matched to the organization's strategy and goal achievement [4]. Weill & Ross [5] point out that firms with effective IT governance can generate more than 20% of profits compared to firms with inadequate governance. Versteeg & Bouwman [6] proposes the influencing factors of IT governance for digital transformation. Emphasizing that human factors and technological factors are important factors using both quantitative and qualitative method, they emphasize that these factors are the main influencing factors of digital transformation. In addition, what are the organizational factors that influence digital transformation capacity? This is the beginning of this research.

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Recently, as digital technology has become more and more applied to business, close cooperation between IT and business is required. The link between IT strategy and business strategy is likely to become more important in order to bring new business models, process improvements and customer experiences to life [7]. For a business to succeed in the future, strategies for introducing and leveraging digital technologies are clearly important, but there are stakeholder disagreements between business and IT strategies. Bharadwaj *et al.* [8] argues that in the context of digital transformation, corporate IT strategy can evolve from a functional strategy that is traditionally dependent on a business strategy to a corporate strategy that utilizes corporate digital resources to create differentiated value.

Digital transformation affects many areas within an organization, and many stakeholders such as marketing, IT, product development, strategy or HR are involved in defining transformation strategies. All these functions require a common understanding of the priorities of digital transformation activities [9]. Therefore, strong leadership is required for digital transformation success. Westerman *et al.* [38] emphasizes that a top-down approach is required for digital transformations in their book "Leading Digital". Bottom-up approach for successful digital transformation and that the stumbling block was at the boundary between the divisions even if it was pursued in the right direction, pointing out that only top management is in a position to push for change beyond the divisional boundaries.

Therefore, this study suggests that related factors with human, technology, strategic linkage of IT and business, and digital leadership of CEO are influential factors of IT governance influence, and establish research model based on this relationship. The purpose of this paper is to propose a method to increase the capability of digital transformation by testing hypotheses. In order to accomplish the purpose of research, human factors and technological factors which are influential factors of IT governance utilize the results of previous studies. Strategic linkage of IT and business, CEO's digital leadership, and digital transformation capacity are employed by related literatures. In order to empirically analyze the causal relationship among these factors, this study presents a research model and hypotheses and conduct a survey on firms' employees and use empirical analysis using structural equation model based on data collection. At this point, there are few researches on the impact factor analysis on digital transformations, and this study will provide implications for companies or organizations seeking digital transformations.

The composition of the study is as follows. Section 2 presents the theoretical background of this study, presents the major influential factors of IT governance for digital transformation, and discusses the existing research flow about IT and business strategic linkage, digital leadership, and digital transformation. Next, Section 3 presents the research model and hypotheses,

and Section 4 presents the results of the structural equation based on the questionnaire. Finally, Section 5 presents the limitations of the study and future direction of the study, along with the empirical and academic implications of the study.

LITERATURE REVIEW

Influential Factors on IT Governance for Digital Transformation

IT governance is becoming increasingly important as IT is recognized as an essential infrastructure for corporate management and becoming a core competency. IT governance is a collective term for the authority and responsibility of internal entities in IT decision making, decision making organization system and process, communication method, decision making system, coordination and control, and post evaluation of decision making. This is the sum of IT-related activities and efforts in the organization to identify the value of IT and reduce the risk. ITGI [10] proposes five key areas covered by IT governance: delivering IT value, managing risk, strategically aligning IT, managing resources, and measuring performance. Gartner emphasized the important role of IT decision-making (for example, setting direction, setting principles and standards, and prioritizing investments) [11]. Weill & Ross [5] presented five key decisions related to IT governance: IT principles, IT architecture, IT infrastructure, business application requirements, and IT investment and priorities. There are various discussions in this academic and industrial field about the areas governed by IT governance, but these discussions generally refer to similar activities [8].

In order to cope with the environment of digital transformation, Zhao *et al.* [12] developed four existing factors based on the Socio-Technical System (STS) framework (People, Organization, Task & Technology), and proposed an Extended-STS framework from an integrated viewpoint by adding external factors, and analyzed the priorities by selecting eighteen IT governance influence factors in the public sector. In the study, Delphi methodology by expert panel was used to prioritize the importance of the major factors.

Strategic Alignment of Business with IT

Strategic linkage between IT and business means that business strategy, goals and requirements are harmonized to apply information technology in a timely manner [13] and is always a fundamental concern of management. Strategic linkages show how IT is linked to business and how business can be aligned with IT [10, 14]. Many companies have adopted information systems, but only emphasized a technical point of view rather than the need for corporate management or business, and that they cannot support corporate strategy [14]. The fact that the link between IT and business is important to reduce this gap and achieve corporate strategic goals has been well known

since the late 1970s and has been proven through various studies [15, 16, 17; 18]. Chan & Reich [19] argue that the strategic linkage between business strategy and IT strategy is an important factor in strengthening the competitive advantage of companies as a means of generating revenue and reducing costs [20]. In a study by [21], the linkage between IT and business has been a top concern for IT managers for nearly 30 years and is always included in key industry issues. According to a survey of UK CIOs' priorities, it ranked # 3 in 2010, # 1 in 2011, and # 2 in 2012. Table 1 shows the results of the UK CIO survey in 2015 and 2016. As shown in the table, IT and business linkages have been recognized as important factors in the industry, ranking the first and the third [22].

Table 1: Priority of IT related factor by UK CIO Survey

	Top 6 2016 focuses for CIOs	Top 6 2015 focuses for CIOs
1	Driving business innovation	Aligning IT initiatives with business goals (64%)
2	Leading change efforts	Improving IT operations/systems performance (61%)
3	Aligning IT initiatives with business goals	Leading change efforts (57%)
4	Simplifying IT	Implementing new systems and architecture (45%)
5	Improving IT operations/systems performance	Driving business innovation (42%)
6	Cultivating the IT/business partnership	Cultivating the IT/business partnership (41%)

Knowledge sharing between business and IT executives is defined as the ability to deeply understand and participate in the other party's core processes and to honor their own contributions and challenges. The shared knowledge construct of [23] is the same concept. On the other hand, Reich & Benbasat [24] presented hypotheses and related literature on each factor, suggesting the strategic link between IT plan and business plan as a social aspect. Chan *et al.* [25] have identified domain knowledge sharing, planning sophistication, IS success experience, organizational size and environmental uncertainty as major influencing factors, and analyzed the differences according to organizational types. The results of this study show that strategic linkages depend on domain knowledge sharing and prior IS experience. Strategic linkages have a positive effect on organizational performance. We also analyzed the effects of IT and business strategic linkages on innovation and organizational performance in order to estimate the effect of strategic linkage between IT and business on digital transformation. Digital transformation is ultimately represented by organizational performance.

Willcocks *et al.* [26] defined IT governance and the IT capabilities of executives and the board as factors influencing

innovation, and analyzed the impact of the IT-business strategic linkage as a parameter. The results show that the higher the level of strategic linkage between IT and business, the greater the impact of IT governance on product innovation and process innovation. However, executives' IT competencies did not affect product or process innovation, even at higher levels of strategic linkage between IT and business. At this time, in order to understand the strategic linkage between IT and business, whether the IT project is connected with the business strategy of the company, whether IT is harmonized with the business strategy, goal and whether the requirements set by the management were measured.

CEO's Digital Leadership

According to [27], an effective way to drive digital transformation is the management-led, top-down approach. It is argued that employees should engage in a variety of ways to make change under the strong leadership of executives, and that top decision makers in the enterprise should be aware of the rapidly changing market conditions and have accurate perception and determination do. It can create a strong vision for the future and deliver this vision throughout the organization. This study also points out that it is not easy to achieve digital transformations in a bottom-up manner through a number of cases, and it shows that the bottom-up approach cannot cross the divisions between divisions. Only top management is in a position to drive change beyond the boundaries of the divisions, and leaders can engage and make changes through digital tools that communicate with their employees. The CEO's strong leadership can lead to a corporate governance and transformation system for digital transformation, leading to appropriate organizational culture and talent development, appropriate investment and technical leadership [27].

Weill & Ross [5] point out that the role of CEO and CIO is important for harmonizing IT and business strategy. CEOs should make governance evolve as they understand the role of IT and understand how to fulfill its responsibilities to maximize IT value [5]. We need to connect IT strategy to corporate strategy in the same direction. To succeed in this role, both the CEO and the CIO need to understand and share knowledge about IT and enterprise-wide. In addition, knowledge sharing between CEOs and CIOs in IT governance decisions has a positive impact on the linkage of IT and business, and this linkage affects the effectiveness of information systems positively. As shown above, the sharing of knowledge between CEO and CIO is also an important factor in the strategic linkage between IT and business [23, 25]. Bass & Stogdill [28] developed and developed leadership in two different styles: transformational leadership and transactional leadership. Transactional leadership is based on mutual attitudes between leaders and employees [29]. Transformative leadership can be viewed as an extension of transactional leadership, particularly

as to how the leader affects employees [30]. Transformational leadership is defined as "the act of a leader that broadens and enhances the objectives of the organization to achieve the goals of the organization, and assures the performance that was expected" [31]. Amabile [32] suggests that this transformational leadership affects the organizational culture and work environment, influencing the organizational attitudes and motivations for interaction and thus affecting the organization as a whole.

Firm's Digital Transformation Capacity

'Transformation' means a fundamental change of strength that is higher than the change that has been pursued by change and transformation. Digital Transformation has a lot of definitions, but in summary, it can be said that 'Digitalization of all kinds of changes', which is caused by all things digital, is based on the digital strategy, organization, process, business model, culture, A fundamentally changing management strategy. Table 2 shows the definition of digital transformation.

Table 2: Definition of digital transformation

Source	Definition
Bain & Company	To redefine the digital enterprise industry as a digital foundation and to make a difference by fundamentally reversing the laws of the game.
AT Kearney	Responding to changes in the business environment triggered by new digital technologies such as mobile, cloud, big data, AI and IoT, and dramatically increase the competitiveness of current business or new growth through new business. Corporate activities to pursue.
PWC	A series of processes that apply the expectations of digital consumers and ecosystems in business management to business models and operations.
Microsoft	The process of embracing new ways to create new value for customers, new ways of thinking of existing business models through intelligent systems, and new ways of combining people, data and processes.
IBM	Entrepreneurs integrate digital physical elements to transform business models and establish new directions for industry.
IDC	A series of processes that make new business models and product services based on digital capabilities in accordance with changes in customers and the market (external environment), apply them to management and lead them to sustainability.
World Economic Forum	A set of activities that transform the organization by leveraging the business model to improve digital skills and performance.

Source: [33]

Digital Transformation, Digital Disruption, and Digitalization are used in combination as approaches for various changes and innovations due to digital. However, digitization and digital transformation strategies differ in their inclusion of vision, planning and implementation of organizational change processes [34]. The definition of digital transformation depends on the company, the leader and the industry. But most of studies emphasize that digital transformations use technology as a means, not as a purpose.

What digital features does affect digital transformation? How does digitization change the business model, operational processes, and user experience? Brennen & Kreiss [35] conducted literature research on digital transformation and digitization. As part of this research, it appears that most of the existing papers on digital technology deal with technological innovations (eg, mobile technology, analytical solutions, etc.) while digital transformations actually cover a broader range. Therefore, digital transformations should be studied from a different angle, and analysis of existing research (eg, [36], [37]) suggests that digital transformation affects all aspects of an organization.

Westerman *et al.* [38] surveyed large companies in traditional industries such as finance, manufacturing, and pharmaceuticals in his book 'Leading Digital', and found that the following four (better customer experience, improved digitization of operations, digital vision presentation and structure) to utilize digital technology to create strategic advantages. Forbes Insight has leveraged the potential of corporate strategy, investment, innovation-driven business, and data analysis as the key elements of a company-wide approach, a balance between people and technology. The study of other companies, such as Cisco and Oracle, focuses primarily on what new technologies are being used. Research on digital transformations is still in its infant stage. Some studies have been done on the maturity assessment of digital transformations [39, 40], but few research has been done on how to get started with digital transformations and what is important.

RESEARCH MODEL AND HYPOTHESES

Research Model

In this study, the main factors influencing digital transformation capacity are human (trust, devotion / sacrifice), technology (IT expertise, strategic role of IT) and IT-business alignment. We propose a strategic link among the factors. Also, we study the relationship between CEO's digital leadership ability and digital transformation ability. The research model is presented in Figure 1. [26] presented the results of the study on the impact of IT governance and IT competence on innovation as a controlling variable of IT-business strategic linkage as an independent variable. On the other hand, this study extracts the major influential factors of IT governance and suggests CEO's digital leadership as a control variable with strategic linkage

between IT and business as independent variable. This is based on previous studies in which leadership competence can be influenced by digital transformation.

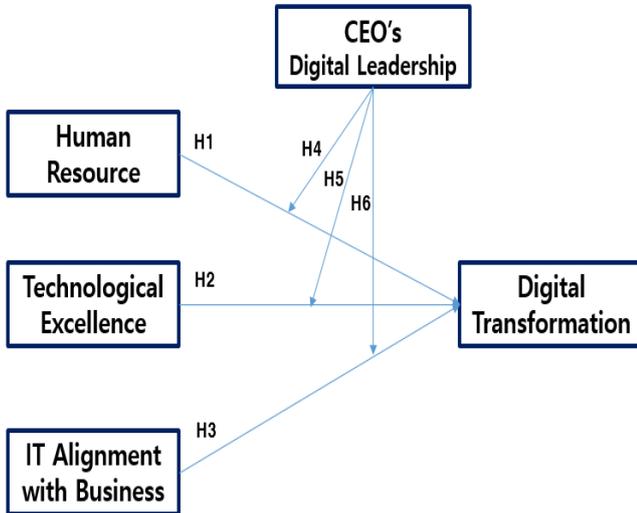


Figure 1: Research Model

Hypotheses

In the previous research, human factors and technology factors were found to be the most important factors affecting the establishment of IT governance for digital transformation. In this study, we hypothesized that these factors also affect the digital transformation capacity. We will test this model by survey data. Digital transformation is an enterprise-wide approach, and strategic alignment of business strategy with IT strategy is critical, especially as IT tends to lead the business.

In the study of [19], directivity and strategic linkage of business and IT strategy have a significant effect on information system effect and organizational performance. Empirical research and case study shows that when firm has good strategic relationship between IT and business performance. This can explain why IT can be used more intensively and strategically to improve organizational performance when strategic linkages are well established. [26] also found that the strategic linkage between IT and business is highly correlated with both IT governance and innovation. Therefore, the strategic linkage between IT and business will affect digital transformation capacity. Since the ultimate goal of digital transformation is innovation and organizational performance, it can be assumed that the CEO's digital leadership has a positive impact on digital transformation. Based on the above literature studies, the

following hypothesis was set.

H1: The human factor have a positive impact on the digital transformation capacity.

H2: The technological factor have a positive effect on the digital transformation capacity.

H3: Strategic linkage between IT and business has a positive impact on digital transformation capacity.

This study suggests that CEO digital leadership plays a moderator role in adjusting the relationship between explanatory variables and dependent variables as a moderating variable in relation to human factors, technology factors, strategic linkage between IT and business and digital transformation capacity. It is presented as follows.

H4: Positive effects of human factors on digital transformation capabilities will be reinforced by CEO's digital leadership.

H5: Positive effects of technology elements on digital transformation capability will be reinforced by CEO's digital leadership.

H6: Positive effects of IT-business strategic link to digital transformation capability will be reinforced by CEO's digital leadership.

In this study, to analyze empirically the effects of human factors, technology factors, IT-business strategic linkage and CEO's digital leadership on digital transformation capacity, which are major influential factors of IT governance for digital transformation, we set up the CEO's digital leadership as a moderating variable, set the digital transformation capacity as a dependent variable, and develop the measurement items through operational definition. The operational definition of the research variables is shown in Table 3.

ANALYTICAL RESULTS

Method and Data Collection

Based on the above researches, it is necessary to consider the purpose of the research for the evaluation of the superiority of the corporate human resources, the excellence of the technical factors, strategic linkage between IT alignment with business and CEO's digital leadership. The questionnaire was composed of Likert scale questionnaires for structural equation model (SEM)

Table 3: Model constructs with measurement items

Construct	Definition	Measurement Items		Related Reference
Human Resource	The degree of trust and dedication / responsibility that enables us to boldly challenge each other and to boldly challenge the risks of cooperation between our organization members and departments.	Trust	Trust in IT governance means mutual reciprocal belief that organizations that make up the network for information technology development benefit each other when they cooperate [41]. The quality of the inter-organizational relationship may depend on the degree of trust, but trust building is time-consuming and requires accountability and accountability [42]	[41]
		Commitment	Commitment and accountability in IT governance refers to the degree of participation of network organizations [41]. In the case of IT-led business, especially, the responsibility and enthusiasm of corporate organization members are often required because decisions move from one or a small number of people to all organizations of the enterprise.	[42]
Technological Excellence	Achievement of new technology and success experience for business innovation, IT expertise for effective enterprise IT development, and strategic role of IT	IT Expertise	In IT governance, IT expertise refers to the skills, experience, and knowledge available to members of network organizations to make the right decisions and to make effective corporate informatization developments [43]	[43]
		Strategic Role of IT	The strategic role of IT in IT governance implies how networking organizations use IT strategically to improve service quality, introduce new services, enhance competitiveness, enhance participation, and improve their sense of duty [44, 45]. This role requires participation and accountability at various organizational levels.	[44] [45]
IT Alignment with Business	Applying IT appropriately in a timely manner to meet corporate goals, business strategies and requirements, and sharing information			[46]
CEO's Digital Leadership	Appropriateness of decision making for digital transformation such as vision setting, organization, human resource development, technology investment, etc.			[38]
Digital Transformation	Digitizing customer experience by using digital technology in business, digitizing operating processes, and the ability to drive a digitized business model			[34] [38]

analysis is a flexible analytical methodology that combines factors analysis and regression analysis among multivariate analysis methods, such as pre-setting, model verification, latent variable measurement, and analysis of the relationship between variables simultaneously. In this study, PLS (Partial Least Square) methodology which is one of the well-known SEM analysis tools is introduced for path analysis. Unlike the existing structural equation analysis methodologies such as AMOS and LISREL, the parameters are estimated by PLS method [47]. In order to verify the causal relationship of complex business environments, PLS has been applied in various fields [48, 49].

The questionnaire was conducted for domestic companies in various industries. Sample collection was conducted online from mid-August to mid-September, 2017. The items related to the research contents of this study were measured using the Likert 7 point scale. As a result, a total of 398 questionnaires were collected. Of the collected questionnaires, 362 were selected as valid samples after elimination of data with no response and duplicate response data. The frequency analysis and the reliability analysis were performed using the SPSS 23 version of the collected survey data, and the path analysis

results were derived using the PLS-graph 3.0 program.

Demographic profile of sample respondent

Of the 362 respondents surveyed, 77.9% were male and 22.1% were female. The distribution of the respondents by age group is as follows: 26 in 20 ~ 30, 62 in 30 ~ 39, 104 in 40 ~ 49, 126 in 50 ~ 59, and 44 in over 60 of the age distribution of the employees. In terms of company work, less than three years accounted for 13.0% of the respondents, 47 of them, and 15.8% of the respondents for 3 ~ 7 years. The number of people in the 7-11 years group was 8.6%. In the 11-15 year group, 46 people were 12.7%. In the 15-19 years, 32 people were 8.8%. Over 19 years, 149 people were 41.2%. Lastly, when we look at the characteristics of survey respondents, 30.1% of the survey respondents were engaged in marketing / sales, and 9.7% of them were in finance/accounting. The number of personnel engaged in product planning / development is 44, accounting for 12.2% of the total, while HR is 10.8%, 7.5% for IT and 9.9% for customer service. Other tasks not covered by the above fields are composed of 19.9% of the total. The detailed demographic distribution of respondents is shown in Table 4 below.

Table 4. Demographic profile of sample

	Item	Number	Percent (%)
Gender	Male	282	77.9
	Female	80	22.1
Ages	20 ~ 30	26	7.2
	30 ~ 39	62	17.1
	40 ~ 49	104	28.7
	50 ~ 59	126	34.8
	Above 60	44	12.2
Working Experience (Unit: Year)	Under 3	47	13.0
	3 ~ 7	57	15.8
	7 ~ 11	31	8.6
	11 ~ 15	46	12.7
	15 ~ 19	32	8.8
	Over 19	149	41.2
Job Responsibility	Marketing/Sales	109	30.1
	Finance/Accounting	35	9.7
	Product Development	44	12.2
	Human Resource	39	10.8
	IT	27	7.5
	Customer Service	36	9.94
	Etc.	72	19.9

Test for model reliability and validity

This study measured the validity and reliability of the measurement variables according to the analysis process suggested by [50]. First, Cronbach's alpha and Composite reliability (CR) were measured to verify the validity of the measured variables and the consistency of the measurements. The results of the analysis show that both Cronbach's alpha and CR exceed 0.7 [51], which is above the standard of validity presented in previous studies. Next, CR and Average Variance

Extracted (AVE) values were verified by data to measure convergence validity. As a result of the analysis, CR values of all variables were found to be 0.7 or more, which is the standard value of convergent validity [52] and the AVE value was over 0.5, which exceeded the standard of validity proposed in previous studies [53]. Information on specific details is given in Table 5.

Table 5. Results of reliability test

Construct	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Human Resource	0.7447	0.8658	0.6829
Technological Excellence	0.7666	0.8651	0.6813
IT Alignment with Business	0.8676	0.9164	0.7855
CEO's Digital Leadership	0.9112	0.9445	0.8504
Digital Transformation	0.8441	0.9061	0.7631

In order to verify the validity of the discrimination between variables, the analysis was performed according to the methodology proposed by [53]. The discriminant validity is

verified by using the square root of AVE of each variable. If the square root of AVE is larger than the correlation coefficient with other variables, it can be said that the discriminant validity

of the research model is secured. As shown in Table 6, the results show that the AVE square root of all variables is larger than the correlation coefficient between the corresponding variable and other variables in the study model.

Table 6. Validity test for measurement items

	Human Resource	Technological Excellence	IT Alignment with Business	CEO's Digital Leadership	Digital Transformation	\sqrt{AVE}
Human Resource	0.89					0.8264
Technological Excellence	0.4089	0.92				0.8254
IT Alignment with Business	0.3896	0.4441	0.81			0.9222
CEO's Digital Leadership	0.4202	0.4566	0.4495	0.82		0.8088
Digital Transformation	0.2433	0.2235	0.2335	0.1632	0.83	0.8736

In addition, cross validation can be used to measure intensive validity and discriminant validity [47]. The results of the analysis show that the factor loadings of the measurement items of each variable are higher than those of the other variables, and

thus the intensive validity and discriminant validity of the study model are secured through the above analysis process. The results are presented in Table 7 .

Table 7. Cross loading value

	Human Resource	Technological Excellence	IT Alignment with Business	CEO's Digital Leadership	Digital Transformation
HR1	0.9172	0.3884	0.3111	0.3272	0.3594
HR2	0.8924	0.3606	0.3469	0.3694	0.4476
HR3	0.9081	0.3326	0.3037	0.3020	0.3809
HR4	0.8209	0.3651	0.3114	0.3734	0.3541
TE1	0.4120	0.9514	0.3702	0.3971	0.4267
TE2	0.3858	0.9412	0.3676	0.4151	0.4207
TE3	0.3329	0.8719	0.3747	0.4153	0.4156
TE4	0.3129	0.8377	0.3876	0.3662	0.3732
AL1	0.3293	0.2818	0.8115	0.3294	0.3684
AL2	0.2467	0.3232	0.8268	0.2938	0.3358
AL3	0.3418	0.4422	0.8704	0.3414	0.3913
AL4	0.3590	0.3927	0.8609	0.2987	0.4118
DL1	0.3231	0.3257	0.3061	0.7862	0.3852
DL2	0.2217	0.2553	0.3118	0.7069	0.3764
DL3	0.3673	0.3862	0.3377	0.8285	0.4133
DL4	0.3982	0.4197	0.4061	0.9034	0.3672
TC1	0.3836	0.3902	0.3974	0.3926	0.8871
TC2	0.3718	0.3961	0.4550	0.3815	0.8643
TC3	0.3596	0.3856	0.3947	0.3717	0.7965
TC4	0.2920	0.3322	0.3534	0.3459	0.7885
TC5	0.2149	0.2310	0.1149	0.1979	0.8416

Path analysis and hypotheses test

As a result of the path analysis through Model # 1, the excellence of the human factor showed a positive effect on the digital transformation capacity ($\beta = 0.238$, p-value <0.01) ($\beta = 0.132$, p-value <0.001), respectively. IT-business strategic linkage also positively affects the digital transformation capacity ($\beta = 0.157$, p-value <0.01). Next, we apply the

Stepwise-moderation methodology [54] to examine the moderating effect between each explanatory variable and dependent variable in digital leadership. As a result of the analysis using Model # 3, it was found that leadership plays a significant role as a control effect when all three explanatory variables influence digital transformation. The results of the path analysis are shown in Table 8

Table 8. Path analysis

Dependent Variable	Digital Transformation Capacity				
	Model #1	Model #2	Model #3 (Stepwise analysis)		
Human Resource	0.238**	0.196**	0.162**	0.139*	0.154*
Technological Excellence	0.132***	0.117**	0.081*	0.090*	0.088*
IT Alignment with Business	0.157**	0.121**	0.101**	0.101**	0.062**
CEO's Digital Leadership		0.121**	0.113*	0.102*	0.098*
<i>HR * Leadership</i>			0.082*		
<i>TE * Leadership</i>				0.068*	
<i>AL * Leadership</i>					0.097*
R²	0.413	0.462	0.498	0.485	0.509

Notes:

*: $p < 0.05$ | **: $p < 0.01$ | ***: $p < 0.001$ | n.s.: not significant.

Based on the above analysis, hypothesis 1, hypothesis 2, and hypothesis 3 were adopted. Furthermore, hypothesis 4, hypothesis 5, and hypothesis 6 were found to be statistically significant.

CONCLUSION

Implications

The purpose of this study is to investigate the factors affecting digital transformation in the global industry due to the development of new technologies such as mobile, artificial intelligence, and big data, and to identify the moderating effects of digital leadership. And this study aims to empirically analyze the influencing factors to enhance the digital transformation capability of companies and to draw policy implications as well as theoretical implications. There are a variety of factors that affect the capacity of a company's digital transformation. However, in order to strengthen competencies efficiently within limited resources, it is important to select and to find out what factors to focus on. In addition, we point out that CEO's digital leadership is more important than previous management in digital transformation, and it was also interested in how this affect with each factor. A summary of the research results and implications can be presented as follows.

First, the human factor has a big influence in strengthening the capacity of digital transformation in the enterprise. In this study, it is analyzed that the effect of digital transformation capacity is the most positive among factors set as independent variables. Human factors have confirmed that they have communication and trust among employees, commitment in business cooperation, and spirit of challenge, which is directly related to corporate culture. Companies should strive to form an open culture within the company to foster and secure human resources suitable for digital transformation.

Second, the technological factor has positive (+) effect on digital transformation. However, it is interpreted as a low priority factor rather than a human factor or a strategic link between IT and business. Technological factors are also important factors in IT governance, and efforts to acquire new technology, strategic role of IT, and experience in applying it to business influence digital transformation capacity. In particular, as shown in Table 1, the strategic role of IT becomes more important as the most demanding part of the CIO in the current era drives business innovation. Third, as the linkage between IT and business strategy is strengthened, it is analyzed that firm's digital transformation capacity is strengthened. Information sharing is important in the strategic linkage between IT and business. From the business planning stage, the business unit must have a system that cooperates with the IT

department and ensure that the IT department understands the company's strategy and business.

Finally, the moderating effect of CEO's digital leadership affects positively (+) on all independent variables. This result can be interpreted as a strengthening of the digital transformation capability when the digital leadership is involved in the strategic linkage between human factors, technology factors and IT-business. In particular, CEO's digital leadership is a strategic link between IT and business. The biggest interaction is interpreted that this is the part where CEOs are most intensively involved. This result is consistent with [38], which suggests that an effective way to drive digital transformation is a top-down approach led by management. To have the capabilities of digital transformation requires a strong leadership of change-led management.

Digital Transformation is not an end to the fact that a new business is pursued by discovering a proprietary business model, but it is a task of the corporation to continue to push forward. Therefore, building capacity is of paramount importance. This study will help you determine which competencies your firm will need to strengthen, how to structure the portfolio for capacity building, and what conversion system to build.

Limitation and further Study

With the rapid development of innovative IT technology, digitalization is proceeding rapidly. There are many research literature on digitalization from the technical point of view, but there is lack of research on factors affecting digital transformation. However, for companies with limited resources, a digital transformation strategy for efficient promotion is needed. Therefore, more research is needed to provide empirical evidence. In this study, we proposed an empirical research model as in Figure 1, but it is necessary to investigate further factors that affect digital transformation in the future. When such literature is abundant, objective guidelines for digital transformation promotion can be formed. The questionnaire for this study was carried out online, and if the size of the company was enough to place the IT department separately, it was possible to respond and did not limit the number of positions. ANOVA analysis was used to analyze the competency questionnaire for each rank. The results were most evaluated by the general manager and the lowest among the board members. This suggests that it is necessary to conduct separate questionnaires for CEOs who are required to have digital leadership, since the perception of the company is different according to the level of the company.

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