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Impact of Digital Transformation on Business Performance: Moderating Role of Innovation Resistance and Organizational Characteristics

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Abstract

Purpose: This study aims to identify the relationship between SMEs' digital transformation capabilities, smart factory utilization, and management performance. It also aims to suggest how companies strategically utilize smart factories to achieve a competitive advantage and sustainable growth through empirical analysis of differences in innovation resistance and organizational characteristics. **Research design, data, and methodology:** This study Implement for SME's building smart factories did. The survey was conducted for 90days from October 1st, 2023 to December 31th, 2023. Total of 210 surveys were collected, and 186 surveys, excluding ones with missing value and outliers (64 surveys), were used. **Results:** The results of the empirical analysis based on previous research are as follows. First, digital transformation capabilities such as digital technology, digital leadership, and digital strategy affect smart factory utilization. Second, smart factory use affects operational performance. Third, innovation resistance has a moderating effect in the relationship with digital transformation capabilities, smart factory utilization, and management performance. Fourth, organizational characteristics have a moderating effect in the relationship with digital transformation capabilities, smart factory utilization, and management performance. **Conclusions:** Explore strategic ways to improve your organization's digital transformation capabilities. It is necessary to establish a strategy to make organizational members aware of the necessity and importance of introducing a new system through centralization of the organization.

Keywords: Digital transformation capabilities, Utilization of smart factory, Business performance

JEL Classification Code: D24, M11, O14, O33

1. Introduction

The digitally driven Industry 4.0 is a world where advanced information and communication technologies are impacting all areas of the economy and society. The 4th Industrial Revolution is characterized by hyper-connectivity, hyper-convergence, and hyper-intelligence through digital transformation, accelerating structural transformation in various fields such as building new business models, and transforming all areas of individuals and companies through digital transformation.

Failure to respond to digital transformation will make it difficult for companies to remain competitive, and 84% of companies that have been first to digitally transform will have a competitive advantage in the marketplace (Toni et al., 2018).

For digital transformation, it is an important competitive advantage for companies and organization members to have digital skills, digital capabilities, and

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digital strategies, and it is expected that building infrastructure for digital transformation will be the key to competitive advantage (Kim, 2021).

The spread of digital transformation will require not only technological maturity and utilization factors, but also awareness of organizational members and environment to prepare capabilities for digital transformation and lead to innovative behavior for digital transformation (Kim, 2021).

Smart factories are raising the possibility of laying the groundwork for industrial competitiveness. In terms of competitive advantage, smart factories can help companies increase productivity, reduce costs and energy, and customize production. Companies that have implemented smart factories have high hopes for the results they can achieve, but they are far from being realized.

Smart factories are successful when they are built and leveraged through a company's context and strategy. It has been shown that the reason for the difference in performance in building and utilizing smart factories, even among competitors, is that smart factories were built without considering the situation and strategy of the building companies (Oh & Kim, 2019).

Looking at the previous research on smart factories, most of the studies have analyzed the current status of smart factories, analyzed case studies, and studied the application of big data in the construction and operation of smart factories (Wiktorsson et al., 2018; Ramakrishna et al., 2017; Wang et al., 2018). However, there is a lack of research on the relationship between digital transformation capabilities, smart factory utilization, and business performance.

The purpose of this study is to identify the relationship between digital transformation capability, smart factory utilization, and business performance and how it differs by innovation resistance and organizational characteristics. Through this, we suggest strategic use of smart factories and ways for companies to achieve competitive advantage and sustainable growth. Through strategic recommendations, this research will contribute to the development of effective digital transformation initiatives and the optimal utilization of smart factory capabilities to maximize business performance.

2. Theoretical Background

2.1. Digital Transformation Capability

Digital transformation has become a hot topic due to the revitalization of the fourth industrial revolution. The term digital transformation has many different meanings in different fields (Warner & Wäger, 2019). Digital transformation is becoming a major issue for countries, industries, and companies, and digital technologies are being used in all sectors (Kaufman & Horton, 2015; Von et al., 2017; Hess et al., 2016).

Digital transformation is the strategic utilization of a company's core competencies and resources to create value. Digital transformation is a way for companies to secure competitive advantage and create customer value by improving existing business models or expanding into new markets through innovative changes such as improving production methods and reorganizing processes (Parvianian et al., 2017; Gong & Ribiere, 2021; Verhoef et al., 2021).

Digital transformation is the transformation of society, industries, and businesses based on digital technologies to improve processes, reduce costs, and strengthen relationships with customers (Vial, 2019; Hong, 2019). Companies are leveraging digital technologies to gain competitive advantage and build digital transformation to create new business models and drive enterprise-wide change.

Digital leadership is the process of leading an organization to sustainable growth by providing a vision and strategy that exceeds the existing values and standards of the organization and inspiring voluntary participation through respect and empathy of the organization's members.

Digital leadership is the ability of a leader to transform current processes into digitalization processes, providing a clear vision and goals for the organization, engaging the organization's members, and making the organization innovative and collaborative with strategies that can be executed, so that the vision is presented and the activities of the organization's members are aligned with the vision (Westerman et al., 2014a; Bersin, 2016; El Sawy et al., 2016).

Digital strategy is an organization's vision and action to transform processes with digital technologies to create differentiated value by leveraging digital resources and incorporate digitalization into its business strategy(Khin & Ho, 2019).

The digital strategy also clarifies digitalization and indicates how digital processes will be built and leveraged. When a digital strategy is embraced and leveraged, processes support digital transformation (Proksch et al., 2021). Rebuilding processes enables companies to transition to a digital business model (Li et al., 2022).

2.2. Utilization of Smart Factory

Smart factory can improve productivity and flexibility by information the entire process of planning, production, distribution, and sales of products. To this end, in terms of productivity improvement, the utilization of smart factory can improve productivity by improving work processes through data collection and analysis of work processes such as defect rate, production lead time, and production process (Kim, 2019).

Smart factory requires an integrated network system of stakeholders to collect and analyze data and use it for decision-making. It can provide information for optimal decision-making for process improvement from product planning to sales to meet customer requirements and check and monitor production process information in real time (Oh & Kim, 2019).

Smart factory is built to improve the flexibility and productivity of the production process of manufacturing companies, and it is intended to be continuously utilized to automate production facilities and tasks, improve and reorganize production processes, and integrate internal and external resources (Oh & Kim, 2019; Lee & Kim, 2020).

The utilization of smart factories can be said to be a factor that increases the competitive advantage of companies by improving productivity, quality, and customer satisfaction (Lee & Kim, 2020).

The efficiency, precautionary measures, safety, and productivity of the manufacturing equipment used on the production floor, as well as the cost savings resulting from reduced defect rates, improve the competitiveness of the company. Utilization of Smart Factory by SMEs in Korea aims to improve productivity and flexibility (Oh & Kim, 2019). The utilization of smart factory will improve the productivity of the production process, flexibility and operational processes for sustainable growth, and create a competitive advantage (Kim, 2019).

2.3. Business Performance

Business performance is variously defined as the achievement of organizational goals, organizational management capabilities, productivity, and profitability, and is measured by the goals that a company achieves.

In terms of operational performance, the goals of a company building a smart factory are to reduce operating costs, improve the efficiency and productivity of work processes, and increase the effectiveness of decision-making, and in terms of financial performance, they are expressed in terms of market share, sales, and profitability (Thompson & Strickland, 1983).

Financial performance measures short-term performance, indicating profitability in terms of revenue, profit margin, etc. and is an important criterion for evaluating a company's business performance (Choi & Son, 2012). Quantitative assessments of sales and net income have been used to measure business performance by evaluating growth and profitability (Miller & Friesen, 1982).

Operational performance is the performance of the Smart Factory implementation and measures the performance of work processes. This is because performance measurement should utilize mainly qualitative evaluation criteria (Covin & Slevin, 1991).

2.4. Resistance to Innovation

Resistance to innovation is the refusal to change from the status quo and the unwillingness to embrace innovation due to threats and pressures of change, which leads individuals to adopt an attitude of resistance when they perceive a change in their situation and organizations to an innovative product or process (Ram, 1987).

Resistance to innovation can occur at any point in an organization's acceptance of newness, and resistance to innovation can occur at any time, resulting in increased costs, burdensome work processes, and a lack of confidence in the organization.

Resistance to innovation requires that members of the organization be adequately rewarded for their efforts, and if this is not met, they will have a negative attitude or psychology toward innovation (Na et al., 2019).

Resistance to innovation is referred to as lagging because organizations delay acceptance until the resistance is resolved, and it is a process that precedes the acceptance of an innovation (Ram & Sheth, 1989). The presence of resistance to innovation does not necessarily mean that innovation is rejected, but that it can be accommodated by continually addressing the resistance (Ram, 1987).

2.5. Organization Characteristic

An organization determines the activities and builds processes to achieve its goals and assigns responsibilities and tasks to its members.

Organizational characteristic in a business is the accumulation of norms, knowledge, skills, etc. shared by the organization's members that provide intrinsic satisfaction and motivation for individuals and enhanced performance for the organization, and is shaped by the organization's goals and policies (Fredickson, 1986).

Organizational structure determines the tasks required to achieve the organization's goals and organizes the organization for effective work, and it affects the organization's strategy and decision-making (Daft & Richard, 1985; Mintzberg, 1979).

The determinants of organizational structure include the level of formalization, centralization, decentralization, authority, and span of control (Kim et al., 2011).

Among the factors of organizational structure, centralization is the degree to which decision-making power is concentrated in a specific organization, and if the concentration of decision-making power is high, it tends to be centralized, and if it is low, it tends to be decentralized. Centralization is directly related to the management and control of decision-making power within an organization (Choi & Kim, 2012).

3. Research Design

3.1. Research Model & Hypothesis

This study aims to identify the relationship between digital transformation capabilities, utilization of smart factory, and business performance among companies that have built smart factory and smart factory workshops. By identifying the differences in the level of resistance to innovation and organizational characteristics of organizational members, this study aims to find ways to utilize the Smart Factory in SMEs and to explore the capabilities of organizational members. <Figure 1> shows the research model

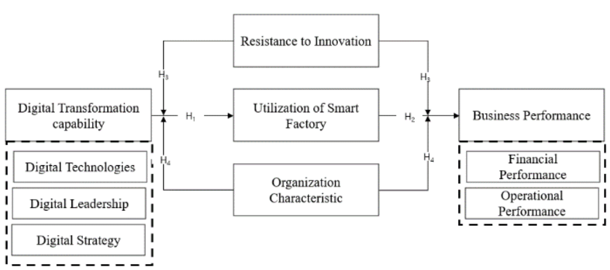

Figure 1: Research model.

Digital transformation is the development of digital technologies such as artificial intelligence, blockchain, big data technology, and cloud computing, which can shape the process of collecting and analyzing data information in various ways (Wang et al., 2022). The application of digital technologies is conducive to digital transformation and sustainable development because it enables companies to accurately collect and analyze data, information, etc. to enable them to use and redeploy their resources more efficiently (Patwa et al., 2021).

The convergence of technologies such as artificial intelligence, blockchain, and big data with traditional production factors has been shown to optimize processes, reduce operating costs, increase the efficiency of production, and restructure processes (Mikalef & Pateli, 2017). Wang et al. (2022) argue that enterprises use digital technologies to promote organizational management effectiveness, process system optimization and reorganization. Zhong et al. (2023) argue that the digitalization of enterprises restructures the processes of enterprises through information sharing and information integration and analysis.

Based on this, we derived hypothesis 1, which assumes that digital transformation capabilities will affect the utilization of smart factories.

H1: Digital transformation capabilities will have a significant impact on the utilization of smart factories.

H_{1-1}. Digital technologies will have a significant impact on the utilization of smart factories..

H_{1-2}. Digital leadership will have a significant impact on the utilization of smart factories..

H_{1-3}. Digital strategy will have a significant impact on the utilization of smart factories.

Utilization of smart factory has shown improved results in cost reduction, supply chain management, optimal production process reorganization, quality control, and increased efficiency by minimizing unproductive time (Kim, 2023). In a previous study on the use of smart factories, Oh et al. (2019) classified the purpose of building a smart factory as automation of tasks and facilities, reconstruction of production processes through the use of big data, utilization of manufacturing big data for gradual improvement of production processes, external integration, and internal integration, and expressed them as achievements. Lee & Kim (2020) showed that the utilization of smart factories affects product quality improvement and innovation performance. The effects of utilizing smart factory include improved product quality control, interlocking tasks such as product planning, design, production, and analysis, and systematic management of information collected, analyzed, and integrated according to the situation of SMEs, which can increase business performance (Kim, 2023). Belli et al. (2019) stated that the utilization of smart factory can provide an opportunity to increase the growth potential of a company through the gradual establishment of process management and the utilization of smart factory for continuous data collection.

Based on this, we derived Hypothesis 2, which assumes that utilization of smart factory will affect business performance.

H2: Utilization of smart factory will have a significant impact on business performance.

H_{2-1}. Utilization of smart factory will have a significant impact on financial performance.

H2-2. Utilization of smart factory will have a significant impact on operational performance.

Resistance to innovation is the psychological state of an innovation adopter to the extent that he or she is threatened by change in the process of adopting an innovation (Ram, 1987). Users experience psychological conflict when an innovative technology is introduced in an environment that utilizes existing technologies. This is the resistance to adoption of smart factories.

In an exploratory study of smartwatch acceptance factors, the relationship between perceived ease of use, perceived usefulness, and intention to adopt was moderated by resistance to innovation Cho and Lee (2016). In a study on the intention to accept and utilize convenience payment services, it was found that resistance to innovation moderates the relationship between effort expectancy and acceptance, social influence, and intention to use among UTAUT (Kang & Kim, 2016). Lee and Heo (2019), who studied the intention to adopt ICT convergence technology in agriculture, found that Resistance to Innovation has a moderating effect on the relationship between performance expectancy, effort expectancy, social influence, and intention to use. The higher the resistance to innovation among organizational members in adopting new technologies, the slower the rate of technology diffusion and the lower the expected performance. It can be predicted that user acceptance of a technology or service will have a different relationship and impact on individuals depending on the magnitude of their perceived resistance.

Based on previous research, we hypothesized hypothesis 3 that the relationship between digital transformation capability, utilization of smart factory, and business performance will vary depending on resistance to innovation.

H3: Innovation resistance will moderate the relationship between digital transformation capability, smart factory utilization, and business performance.

H3-1. There will be differences in the utilization of digital technologies and smart factories depending on the level of resistance to innovation.

H3-2. There will be a difference between digital leadership and utilization of smart factory based on the level of resistance to innovation.

H3-3. There will be differences in digital strategy and utilization of smart factory based on the level of resistance to innovation.

H3-4. Depending on the level of resistance to Innovation, the utilization of smart factory will have different financial performance.

H3-5. Depending on the level of resistance to Innovation, the utilization of smart factory will have different operational performance.

Centralization is the concentration of decision-making power at the top of an organization, and it works best when an organization has strong leadership, especially if it is new or has some members. In highly centralized organizations, most decisions are made at the top, with less participation at the bottom.

Higher levels of centralization may increase the organization's ability to seek, acquire, and react to information, but it also makes it more difficult for organizational members to adapt to market and environmental changes (Leavitt & Whisler, 1958).

Organizational characteristics, along with jobs, have been shown to influence organizational members' attitudes, behavioral organizational performance, productivity, job satisfaction, customer satisfaction, and job commitment (McAllister, 1995; Seabright et al., 1992; Kirkman & Rosen, 1997). Lee (2021) finds that centralization has a moderating effect on departmental cooperation on execution capabilities.

Based on previous research, we hypothesized hypothesis 4 that the relationship between digital transformation capability, utilization of smart factory, and business performance will vary depending on Organization Characteristic

H4: Organizational characteristics will moderate the relationship between digital transformation capabilities, smart factory utilization, and business performance.

H4-1. There will be differences in the utilization of digital technologies and smart factories depending on the level of organization characteristic

H4-2. There will be a difference between digital leadership and utilization of smart factory based on the level of organization characteristic.

H4-3. There will be differences in digital strategy and utilization of smart factory based on the level of organization characteristic

H4-4. Depending on the level of organization characteristic, the utilization of smart factory will have different financial performance.

H4-5. Depending on the level of organization characteristic, the utilization of smart factory will have different operational performance.

3.2. Data Collection

The survey for this study was conducted from october 2023 to december 2023 among smart factory deployment companies. A total of 210 questionnaires were distributed phone, and in-person, and a total of 186 (88.6%) of he returned questionnaires, excluding non-responses, were used for analysis.

3.3. Scale of Variable

For this study, digital transformation capability is based on the research of Westerman et al. (2014a), Leischnig et al. (2017), and Nwankpa and Roumani (2016), Digital technologies, digital leadership, and digital strategy are five items each, utilization of smart factory is six items based on the research of Burke (2017), Oh and Kim (2019), and Lee and Kim (2019), resistance to innovation is five items based on the research of Ram (1987), Jang and Lee (2018), organization characteristic is four items based on the research of Kim et al. (2003), and business performance is six items based on the research of Futterer et al. (2018), resistance to innovation is 5 items based on the research of Ram (1987), Jang and Lee (2018), organization characteristic is 4 items based on the research of Kim et al. (2003), and business performance is 5 items each of financial performance and operational performance based on the research of Futterer et al. (2018), Nwankpa and Roumani (2016), and Torres et al. (2018).
Each item was measured on a 5-point Likert scale, modified and adapted for this study.

Table 1: Scale of variable

Variable			Item	Source
Digital Transformation Capability	Digital Technologies	-Ability to change -Development ability -Business model -Digital transformation response ability -Digital device literacy	5	Westerman et al. (2014a) Leischnig et al. (2017) Nwankpa & Roumani (2016)
	Digital Leadership	-Establishing a vision -Technology leadership competency -Governance ability -Competitive advantage -Level evaluation	5	
	Digital Strategy	-Strategy update -Trend survey -Differentiated value creation -Business process improvement -Digital project	5	
Utilization of Smart Factory		-Operation system -Equipment system -Automatic monitoring -Automatic control -Real time tracking management -Process, Quality Management system	6	Burke (2017) Oh & Kim (2019) Lee & Kim (2019)
Resistance to Innovation		-New technological burden -Burden of technology introduction -Burden of ICT technology introduction -I can't use it -Job threat	5	Jang & Lee (2018) Ram (1987)
Organizational characteristics		-Research and development rights -Production work authority -Purchase authority -Marketing rights	4	Kim et al. (2003)
Business performance	Firm performance	-Sales -Profit rate -Net sales growth rate -Market share -ROI	5	Futterer et al. (2018) Nwankpa & Roumani (2016) Torres et al. (2018)
	Operational performance	-Operating cost -Service product -Work efficiency -Work production -Decision effect	5	

4. Research Methods

4.1. Analysis Method

Statistical analysis was conducted using the statistical package SPSS 24. AMOS 24.0 was used to analyze the survey data. Frequency analysis was performed to identify demographic and variable characteristics. Confirmatory factor analysis was conducted for convergent validity analysis, Cronback's ɑ value was calculated for internal consistency to check reliability, correlation analysis was conducted between each variable, and structural equation modeling was conducted to test hypotheses.

4.2. Demographic Character Analysis

The demographic characteristics are shown in Table 2.

Table 2: Demographic Characteristics

Demographic factors		Frequency	%
Gender	Male	109	58.6
	Female	77	41.4
Positiom	Employee	90	48.4
	Team leader	62	33.3
	CEO	34	18.3
Business	Sales, Marketing	52	28.0
	production	79	42.5

	general affairs	32	17.2
	development	23	12.4
Corporate history(year)	1 (less than)	19	10.2
	1~5	42	22.6
	5~10	48	25.8
	10 (above)	77	41.4
Number of employees	1~50	75	40.3
	51~100	64	34.4
	101~300	29	15.6
	301(above)	18	9.7
Industry type	Machine, Metal	57	30.6
	Electrical, Electronics	65	34.9
	Rubber, Plastics	39	21.0
	Chemistry	25	13.5
Sales	50(less)	84	45.2
	50~200	69	37.1
	201~1,000	22	11.8
	1,000(above)	11	5.9

4.3. Validity and Reliability Analysis

A confirmatory factor analysis was conducted to confirm the validity of the factors for each question, and the results of the reliability analysis using Cronbach's α coefficient for internal consistency are shown in Table 3.

Table 3: Results of Validity & Reliability

Variable	Item	Construct Reliability	AVE	Cronbach's α
Digital Technologies	5	.941	.762	.939
Digital Leadership	5	.927	.718	.919
Digital Strategy	5	.944	.772	.947
Utilization of Smart Factory	6	.918	.652	.907
Finance performance	5	.942	.766	.958
Operational performance	5	.964	.844	.920

4.4. Correlation Analysis

To check the relationship between the variables, we conducted a correlation analysis. The analysis showed that each variable has a positive correlation, with coefficients ranging from 0.233 to 0.687. A comparison of the coefficient of determination, which is the square of the correlation coefficient, and the average variance extracted (AVE) showed that each variable met the discriminant validity requirements.

Table 4: Results of Correlation Analysis (n=186)

item	1	2	3	4	5	6
1. DTech	(.762)					
2. DLead	.327**	(.718)				
3. DStra	.239**	.556**	(.772)			
4. SF	.374**	.448**	.426**	(.653)		
5. FP	.088	-.062	-.176*	-.038	(.844)	
6. OP	.329**	.462**	.347**	687**	-.037	(.766)
Mean	3.3613	3.4559	3.4140	3.1228	3.3065	3.5247
S.D	.88776	.83640	.94453	.77150	.82767	.74481

Note) ** p<.01, AVE marked in ( ).
1. DTech: Digital Technologies, 2. DLead: Digital leadership, 3. DStra: Digital Strategy. 4. SF: Utilization of Smart Factory,
5. FP: Finance performance, 6. OP: Operational performance

4.5. Hypothesis Verification Result

Similar to the measurement model, the structural path model showed a good fit to the data. χ^2=897.843, df=426, χ^2/df=2.108, p=.000, RMR= .058, NFI=.848, RFI=.834, IFI=.914, TLI=.905, CFI=.913, RMSEA=.077 which indicates that the overall model fit is good, although there are some weaknesses. The path model analysis for this study is shown in Table 5.

Table 5: Path Model Analysis

Path	Estimate	S.E	C.R	P
DTech -> SF	.219	.062	3.508	.000
DLead -> SF	.253	.081	3.121	.002
DStra->SF	.226	.077	2.939	.003
SF -> FP	-.021	.082	-.262	.793
SF -> OF	.582	.061	9.562	.000

Note)
1. DTech: Digital Technologies, 2. DLead: Digital leadership,
3. DStra: Digital Strategy. 4. SF: Utilization of Smart Factory,
5. FP: Finance performance, 6. OP: Operational performance

<Hypothesis 1> Digital transformation capability has a partially significant impact on utilization of smart factory.

H_{1-1}: The impact of digital technology on utilization of smart factory was adopted as it was found to have a significant impact with (t=3.508, p<.001).

H_{1-2}: The impact of digital leadership on utilization of smart factory was adopted as it was found to have a significant impact with (t=3.121, p<.01).

H_{1-3}: The impact of digital strategy on utilization of smart factory was adopted as it was found to have a significant impact with (t=2.939, p<.01).

<Hypothesis 2> > Utilization of smart factory was found to have a partial impact on business performance.

H_{2-1}: The impact of utilization of smart factory on financial performance was rejected as it was found to have no impact with (t= - .262, p>.05).

H_{2-2}: The impact of utilization of smart factory on operational performance was adopted as it was found to have a significant impact with (t=9.562, p<.001).

<Hypothesis 3> Resistance to innovation levels are averaged, so that groups below the average are labeled as having low resistance to innovation and groups above the average are labeled as having high resistance to innovation.

In the influence relationship of resistance to innovation with digital technology, digital leadership, digital strategy, utilization of smart factory, financial performance, and operational performance, model comparison χ2=15.179, p=.010, indicates that there is a moderating effect, χ^2=1530.569, df=852, χ^2/df=1.796, p=.000, RMR= .068 and it is adopted.

For the low resistance to innovation group, the digital transformation factors of digital technology, digital leadership, and digital strategy had an impact on utilization of smart factory. Operational performance had an impact on utilization of smart factory, but not financial performance.

For the high resistance to innovation group, only digital technology had an impact on utilization of smart factory. In terms of utilization of smart factory, it had an impact on operational performance but not financial performance, which is the same result as the group with low resistance to innovation.

The path model analysis of the difference in the influence of digital transformation capabilities (digital technology, digital leadership, digital strategy), utilization of smart factory, and business performance (financial performance, operational performance) on resistance to innovation is shown in Table 4-6.

Table 6: Path model analysis according to Innovation resistance level

(Low Innovation resistance)

Path	Estimate	S.E	C.R	P
DTech -> SF	.268	.088	3.034	.002
DLead -> SF	.401	.094	4.251	.000
DStra->SF	.245	.105	2.331	.020
SF -> FP	-.067	.157	-.424	.671
SF -> OF	.664	.102	6.508	.000

Note)
1. DTech: Digital Technologies, 2. DLead: Digital leadership,
3. DStra: Digital Strategy. 4. SF: Utilization of Smart Factory,
5. FP: Finance performance, 6. OP: Operational performance

(High Innovation resistance)

Path	Estimate	S.E	C.R	P
DTech -> SF	.122	.073	1.656	.048
DLead -> SF	.051	.107	.482	.630
DStra->SF	.007	.089	.082	.935
SF -> FP	.123	.117	1.045	.296
SF -> OF	.386	.089	4.356	.000

Note)
1. DTech: Digital Technologies, 2. DLead: Digital leadership,
3. DStra: Digital Strategy. 4. SF: Utilization of Smart Factory,
5. FP: Finance performance, 6. OP: Operational performance

<Hypothesis 4> Organization characteristic represents the average of centralization, so that groups below the average are considered low centralization and groups above the average are considered high centralization.

In the influence relationship between digital technology, digital leadership, digital strategy, utilization of smart factory, financial performance, and operational performance according to organization characteristic, model comparison χ2=15.428, p=.006 showed that there is a moderating effect, χ^2=1633.091, df=852, χ^2/df=1.917, p=.000, RMR= .074, so it was adopted.

Digital technology, digital leadership, and digital strategy impacted utilization of smart factory for the less centralized group. Utilization of smart factory influenced operational performance. In the highly centralized group, Digital technology, digital leadership, and digital strategy influenced utilization of smart factory, and utilization of smart factory influenced operational performance.

The path model analysis of the difference in the relationship between Digital Transformation Capability (Digital Technology, Digital Leadership, Digital Strategy), Utilization of Smart Factory, and Business Performance (Financial Performance, Operational Performance) by Organization Characteristic is shown in Table 7.

Table 7: Path model analysis according to Organization characteristic

(Low Centralization)

Path	Estimate	S.E	C.R	P
DTech -> SF	.285	.086	3.317	.000
DLead -> SF	.121	.190	1.343	.032
DStra->SF	.395	.205	1.904	.002
SF -> FP	-.119	.129	-.921	.357
SF -> OF	.641	.078	8.195	.000

Note)
1. DTech: Digital Technologies, 2. DLead: Digital leadership,
3. DStra: Digital Strategy. 4. SF: Utilization of Smart Factory,
5. FP: Finance performance, 6. OP: Operational performance

(High Centralization)

Path	Estimate	S.E	C.R	P
DTech -> SF	.153	.089	1.714	.047
DLead -> SF	.529	.148	3.575	.000
DStra->SF	.244	.109	2.241	.025
SF -> FP	.063	.105	.600	.549
SF -> OF	.547	.093	5.875	.000

Note)
1. DTech: Digital Technologies, 2. DLead: Digital leadership,
3. DStra: Digital Strategy. 4. SF: Utilization of Smart Factory,
5. FP: Finance performance, 6. OP: Operational performance

5. Conclusions and Implications

This study aimed to identify the relationship between digital transformation capabilities, utilization of smart factories, and business performance among companies building smart factories and provide implications for how to utilize smart factories according to digital transformation. To this end, we identified the relationship between digital transformation capability, utilization of smart factory, and business performance, and empirically analyzed the differences between Resistance to Innovation and organizational characteristics of organizational members. Here are the results and implications

First, Digital technology, digital leadership, and digital strategy factors of digital transformation capability influenced utilization of smart factory, followed by digital technologies, digital leadership and digital strategy.

It is necessary for Organization members acquire digital skills, such as the ability to develop innovative digital product processes or utilize and apply the latest devices.

Organizational leaders build leadership capabilities by establishing a digital vision and recognizing the organization's digitalization as a key component of competitive advantage.

Continuously improve your digital strategy and strategically use digital resources to create differentiated value. This enables us to improve our business processes.

The most effective use of Smart Factory is to train organization members in digital technologies to improve their capabilities, develop digital leadership capabilities, and establish a digital strategy.

Second, Utilization of smart factory had an impact on operational performance, a factor of business performance, but not financial performance.

It is to improve the efficiency and productivity of business processes by using new business programs, collecting data on the products produced, analyzing and managing information that can be optimized, establishing a system to automatically control facilities through a management system, and utilizing an operating system that is easy to use for process management and quality control.

Similar to previous researchers, building and utilizing smart factories does not affect financial performance such as sales growth and market share expansion. Building and utilizing smart factory does not affect financial performance in the short term, but it improves operational performance in the medium to long term.

Third, There is a difference between digital transformation capabilities, utilization of smart factory, and business performance depending on the level of resistance to innovation.

Organizations with lower resistance to innovation scored higher on digital technologies, digital leadership, digital strategy, utilization of smart factory, and operational performance than organizations with higher Resistance to Innovation.

Adopting new technologies, building new work processes, etc. requires training to make people in the organization aware of the need and rationale, and to build acceptance.

Find ways to reduce the stress, fear, and discomfort of introducing new processes, technologies, etc. to your people and incorporate them into your management strategy.

It is believed that companies building smart factories are bound to face resistance to innovation because there is no systematic effort to acquire and share new technologies and skills within the organization, or related education and learning systems. We judge that strong understanding and empathy among organizational members will reduce resistance, as strategy requires a long-term view, with a large budget and capital investment, acceptable technology and infrastructure and systems, and a commitment to continuous innovation.

Fourth, there are differences between digital transformation capabilities, utilization of smart factory, and business performance depending on the organization characteristics.

Low levels of centralization had an impacted utilization of smart factory, followed by digital technologies, digital strategy and digital leadership.

Higher levels of centralization impacted utilization of smart factory, followed by digital leadership, digital strategy, and digital technologies.

In less centralized groups, the utilization of Smart Factory requires improving the ability of organizational members to utilize and apply digital devices and establishing strategies so that organizational members have behavioral goals and standards. It will be necessary to establish strategies and measures to improve the capabilities of organizational members and explore ways to leverage smart factories for sustainable growth.

Smart factory builders will need to explore ways to improve their digital transformation capabilities and establish a viable strategy for doing so.

Our findings have both academic and practical implications.

In terms of academic research, first, existing studies have been case-centered based on successful cases of Smart Factory construction and smart factory characteristics. However, this study provides a theoretical foundation for the utilization of smart factories by empirically analyzing the relationship between digital transformation capability, utilization of smart factories, and business performance.

Second, we theoretically present the utilization of smart factory for resistance to innovation level. This study suggests a strategic choice that the relationship between digital transformation capability, utilization of smart factory, and business performance depends on the level of resistance to innovation of organizational members.

Third, there are differences in the level of centralization, which is an organizational characteristic, so we can explore strategic ways to use smart factories according to organizational characteristics.

From a practical perspective, first, we can see that digital transformation capabilities are becoming an important factor in the utilization of smart factories. When utilizing new business processes or operational processes, Smart Factory should be utilized according to the expectations and capabilities of the organization's members.

Second, it suggests how to build a company's strategy for digital transformation capability, utilization of smart factory, and business performance according to the level of resistance to innovation of organizational members.

As resistance to innovation varies, the study suggests that companies need to take a proactive stance to embrace innovation through efforts to respond to environmental and technological changes, rather than resisting smart factory technologies by shaking off fear of innovation or vague anxiety that their influence will decrease with the introduction of new technologies. The study provides verification that it is not advisable to introduce Smart Factory based on the expectation that it will achieve various management outcomes such as improved productivity, improved working conditions, and reduced defect rates, and thus provides an opportunity to urge organizational change. However, despite these results, there are limitations to the study, including the following

First, it does not consider various factors such as organizational culture, industry characteristics, and company characteristics that affect the utilization of smart factories. Therefore, future studies need to analyze based on various factors and situations.

Second, the survey sample size was small at 186, which was insufficient to identify the overall industry characteristics, product characteristics, etc. of the companies.

Third, we divided Resistance to Innovation and organization characteristic into two groups: high and low. It is necessary to analyze the effects of various groups and establish research on the utilization of smart factories and strategies for business performance.

Fourth, it was not easy to identify the level of resistance to Innovation and organization characteristic through the statistical part of the questionnaire. In future studies, we hope to improve the research methodology and conduct more precise research.

Fifth, this study did not include a wide range of industrial types of smart factory companies, so it is necessary to analyze the types of industries.

Sixth, as an additional research technique, a realistic and meaningful analysis of the relationship between digital transformation capability, utilization of smart factory, and business performance is needed.

Seventh, because different directions may be suggested depending on the authority of organizational members, additional research appears to be necessary.

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