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CƠ HỘI VÀ THÁCH THỨC**

INTERNATIONAL CONFERENCE

**SUSTAINABLE ECONOMIC DEVELOPMENT:
OPPORTUNITIES AND CHALLENGES**

NHÀ XUẤT BẢN HÀNG HẢI - 2024

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TOE MODEL APPLICATION FOR ANALYZING FACTORS INFLUENCING DIGITAL TRANSFORMATION IN SMALL AND MEDIUM-SIZED ENTERPRISES IN THE BINH TRI THIEN AREA

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Tóm tắt: Chuyển đổi số (CDS) đóng vai trò quan trọng đến sự phát triển của tổ chức, nó mang lại hiệu quả kinh doanh, mối quan hệ với khách hàng cải thiện, kiến tạo lợi thế cạnh tranh và tăng trưởng bền vững. Mục tiêu của bài viết này dựa trên Mô hình công nghệ - tổ chức – môi trường (TOE) nhằm đo lường mức độ ảnh hưởng của các nhân tố đến chuyển đổi số của doanh nghiệp nhỏ và vừa tại khu vực Bình Trị Thiên. Dữ liệu được tập hợp thông qua khảo sát 348 nhà quản trị trong các DNNVV, và kiểm định mô hình đề xuất bằng mô hình cấu trúc tuyến tính (SEM). Kết quả chỉ ra các nhân tố của TOE bao gồm: bối cảnh công nghệ (Hạ tầng CNTT hiện có, lợi thế chuyển đổi, nhân lực số); bối cảnh tổ chức (chiến lược, sự sẵn sàng, sự hỗ trợ của ban lãnh đạo); bối cảnh môi trường (áp lực từ đối thủ, hỗ trợ của chính phủ, hành vi khách hàng) đều có ảnh hưởng tích cực đến chuyển đổi số của doanh nghiệp nhỏ và vừa tại khu vực Bình Trị Thiên. Riêng yếu tố chi phí chuyển đổi có ảnh hưởng tiêu cực đến chuyển đổi số của doanh nghiệp nhỏ và vừa. Cuối cùng, kết luận và một số hàm ý được đề xuất nhằm tăng cường chuyển đổi số của doanh nghiệp nhỏ và vừa tại khu vực Bình Trị Thiên trong thời gian tới.

Từ khóa: *Chuyển đổi số, DNNVV, mô hình TOE.*

Abstract: Digital transformation (DT) plays a crucial role in the development of organizations, which brings about business efficiency, improved customer relationships, competitive advantages, and sustainable growth. The objective of this article is based on the Technology-Organization-Environment (TOE) framework to measure the impact of factors on the digital transformation of small and medium-sized enterprises (SMEs) in the Binh Tri Thien area. Data was collected through a survey of 348 managers in SMEs, and the proposed model was validated using a structural equation modeling (SEM) approach. The results indicate that TOE factors including: technological context (existing ICT infrastructure, transformation advantages, digital workforce); organizational context (strategy, readiness, leadership support); environmental context (pressure from competitors, government support, customer behavior) all positively influence the digital transformation of SMEs in the Binh Tri Thien area. The cost conversion factor specifically

has a negative impact on the digital transformation of small and medium-sized enterprises. Finally, conclusions and implications are proposed to enhance the digital transformation of SMEs in the Binh Tri Thien area in the future.

Keywords: Digital transformation, SMEs, TOE model.

1. Introduction

Digital transformation (DT) plays a crucial role in the development of organizations in the era of the Fourth Industrial Revolution. Organizations consider DT as a key strategy for sustainable development through the use of digital technology to change business methods, operations, communication with customers, and partners. Therefore, DT brings about business efficiency, improved customer relationships, competitive advantages, and sustainable growth. From awareness to implementing DT actions, it is essential for organizations in the context of the digital economy and increasing competition becoming more fierce. Currently, there is no unified definition of DT. Organizations and researchers such as the DT consulting firm Garner and the Ministry of Information and Communications of Vietnam have different perspectives on DT. In general, all acknowledge the importance and profound impact of DT on various aspects of socio-economic life. In Vietnam, DT has received significant attention from the government, central and local management agencies, organizations, and enterprises. To date, digital transformation has become a familiar concept for many businesses; it is a necessity and a survival solution to maintain and develop enterprises, including small and medium-sized enterprises (SMEs).

In the general context, the application of technology and digital transformation for small and medium enterprises (SMEs) in the Binh Tri Thien area is imperative. In recent years, the Binh Tri Thien area has experienced significant growth, with relatively high growth rates that have attracted domestic and foreign investment to promote socio-economic development, gradually improve living standards, and contribute to poverty reduction and local development. SMEs play a crucial role in job creation, income generation for workers, mobilizing social resources for investment and development, poverty alleviation, and actively supporting the development of provinces. In the past, the provinces in the Binh Tri Thien area have received attention and support from the government and provincial departments in the digital transformation effort, but the implementation process still faces many challenges. The most significant challenges include SMEs' incomplete understanding of digital transformation, concerns about the high costs associated with digital transformation, worries about the lack of technology-savvy personnel, concerns about internal information security, and business confidentiality. Especially, SMEs find it difficult to determine specific directions and

roadmaps for digital transformation within their enterprises. Currently, SMEs only have sufficient funds for basic production, and not all enterprises can afford large investments in digital transformation due to cost, consultancy, valuation, implementation solutions, among other issues. Moreover, accessing bank loans is challenging for many SMEs due to their inability to meet the requirements for bank loans and their limited capacity to manage capital flows. Through this research, we will identify the factors influencing digital transformation in small and medium-sized enterprises. Subsequently, this will provide guidance for businesses to prepare accordingly and recommend necessary support from the government, which is crucial.

2. Literature review and research methodology

2.1. Digital Transformation

Digital transformation has been studied for many years, yet there is still no unified definition. At each stage, authors offer different definitions based on their perspectives. According to the Ministry of Information and Communications (2021), digital transformation is the comprehensive process of changing individuals' and organizations' ways of living, working, and producing based on digital technologies. According to the leading global consulting firm Gartner, digital transformation involves using digital technologies to change business models, create new opportunities, revenues, and value. At this level of transformation, digital applications will introduce new and innovative forms across entire sectors rather than merely upgrading and supporting traditional methods. According to Microsoft (2018), digital transformation involves rethinking how organizations gather people, data, and processes to create new value. In general, current perspectives mainly define digital transformation from the standpoint of technology, value and strategy. According to Stolterman & Fors (2004), digital transformation is the use of technology to significantly improve efficiency or the reach of an enterprise. Fitzgerald & colleagues (2013) define digital transformation in businesses as the use of new digital technologies such as social media, new analytics techniques, or automated linking systems to make significant changes in business operations, such as enhancing customer experience, optimizing operations, and creating new business models. Hess & colleagues (2016) argue that digital transformation involves changes that digital technology can bring to business models, leading to changes in products or organizational structures, or the automation of business processes. McDonald & Rowsell (2012) suggest that digital transformation is not just about digitizing resources but about the business values created based on digital assets. Solis (2014) suggests that digital transformation involves restructuring or investing in new technology, business models, and processes to deliver value to customers and employees. Additionally, some scholars define digital

transformation from the perspective of strategic change. According to Gobble MaryAnne M (2018), digital transformation is a profound transformation of business activities, processes, capabilities, and models of organizations to strategically and priorities drive changes and opportunities brought by digital technology.

In summary, regardless of which definition is used, digital transformation in businesses entails changing the business model from traditional to digital by applying advanced technologies to alter work processes, operational methods, management activities, corporate culture, etc., thereby bringing about new opportunities, values, and generating more profits. Therefore, based on the comprehensive overview of perspectives on digital transformation from both domestic and international studies, and drawing on the practical implementation of digital transformation in Vietnam, this study adopts the viewpoint that digital transformation is the process of changing mindset, perception, models, and traditional business methods to digital models by applying information technology to business operations. Thus, the core essence of digital transformation in businesses includes: transformation in perception - transformation in technology - transformation in business models/management methods within the organization.

2.2. The TOE Model

There are several theoretical models commonly used to predict and explain technology acceptance behavior. These models include: Theory of Reasoned Action (TRA); Theory of Planned Behavior (TPB); Technology Acceptance Model (TAM); Unified Theory of Acceptance and Use of Technology (UTAUT). Although the contributions of these models to technology adoption are highly regarded, Oliveira and Martins (2011) argued that these models are suitable for investigating technology adoption at the individual level. In a comprehensive study of technology adoption models at the organizational level, Oliveira and Martins (2011) noted that the TOE theory is stronger in explaining technology adoption from the organizational perspective. The TOE model is a theory of technology acceptance behavior from the organizational perspective developed by Tornatzky et al. (1990). According to the TOE theory, three contextual groups are the driving forces of new technology acceptance, including (1) technology, (2) organization, and (3) environment. The technological context reflects aspects of technology both internally and externally, such as technology characteristics and readiness. The organizational context reflects dimensions such as organizational size, level of centralization and standardization, complexity of management structure, human resources, and availability of resources within the organization. The environmental context reflects external contextual conditions influencing the adoption of new technology. Therefore, the TOE theory provides a comprehensive view of organizational readiness for innovation by

considering both internal and external contexts (Rababah et al., 2020; El-Haddadeh et al., 2021; Park & Kim, 2021).

The TOE theory has been empirically validated in various technological contexts such as information and communication technology (Eze et al., 2019), green information technology (Mouakket&Aboelimged, 2021), social media (Abdullahi, social commerce (Abed, 2020), cloud computing (Rababah et al., 2020), e-business (Putra & Santoso, 2020), and big data (ElHaddadeh et al., 2021). Many foreign studies have used this model to investigate the influence of factors on digital transformation in small and medium-sized enterprises (SMEs). Alshamaila et al. (2013) identified factors influencing digital transformation in enterprises, specifically in the technology group (Relative advantage; Uncertainty and geographical constraints; Compatibility and complexity; Trialability); environmental group (Competitive pressure; Market and industry scope, Supplier efforts); organizational group (Organizational size; Support from top management; Innovation). Abed (2020) constructed a research model on social commerce acceptance and collected data from 181 questionnaires from businesses in Saudi Arabia to explore the contextual factors of technology (perceived usefulness and security issues), organization (support from top management and readiness to apply), and environment (pressure from customers and business partners) that drive the use of social commerce. Similarly, the TOE theory has been used to test the research model of cloud computing acceptance and identified technological context (compatibility, security issues), organizational (support from top management, readiness to use), and environmental (competitive pressure) as important conditions driving the adoption of this technology in 350 SMEs in Jordan (Rababah et al., 2020). In this way, the prevalence of the TOE model over other models can be observed. The TOE theory provides a comprehensive view of an organization's readiness for technological innovation through examining both internal and external contexts. Moreover, this model has been verified for its suitability across various fields. Therefore, this research utilizes the TOE model as a foundation to explore the factors influencing digital transformation in small and medium-sized enterprises

2.3. Research Methodology

2.3.1. Research Sample

The scale of the initial research model was validated based on an overview of the study. Survey questionnaires were sent to 4 experts in digital transformation and 8 managers of SMEs in three provinces of Binh Tri Thien for review and adjustment to suit the context and research subjects. Subsequently, 31 respondents were preliminarily quantified and the scale was tested. The results showed that all scales ensured Cronbach's alpha (CA) reliability and were used for the official survey. The scale constructed

comprised 57 observable variables measuring independent and dependent variables. According to Hair et al. (2018), the minimum sample size is 5 times the number of observable variables ($n=5*m$ where n is the sample size and m is the number of observable variables). Therefore, the minimum sample size for this study is 285. The formal study was conducted by collecting data using survey questionnaires. The survey questionnaires were created using Google Docs and the link was sent to the survey respondents via email; in addition, direct surveys of businesses were conducted. The survey respondents were Directors (Director, Deputy Director) of SMEs in three provinces: Quang Binh, Quang Tri, Thua Thien Hue, all of whom were familiar with the objectives and current situation of digital transformation within their organizations. Due to time and budget constraints, a convenient sampling approach was employed.

After collection and screening, 348 valid survey questionnaires were used for analysis. Among them, the majority were small and medium-sized enterprises; 43.8% were limited liability companies; 15.2% were joint-stock companies; 38% were sole proprietorships, and 3% were other types of entities. The main sectors of the surveyed enterprises were other manufacturing and processing (32.3%) and retail distribution (40.1%). Following data collection, the SPSS and AMOS software were employed to process quantitative data through the following steps: (1) Testing reliability, (2) Testing convergence and discriminant validity, and (3) Testing the research model.

2.3.2. Research Model and Hypotheses

2.3.2.1. Factors of Technology

The application and acquisition of IT infrastructure will be the fundamental premise of digital transformation activities, thereby changing the work structure (Loebbecke & Picot, 2015). Lanzolla & Anderson (2008) emphasize the application of digital technologies as a driving force for digital transformation. Digital technologies may include big data, mobile, cloud computing, or search-based applications (White, 2012). Another perspective, Chatterjee & colleagues (2002), argue that successful digital transformation requires leaders to believe in the value and benefits of new technologies and support their deployment in organizational activities. Thus, how businesses have a technology application platform in current operations will significantly impact the future success of digital transformation in the business.

Hypothesis H1: The current information technology infrastructure will have a positive impact on digital transformation in businesses.

Hess & colleagues (2016) emphasize the role of human factors in driving transformation processes, requiring alignment between human capabilities and digital technology applications. Therefore, employees need to have sufficient skills, readiness to access, develop, and use new technologies in job improvement and execution (Bharadwaj et al., 2013). Depending on business conditions, employees need to develop the ability to

perceive and adapt to the digital environment (Brennen & Kreiss, 2016; Daniel & Wilson, 2003). Employee capabilities are manifested in their effective use of information technology applications, training for employees in using digital applications, and having IT-specialized employees (Putthiwat et al., 2021).

Hypothesis H2: Digital workforce will have a positive impact on digital transformation in businesses.

The advantage of applying technology refer to the advantages that a company gains from applying innovative technology beyond the current state (Oliveira et al., 2014). Previous studies have shown that the digital transformation process can transform organizational business models (Pagani & Pardo, 2017), help companies save costs, improve operational efficiency (Yin, 2022), achieve better business performance, and thus, provide a competitive advantage for companies (Matarazzo et al., 2021).

Hypothesis H3: The advantage of applying technology will have a positive impact on digital transformation in businesses.

2.2.3.2. Factors of Organization

The term "digital transformation costs" refers to the expenses that businesses must incur when implementing measures related to the digital transformation process, primarily including costs arising from the adoption of digital technologies. Typically, high costs will diminish the enthusiasm of businesses in adopting new technologies (Lin, H; 2014). Costliness related to the adoption of digital technology, such as high costs for technical learning and management, is also a limiting factor in digital transformation (Toufaily, E et al., 2021). Alternatively, according to (Wang, X. et al.; 2022), costs pose a significant barrier to the adoption of digital technologies such as blockchain in businesses.

Hypothesis H4: Digital transformation costs have a negative impact on digital transformation in businesses.

Organizational readiness reflects the available resources in an organization to support the digital transformation process, including existing infrastructure, relevant personnel, and available financial resources (Chatterjee, S. et al.; 2021). Many scholars have found through research that organizational readiness has a positive influence on business adoption of new technologies (Pan, M.; Pan, W.; 2021). For example, organizational readiness is an important motivating factor for businesses to adopt big data (Lutfi, A. et al.; 2022).

Hypothesis H5: Organizational readiness has a positive impact on digital transformation in businesses.

To ensure and enhance the success of a business's digital transformation process, digital strategy and senior management have garnered significant attention from both researchers and practitioners (North, K.; 2019). Bharadwaj, A. (2013) research has

demonstrated that practical experience shows that digital strategy is the key to the success of business digital transformation processes. Organizations that digitally transform their business processes and structures often demonstrate a clear and consistent digital strategy (Kane, G.C.; 2015). A digital strategy can support organizational transformation processes and achieve expected goals (Alexander, L.; 2017).

Hypothesis H6: Digital transformation strategy has a positive impact on digital transformation in businesses.

The success of a business's digital transformation largely depends on the motivation of senior management and their ability to combine resources successfully. Outstanding leadership is crucial for any transformation process, including the business's digital transformation process (Cichosz, M.; 2020). The leadership creates an environment and provides the necessary resources to implement e-business (Putra & Santoso, 2020). Leadership support plays a crucial role in the acceptance of technology explored in the social commerce context (Abed, 2020) and social media (Tajudeen et al., 2018). Leadership support for digital transformation includes attention to digital transformation, support for technology application proposals to digitize business operations and management processes, and readiness to address concerns arising from the dark side of digital transformation (Putthiwat et al., 2021; Stoianova et al., 2020).

Hypothesis H7: Leadership support has a positive impact on digital transformation in businesses.

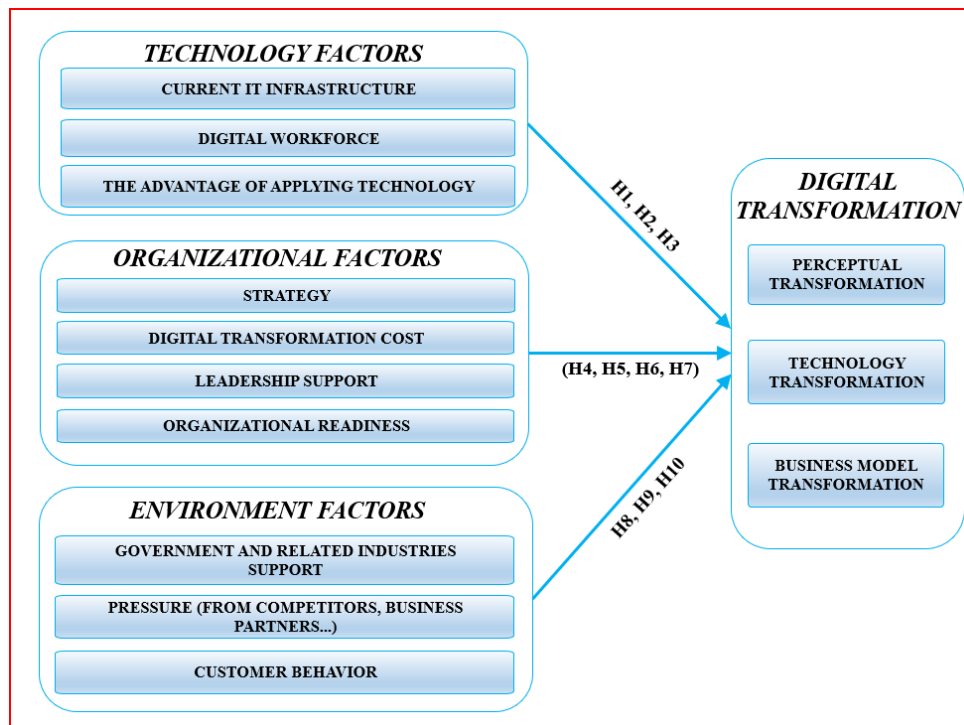


Figure 1: Proposed Research Model of Factors Influencing Digital Transformation in SMEs in the Binh Tri Thien Area based on the TOE Model

2.2.3.3. Factors of Environment

Competitive pressure from competitors refers to the extent to which businesses are influenced by competitive rivals in the market to adopt new technologies (Wong, L. et al., 2020). Specifically, to gain a competitive advantage, companies often need to apply innovative methods and further optimize production allocation (Wang X. et al., 2020), such as improving production quality and efficiency, reducing costs under competitive pressure from competitors. Wong, L. et al. (2020) study has shown that competitive pressure can drive businesses to transform and ultimately achieve digital transformation. Singh et al. (2021) also found that competitive pressure significantly impacts the digital transformation process in the Indian manufacturing industry.

Hypothesis H8: Pressure from competitors and business partners has a positive impact on digital transformation in businesses.

The changing customer behavior in the current digital transformation landscape is a factor influencing digital transformation (Mithas et al., 2013). Understanding changes in customer behavior can contribute to improving digital transformation outcomes and customer experiences (Beckers et al., 2018). Tarutè et al. (2020) also pointed out that changes in consumer demands impact the digital transformation of businesses, especially in upgrading consumer behaviors and expectations. Trends focusing on consumer-centric development also influence the digital transformation process of businesses (Reed et al., 2016).

Hypothesis H9: Customer behavior positively impacts digital transformation in businesses.

Luo, X. et al. (2022) found that government policy support positively affects digitization and can drive the digital transformation process of pharmaceutical companies. Many studies have also indicated that government policies and support are crucial factors for the successful digital transformation of businesses (Tarute et al., 2018). Governments can develop and reinforce policies and programs to support the digital transformation of small and medium-sized enterprises by creating specific policies, support initiatives, consultations, customized training programs, and collaborative ecosystems (Isensee, 2020). Putra and Santoso (2020) also identified the influence of Government support on the intention of organizational leaders to implement digital transformation.

Hypothesis H10: Government and relevant agencies support have a positive impact on digital transformation in businesses.

Based on the proposed research model and hypotheses, the scale for digital transformation and factors influencing digital transformation in SMEs is constructed as follows:

Table 1: Scale of Digital Transformation in SMEs

CODE	DIGITAL TRANSFORMATION CONTENT	REFERENCES
I	PERCEPTUAL TRANSFORMATION	
NT1	The Leadership understands the importance of digital transformation	WilaisaKoolyong (2018); Sandkuhl et al. (2019); Putthiwat&colleagues (2021); Ministry of Information and Communications (2021)
NT2	The Leadership is aware of the impact of digital transformation on the business.	
NT3	The Leadership understands and applies the current legal frameworks, regulations, and government policies supporting businesses in digital transformation.	
NT4	The Leadership has knowledge of digital transformation trends related to the market, customers, competitive rivals, and industry management within which the business operates.	
NT5	Employees within the business have knowledge of digital transformation trends.	
NT6	Employees within the business understand the company's digital transformation strategy.	
II	TECHNOLOGY TRANSFORMATION	
CN1	Businesses regularly update their systems with the latest advanced technology solutions from providers in the market.	Nguyen Thi Mai Huong and Bui Thi Sen (2021); Ministry of Information and Communications (2021)
CN2	Businesses have implemented new technologies to reduce costs and improve the efficiency of their IT systems.	
CN3	The current IT systems or solutions of the enterprise are capable of easily integrating with new technology solutions.	
CN4	The enterprise has plans and resources to upgrade and innovate its IT systems when necessary.	
CN5	The enterprise has policies and procedures related to data collection, technology storage, and analysis to support business decision-making.	

III	BUSINESS MODEL TRANSFORMATION, OPERATING PROCESSES, IMPLEMENTATION METHODS	
MH1	Businesses have implemented business models in the digital environment such as applying forms of e-commerce, online business, Mobile Apps - interacting with customers...	Nyandore (2016); Nair et al. (2019); Viral (2019); Gamache et al. (2019); Isensee (2020); Ministry of Information and Communications (2021)
MH2	Businesses have implemented digital business processes for internal management tasks such as human resources management, finance...	
MH3	Businesses apply ICT systems and digital technologies for data storage, data sharing and information, workflow between departments, units (accounting, sales, human resources, etc.).	
MH4	Businesses have digitized production management processes and product/service supply.	

(Source: Synthesis of the authors)

Table 2: Scale of Factors Influencing Digital Transformation in Enterprises in the Binh Tri Thien

CODE	Factors Affecting Digital Transformation	REFERENCES
I	TECHNOLOGY FACTORS	
I.1	CURRENT INFORMATION TECHNOLOGY (IT) INFRASTRUCTURE	
HT1	The enterprise has network connectivity (broadband Internet and wireless Internet).	(Loebbecke& Picot, 2015), Lanzolla& Anderson (2008), (White, 2012); Chatterjee et al. (2002); Ministry of Information and Communications (2021)
HT2	The enterprise has implemented basic digital technologies (using LAN, Internet, electronic invoices, electronic records...).	
HT3	The enterprise has adopted advanced digital technologies (cloud computing, 5G mobile technology, IoT solutions, ERP software...).	
HT4	The enterprise has implemented digital technologies to serve business operations (robotics, automation, 3D printing, automatic brand/product recognition technology...).	

HT5	The enterprise has formed an "ICT culture" (employees work in an internet environment, have enterprise domain email, online meeting systems, use office tools, smartphones for work).	
I.2	DIGITAL WORKFORCE	
NL1	Employees are competent in using existing digital systems.	Hess et al. (2016); Bharadwaj et al. (2013); Brennen & Kreiss (2016); Daniel & Wilson (2003); Putthiwat et al. (2021); Ministry of Information and Communications (2021)
NL2	Employees are willing to learn and embrace new digital systems.	
NL3	The company has an IT department dedicated to managing ICT systems.	
NL4	The company has established online knowledge repositories and expertise.	
NL5	The company has policies to attract high-quality technology talent in its field of operation.	
I.3	THE ADVANTAGE OF APPLYING TECHNOLOGY	
LT1	Applying new technology helps businesses change their business models.	Oliveira T. and colleagues (2014); Pagani, M., Pardo, C. (2017); Yin, W. (2022); Matarazzo, M. and colleagues (2021).
LT2	Applying new technology helps businesses improve operational efficiency.	
LT3	Applying new technology brings competitive advantages to businesses.	
LT4	Applying new technology helps businesses reduce certain costs in their operations.	
LT5	Applying new technology enables businesses to bring new values and experiences to customers on digital platforms.	
II	ORGANIZATIONAL FACTORS	
II.1	STRATEGY	
CL1	The Leadership implements digital transformation initiatives into the strategic direction of the business	North, K. (2019); Bharadwaj, A. (2013); Kane, G.C. (2015);
CL2	The Leadership has devised an action plan based on its digital transformation strategy	

CL3	The business applies information technology systems and data analysis to support strategic activities within the organization	Alexander, L. (2017); Ministry of Information and Communications (2021);
CL4	The digital transformation process of the business is propelled by both the digital transformation strategy and the business strategy	
II.2	DIGITAL TRANSFORMATION COST	
CPH1	The costs incurred are quite substantial for investing in and purchasing new technologies.	Lin, H. (2014); Nyandore (2016); Gamache et al. (2019); Toufaily, E. et al. (2021); Won, D. et al. (2022); Wang, X. et al. (2022)
CPH2	There are high expenses associated with knowledge transfer and training to enhance digital skills for the workforce.	
CPH3	Significant costs are involved in maintaining and upgrading information technology systems within the organization.	
CPH4	High expenses are incurred for renting digital infrastructure and software systems from ICT service providers.	
II.3	LEADERSHIP SUPPORT	
LD1	The Leadership demonstrates a positive attitude towards digital transformation in the enterprise.	Cichosz, M.(2020); (Putra & Santoso, 2020; Abed (2020) Tajudeen et al (2018). Stoianova et al (2020); Putthiwat et al (2021)
LD2	The Leadership allocates financial resources and assets to implement digital transformation.	
LD3	The Leadership actively promotes and encourages digital transformation to employees at all levels.	
LD4	The Leadership continuously learns to develop capabilities to meet the demands of digital transformation.	
II.4	ORGANIZATIONAL READINESS	
SS1	The organizational structure of the enterprise is flexible enough to be ready for digital transformation.	Chatterjee, S. et al (2021); Pan, M.& Pan, W. (2021). Lutfi, A.
SS2	The enterprise is prepared with the necessary resource factors to execute digital transformation.	

SS3	Employees are ready to collaborate, share knowledge, and experiences with each other to carry out digital transformation alongside the enterprise.	et al (2022); Ministry of Information and Communications (2021)
SS4	The enterprise is prepared to deal with the risks associated with digital transformation.	
III	ENVIRONMENT FACTORS	
III.1	GOVERNMENT AND RELATED INDUSTRIES SUPPORT	
CP1	The government has formulated policies, guidelines, and incentives to promote the digital transformation of businesses.	Luo, X. et al (2022); Tarute et al (2018); Isensee (2020); Putra & Santoso (2020)
CP2	Policies have been established to facilitate technology transfer and connectivity for the digital transformation of businesses.	
CP3	Financial support policies have been implemented to facilitate the digital transformation of businesses.	
CP4	The government has issued legal frameworks (laws, decrees, circulars) related to the digital transformation of businesses.	
CP5	Local government departments have undertaken initiatives to support the digital transformation of businesses.	
III.2	PRESSURE (FROM COMPETITORS, BUSINESS PARTNERS...)	
AL1	Competitors of the enterprise are using ICT systems.	Wong, L. et al (2020); Wang X. et al (2020); Singh et al (2021)
AL2	Competitors of the enterprise have undergone digital transformation.	
AL3	Business partners of the enterprise tend to engage in activities through technology applications.	
III.3	CUSTOMER BEHAVIOR	
KH1	Customers of the business desire digital transformation.	Mithas et al (2013); Beckers et al (2018); Tarutè et al (2020); Reed et al (2016).
KH2	Customers of the business engage in electronic transactions with the business.	
KH3	Customers have experienced the digital services of the business.	

(Source: Synthesis of the authors)

3. Research results

3.1. Exploratory Factor Analysis of the Scale of Factors Influencing Digital Transformation in SMEs in the Binh Tri Thien Area

Before conducting the exploratory factor analysis (EFA) of the scale, the reliability of the scale was assessed using internal consistency via Cronbach's Alpha coefficient. The Cronbach's Alpha coefficient method was used before conducting the EFA factor analysis to eliminate inappropriate variables because these junk variables could create spurious factors. The number of observed variables included in Cronbach's Alpha analysis was 57 observed variables. The results of all scales showed Cronbach's alpha coefficients >0.6 ; variables with item-total correlation coefficients > 0.3 . Specifically, the Internal Consistency of Digital Transformation (0.904); Current IT Infrastructure (0.906); Digital Workforce (0.924); Technological Advantages (0.92); Strategy (0.923); Conversion Cost (0.935); Leadership Support (0.899); Organizational Readiness (0.901); Pressure from Competitors (0.855); Government Support (0.939); and Customer Behavior (0.826). Thus, the scale achieved reliability for the subsequent exploratory factor analysis.

For the set of independent variables, factor analysis with Varimax rotation was conducted to identify factors for further analysis. The hypothesis posited in this analysis is that there is no correlation among the observed variables in the population. The KMO and Barlett's tests in the factor analysis indicate that this hypothesis is rejected ($\text{sig} = 0.000$), with a KMO coefficient of 0.894 (>0.5). This result indicates that the observed variables in the population are correlated with each other, and factor analysis (EFA) is appropriate. The EFA results show at an Eigenvalue of 1.813 (>1) using the Principal component extraction method, with Varimax rotation allowing for the extraction of 10 factors from 42 observed variables, and the cumulative variance extracted is 79.09%, meeting the requirement. The factor rotation matrix clearly indicates that all observed variables have loading coefficients > 0.5 . Therefore, the results ensure the distinctiveness among the factors.

Table 3: Rotated Component Matrix^a

Observable variables	Component									
	1	2	3	4	5	6	7	8	9	10
CPH3	0.886									
CPH2	0.871									
CPH5	0.856									
CPH4	0.854									
CPH1	0.850									
NL3		0.807								

NL1	0.795								
NL5	0.787								
NL4	0.781								
NL2	0.781								
LT1		0.804							
LT2		0.786							
LT4		0.756							
LT3		0.754							
LT5		0.742							
HT3			0.873						
HT1			0.850						
HT4			0.828						
HT2			0.817						
HT5			0.796						
CP1				0.903					
CP3				0.901					
CP2				0.899					
CP4				0.881					
SS2					0.840				
SS4					0.821				
SS3					0.811				
SS1					0.779				
LD2						0.862			
LD1						0.849			
LD4						0.838			
LD3						0.821			
CL2							0.744		
CL3							0.730		
CL4							0.717		
CL1							0.715		
AL1								0.874	
AL2								0.850	
AL3								0.752	
KH2									0.843
KH3									0.827
KH1									0.803

(Source: Data processing of the survey in 2023)

Table 4. Factor loading coefficients of dependent variables

Code	Observed Variables for Digital Transformation	Loading Coefficient
NT	Perceptual Transformation	0.829
CN	Technological Transformation	0.801
MH	Model and Process Transformation	0.831

(Source: Data processing of the survey in 2023)

For the scales belonging to the Dependent Variable Digital Transformation, the hypothesis set in this analysis is that there is no correlation among the observed variables in the population. The KMO and Barlett’s test in the factor analysis showed rejection of this hypothesis (sig = 0.000), with a KMO coefficient of 0.776 (>0.5). This result indicates that the observed variables in the population are correlated with each other, and factor analysis (EFA) is appropriate. From the initial 3 observed variables, 1 factor was extracted with an explained variance of 69.8%, and the data convergence point was 2.793>1. The loading coefficients of the observed variables were all greater than 0.5, so no observed variable was excluded from the model. Thus, the digital transformation scale is measured by 3 observed variables: NT, CN, MH.

3.2. Testing the Convergence and Discriminant Validity of the Model

In relation to confirmatory factor analysis (CFA), the composite reliability (CR) and average variance extracted (AVE) are two criteria used to test convergence value. According to Hair et al. (2018), CR needs to achieve a value > 0.70 and AVE needs to achieve a value > 0.50. The results show that CR and AVE of the factors meet the standard values (Table 3). Therefore, the study ensures convergence value.

Table 5: Testing the Convergence Value of the Model

Factor	Composite Reliability (CR)	Extracted Variance (AVE)
DT - Digital transformation	0.871	0.559
LT - Advantages of technology application	0.918	0.693
CP - Support from government and related agencies	0.932	0.734
NL - Digital workforce	0.924	0.708
HT - Current ICT infrastructure	0.902	0.648
LD - Leadership support	0.899	0.690
SS - Organizational readiness	0.925	0.755
CPH - Digital transformation costs	0.930	0.770
CL - Strategy	0.924	0.752
AL - Pressure from competitive rivals	0.859	0.671
KH - Customer behavior	0.826	0.613

(Source: Data processing of the survey in 2023)

Furthermore, this study utilizes the square root of AVE and the correlation between variables to test discriminant validity. Fornell and Larcker (1981) suggested that the square root of AVE should be greater than the correlations between variables. The test results meet the proposed requirements. Moreover, the results from bootstrapping with 5000 samples show that there is no confidence interval of factors containing a value of 1 (significance level $\alpha = 5\%$). Therefore, the research model achieves discriminant validity.

Table 6: Discriminant Validity Test of the Model

	CDS	LT	CP	NL	HT	LD	SS	CPH	CL	AL	KH
CDS	0.748										
LT	0.344	0.832									
CP	0.286	0.339	0.857								
NL	0.445	0.612	0.357	0.842							
HT	0.254	0.190	0.063	0.242	0.805						
LD	0.203	0.389	0.187	0.277	0.172	0.831					
SS	0.332	0.616	0.336	0.560	0.091	0.240	0.869				
CPH	-0.093	0.052	-0.011	-0.073	-0.343	0.123	-0.053	0.878			
CL	0.437	0.702	0.369	0.699	0.209	0.394	0.606	-0.088	0.867		
AL	0.263	0.284	0.321	0.218	0.106	0.301	0.232	0.084	0.301	0.819	
KH	0.198	0.205	0.358	0.066	0.067	0.217	0.171	0.047	0.141	0.478	0.783

(Source: Data processing of the survey in 2023)

To assess the adequacy of the research model, several criteria were used, including Cmin/df, GFI, TLI, CFI, PCLOSE, and RMSEA. According to Hair et al. (2018) recommendations, the research results indicate that all the above criteria meet the proposed values (Table 6). Therefore, the study achieves the adequacy of the research data.

Table 7: Model Fit Test

Index	CMIN/df	GFI	TLI	CFI	RMSEA	PCLOSE
Value	1.811	0.801	0.919	0.926	0.048	0.822
Reference Standard	<3	≥ 0.8	≥ 0.9	≥ 0.9	≤ 0.08	≥ 0.05

(Source: Data processing of the survey in 2023)

3.3. Testing the model of factors influencing digital transformation in SMEs in the Binh Tri Thien area

The article analyzes the factors influencing the digital transformation of SMEs in the Binh Tri Thien area through the TOE model. The SEM model results indicate that factors related to technological context, organizational context, and environmental context

all have an impact on the digital transformation of SMEs in the Binh Tri Thien area. With an R-squared value of 77.9%, this means that the factors within the TOE model explain 77.9% of the digital transformation in SMEs in the Binh Tri Thien area.

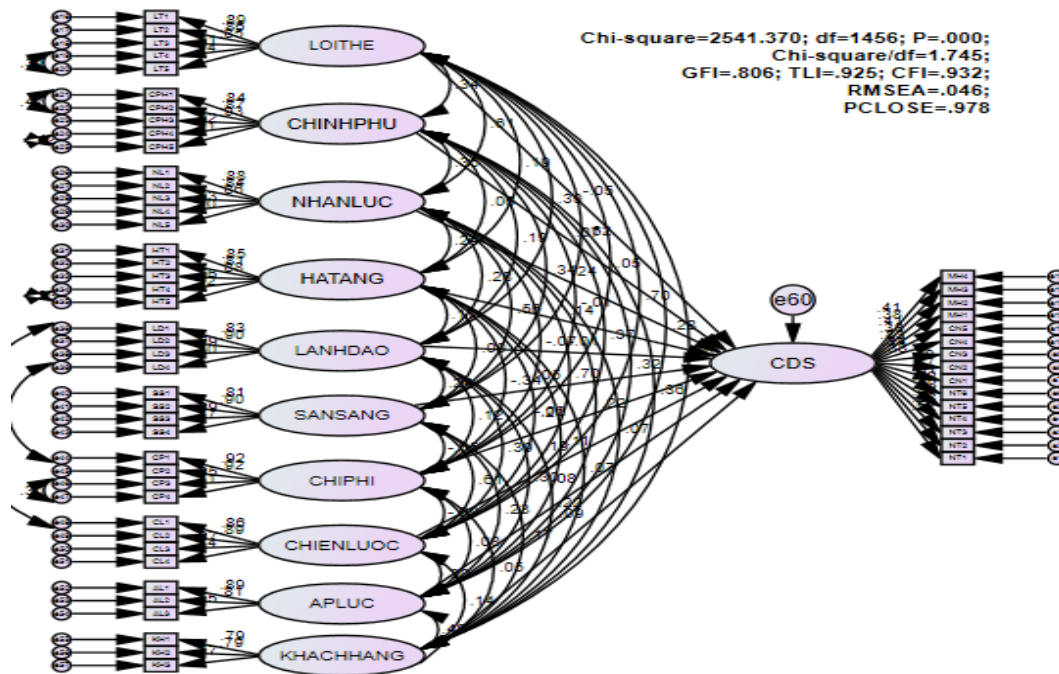


Figure 2: SEM model of factors influencing digital transformation in SMEs in the Binh Tri Thien area

(Source: Data processing of the survey in 2023)

Specifically, the hypotheses of the study are tested as follows:

Table 8: Hypothesis Testing Results

	Hypothesis	β value	pvalue	Conclusion
H1	CDS<---HATANG	0.093	0.020	Accepted
H2	CDS<---NHANLUC	0.137	0.005	Accepted
H3	CDS<---LOITHE	0.26	0.004	Accepted
H4	CDS<---CHIPHI	-0.068	0.014	Accepted
H5	CDS<---SANSANG	0.127	0.030	Accepted
H6	CDS<---CHIENLUOC	0.104	0.047	Accepted
H7	CDS<---LANHDAO	0.305	0.000	Accepted
H8	CDS<---APLUC	0.047	0.005	Accepted
H9	CDS<---KHACHHANG	0.056	0.000	Accepted
H10	CDS<---CHINHPHU	0.038	0.000	Accepted

(Source: Data processing of the survey in 2023)

4. Results and implications

4.1. Discussion of Results

Firstly, the technological context. Factors within the technological context, including the Existing Infrastructure ($\beta = 0.093$; $p < 0.001$), Advantage of Technology Adoption ($\beta = 0.26$; $p < 0.001$), and Digital Literacy ($\beta = 0.137$; $p < 0.001$), positively influence digital transformation in the SMEs. Thus, H1, H2, and H3 are accepted. Therefore, the technological context impacts digital transformation in SMEs. This finding aligns with the study of Park and Kim (2021). Specifically, the technological context encompasses aspects and characteristics of technology such as relative advantage, compatibility, technological readiness, observability, etc., which drive digital transformation in SMEs. Alshamaila et al. (2013) identified technological factors influencing digital transformation in enterprises, including Relative Advantage, Compatibility and Complexity, and Trialability. Similarly, Isensee (2020) emphasized the importance of information technology for companies to achieve digital transformation, optimizing business processes, thereby creating value for customers and businesses. Chatzoglou&Chatzo (2016) indicated that when digital technologies penetrate an organization, they interact with organizational prerequisites to initiate the digital transformation process for the business. Meanwhile, Gamache et al. (2019) argued that progress in technology has brought about changes in the economic value of enterprises, business innovation, and competitive models, providing a platform for digital transformation. In other words, digital technology is creating new forms of business strategy by altering the path of value creation that organizations have relied on to maintain competitiveness while providing technical support for their effective implementation.

Secondly, the organizational context. Factors including Strategy ($\beta = 0.104$; $p < 0.001$), Organizational Readiness ($\beta = 0.127$; $p < 0.001$), and Leadership Support ($\beta = 0.305$; $p < 0.001$) positively influence digital transformation in the SMEs. Meanwhile, the Cost of Digital Transformation with $\beta = -0.068$ has a negative, inverse impact on digital transformation in the SMEs. Thus, H4, H5, H6, and H7 are accepted. This means that the organizational context will help SMEs identify available resources to implement digital transformation. This result is supported by previous experimental evidence from El-Haddadeh et al. (2021). Dilber, U. (2019) asserts that as a crucial commitment and crucial ability for the digital transformation of businesses, digitalization strategies and senior management have attracted the most attention from researchers and practitioners. Research and practical experience have shown that digitalization strategies are crucial for the success of digital transformation plans for businesses (WilaisaKoolyong, 2018). Isensee (2020) suggests that organizations undergoing digital transformation in their

business processes and organizational structures often have a clear and consistent digitalization strategy. On the other hand, management leadership is the most important factor for the success of digital transformation. The ability of managers to continuously monitor market trends, identify and exploit technological opportunities, and turn them into business opportunities is more important than ever (Yoon & George, 2013). Additionally, as orchestrators of change, leaders encourage stakeholders to participate in the digital transformation process and allocate resources reasonably, so that digital transformation can develop smoothly.

Thirdly, the environmental context is an important condition for enhancing digital transformation in SMEs. Factors including Competitive Pressure ($\beta = 0.047$; $p < 0.001$), Government Support ($\beta = 0.038$; $p < 0.001$), and Customer Behavior ($\beta = 0.056$; $p < 0.001$) positively influence digital transformation in SMEs. It implies that components of the environmental context such as competitive pressure, market, customers, government support, and legal framework will promote digital transformation in SMEs. Tarute et al. (2018) pointed out that policies and support from the government are important factors for the success of digital transformation in enterprises. The government can develop and strengthen policies and programs to support the digital transformation programs of SMEs by creating specific policies, support initiatives and consulting, customized training programs, and collaborative ecosystems (Isensee, 2020). Similarly, WilaisaKoolyong (2018) argues that through collaboration with partners, small and medium-sized enterprises can improve business performance and achieve growth, even when they have limited resources. Therefore, Viral (2019) suggests that government support and partnerships, as important environmental factors, can significantly impact the success of digital transformation.

4.2. Implications

Based on the significant relationship between the technological context and digital transformation in SMEs, it implies that SMEs need to consider the components of the technological context such as the suitability, compatibility of technology infrastructure, and the benefits and advantages of digital transformation implementation to gain competitive advantages for the business. Digitizing processes creates a competitive advantage for businesses, reduces costs, and facilitates convenient operations. Enterprises need to invest in or lease digital infrastructure such as cloud computing hardware infrastructure (smart cloud) for digitized database storage, network infrastructure (WAN, MAN, LAN, VPN) for connectivity, application software for internal management (ERP, HRM, BSC...), and customer and partner-facing application software (Apps on IOS, Android platforms used on smart devices like smartphones, iPads, tablets... for customer

care, enhanced interaction, customer experience, and communication), especially ensuring information security for digital transformation plans. Businesses need to enhance employees' appropriate skills in digital competency. Assessing the current state of the workforce (response and non-response rates to job demands) and predicting essential skill changes for the digital age. Developing programs to improve the digital skills of the workforce, applying technology solutions for effective training and retraining, such as deploying solutions to build online learning platforms for internal professional training, information technology, and language training relevant to the industry and field of the enterprise.

In addition, factors of the organizational context also need attention. SMEs need to focus on building and operating advanced digital infrastructures; integrating business strategies with digital strategies, technology, and knowledge resources; enhancing digital management capabilities; expanding digital systems; and increasing readiness in the system. Enterprise leaders need to study experiences and proactively learn to develop appropriate digital transformation strategies for their businesses. Business leaders need to update and participate in digital transformation knowledge training programs, enhance awareness of the benefits of digital transformation, focus on building strategies, plans, and implementation roadmaps, organize implementation, monitor results, adjust plans if necessary, and manage risks during the transformation process.

On the other hand, to facilitate digital transformation deployment, the importance of the environmental context also drives SMEs to endeavor to capitalize on opportunities (such as government support, priority policies, legal systems) and limit, effectively address challenges (such as customer pressure, competitive business environments, and partners). Currently, the government has issued policies, strategies for digital transformation in economic and social fields, so SMEs need to seize this opportunity to implement digital transformation in business and aim for a sustainable digital economy. At the same time, to leverage the effectiveness of digital transformation capacity, the government and related agencies need to pass more policies, support programs, incentives, organize workshops and training programs to equip knowledge, financial and non-financial support. Additionally, the government needs to invest resources to promote the digital transformation process in Vietnam such as information and communication technology infrastructure, cybersecurity, and good data management, enhance digital skills and capabilities for the entire population, and promote innovation in the fourth industrial revolution.

5. Conclusion

Digital transformation is a breakthrough step and a crucial task for every organization and business. To analyze the factors influencing digital transformation, the TOE model is used to identify factors within the technological, organizational, and environmental contexts. With a survey of 348 SMEs in the provinces of Quang Binh, Quang Tri, and Thua Thien Hue, the study has identified 10 groups of factors within the TOE model that all have an impact on digital transformation in SMEs. Consequently, the study provides managerial implications for SMEs to implement digital transformation measures in order to achieve significant changes in the context of the current digital economy. The research findings have practical implications for SMEs as well as relevant authorities in the area in the ongoing digital transformation efforts.

Despite the achievements, this study has limitations and future research directions. Firstly, the factors of the contexts in the TOE theory need to be examined specifically to provide a more comprehensive picture of the mutual influence of these factors. The number of businesses accessed in the study is limited, and the research subjects span across various sectors, therefore, the research findings have not been implemented and validated further for a specific industry. This serves as a suggestion for researchers to carry out and extend in future studies.

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