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Digital transformation in Vietnam: A case study of Hanoi SMEs

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ABSTRACT

This research involved surveying 456 Small and Medium-sized Enterprises (SMEs) in Hanoi, Vietnam, to understand the factors that affect their digital transformation. After gathering the data, it was analyzed using advanced statistical methods, specifically Structural Equation Modeling (SEM), with the help of software tools like SPSS and AMOS. The findings revealed six key factors that play a significant role in the digital transformation of SMEs. These factors mostly impact the process indirectly by shaping the companies' intentions toward digital transformation, with a less direct influence on the transformation process itself.

1. Introduction

Digital Transformation has garnered significant attention in the activities of governments, enterprises, and academia. Digital transformation is a continuum of activities, a comprehensive process of digitalization and its advanced application aimed at creating novel methodologies and approaches at a higher level of operation. By this understanding, digital transformation unfolds through three stages: digitization, digital application-digital operation, and digital transformation (Nguyen and Nguyen, 2022; Singhdong et al., 2021). In the literature, there are two main streams of research. The first one concentrates on the digital transformation strategy of enterprises, as illustrated by studies such as those by Hess et al. (2016), Matt et al. (2015), and Zinder and Yunatova (2016). The second one delves into an examination of the digital transformation process and the influencing factors (Gamache et al., 2019; Eller et al., 2020), primarily focusing on assessing the direct impact of these factors on the digital transformation process, with less emphasis on other aspects. According to the Theory of Planned Behavior (TPB), the argument may still not be convincing because adopting new management methods primarily depends on the intentions of the individuals involved (Ajzen, 1991; Dung et al., 2023).

Our research indicates that there is a limited amount of literature on digital transformation in small and medium-sized enterprises (SMEs) in Vietnam. Most of these studies focus on assessing readiness levels or stages of digital transformation without thoroughly examining the factors that influence it. Consequently, as many as 57.6% of SMEs in Vietnam face challenges in implementing digital transformation. According to a 2020 survey by Cisco and IDC on the digital maturity of SMEs across 14 Asia Pacific countries, the findings include: (1) only 3% of businesses, down from 22% in 2019, believe that digital transformation is unimportant to their operations; (2) 62% anticipate that digital transformation will enhance performance and foster the creation of new products and services; (3) 56% recognize that keeping up with competition and digital transformation is crucial for survival and growth in today's market. However, in Vietnam and other developing countries, SMEs—which often make up over 90% of businesses—typically struggle with digital transformation due to limited resources, outdated technology, and a workforce that is unable to keep pace with technological advancements, leading to delays in digital transformation initiatives.

Therefore, in this study, we focus on assessing the current state of digital transformation within enterprises and the factors influencing this process through two mechanisms: direct and indirect effects via the intermediary variable 'Digital Transformation Intention.' We anticipate that the indirect

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mechanism will exhibit greater strength, as human behavior is strongly driven by the intention to perform such actions, according to TPB theory.

2. Literature review

2.1. Digital transformation in enterprises

In recent years, Digital Transformation has emerged as a pivotal issue in shaping information system strategy (Agarwal, 2020). At the macro level, Digital Transformation encompasses profound changes occurring in society and industries through the utilization of digital technology (Agarwal, 2020).

Digital transformation involves leveraging technology to significantly improve a business's overall performance and effectiveness (Stolterman and Fors, 2004). Digital transformation goes beyond merely digitizing resources; it requires that business value is generated on the foundation of digital assets.

Following this perspective, digital transformation in enterprises can be understood as the utilization of new digital technologies, such as social media platforms, advanced analytical techniques, or automated linking systems, to drive significant changes in business operations. This includes enhancing the customer experience, optimizing operations, and creating new business models mới (Fitzgerald et al., 2014). Digital transformation encompasses changes enabled by digital technology within the business model, resulting in product adjustments, organizational restructuring, or the automation of enterprise processes (Hess et al., 2016). Thus, digital transformation within enterprises goes beyond mere digitization of data, operational processes, or organizational information. What is crucial is the application of technology to analyze digitized data, subsequently changing the way value is created for the business.

The process of business digital transformation encompasses three key aspects. Firstly, it involves the transformation of operational processes. The establishment and utilization of electronic data exchange systems can help businesses save time and enhance efficiency. Secondly, it entails a shift in operational models, meaning a change in the way operations are conducted to create value for the business. Finally, it encompasses the modification of the customer experience, stemming from the dynamic interaction between customers and the business, influencing customers' experiences and perceptions.

The digital transformation process of businesses unfolds across three distinct stages. In the initial stage of strategic alignment, enterprises harness technological solutions to enhance the customer experience and achieve their goals. Resources that are readily available and cost-effective, aligning with the enterprise's capabilities, are commonly utilized during this phase. The subsequent phase revolves around the digital transformation of the business model. Here, enterprises emphasize the widespread adoption of digital technology, fostering interconnectivity across functions. This phase places significant emphasis on restructuring management models for more effective business operations. Finally, the third phase, known as the digital transformation of managerial capabilities, represents a comprehensive shift toward complete digital transformation. It focuses on seamless integration and synchronization of business and management systems, enabling real-time information sharing across departments. This transformation empowers businesses to manage and execute operations more efficiently and cost-effectively (Li et al., 2018).

2.2. Factors affecting the digital transformation process of enterprise

The application of digital technologies is recognized as a catalyst for enhancing digital transformation capabilities (Lanzolla and Anderson, 2008). Digital technologies encompass a wide spectrum, including big data, mobile, cloud computing, and search-based applications (White, 2012). An alternate viewpoint, Chatterjee et al. (2002) suggested that for digital transformation to be effective, it is crucial that managers recognize and support the advantages and benefits of new technologies by integrating them into the company's processes. Along the same lines, Hess et al. (2016) emphasized the role of human factors in driving transformation processes, stressing the importance of aligning human capabilities with digital technology applications.

Nadkarni and Prügl's (2021) synthesis of prior research indicated that the factors influencing a business's digital transformation capability can be categorized into three groups: 33% focus on technology, 34% on organization, and 33% on both technology and organization. In studies concentrated on organizational aspects, four frequently mentioned factors that directly impact the expected outcomes of a business's digital transformation are (1) The attitude and capabilities of managers, (2) digital transformation strategy, (3) employee capabilities, and (4) corporate culture. Regarding research emphasizing technology, the utilization of technology platforms for business activities, such as systematic data storage, customer interaction, internal communication, and other functions, affects a business's digital transformation capability (Nadkarni and Prügl, 2021). In the research conducted by Nguyen and Nguyen (2022), technology platforms were identified as a key component. The authors also introduced a new aspect, referred to as the pressure for businesses to undertake digital transformation. This factor, named 'Digital Transformation Pressure,' highlights the compelling forces pushing businesses to improve their operational methods and change their business models. Digital platforms greatly enhance the efficiency of interactions within enterprises and with external parties, offering more convenience than traditional methods. Moreover, the digitalization of

management information systems and customer relations, combined with advanced analytical techniques, provides a stronger and more effective basis for implementing business solutions. Consequently, the evident trend toward digital transformation exerts pressure on businesses to engage in such changes, which is why this factor is called 'Digital Transformation Pressure.'

An alternative perspective posits that decisions concerning digital transformation closely resemble choices made when adopting a novel management approach involving the replacement of outdated technologies with more contemporary ones (Ajzen, 1991; Davis, 1989; Ong et al., 2015; Tang et al., 2010). Consequently, the decisions associated with an organization's digital transformation process are evidently subject to the influence of decision-makers intentions to execute the digital transformation (Kim and Kim, 2022). Thus, in the context of this research, we propose the inclusion of the variable 'Digital Transformation Intention' as an intermediate factor mediating the relationships between the various factors affecting a business's digital transformation process. Our objective is to assess the impact of these factors on the digital transformation of small and medium-sized enterprises, exploring both their direct and indirect effects.

The transformation in the thinking and actions of managers significantly influences the digital transformation capabilities of an enterprise. These changes involve the managerial capacity to enhance decision-making processes by incorporating open information and data (Wu et al., 2024). Additionally, they involve alterations in the learning and development of managers (Sia et al., 2016). Digital transformation managers exhibit characteristics such as a keen interest in digital transformation, a positive attitude towards the digital transformation of their enterprises, the utilization of new technology applications in interactions, support for proposals involving technological applications to digitize operational and management processes within their organizations, continuous learning to enhance their capabilities in meeting digital transformation requirements, and readiness to address concerns arising from the darker aspects of digital transformation (Nguyen and Nguyen, 2022; Singhdong et al., 2021; Stoianova et al., 2020).

Information technology plays a crucial role in business operations. It not only supports management activities but has evolved into an essential element in building business strategy (Bharadwaj, 2000; Kim et al., 2021). The digital transformation strategy is reflected in aspects such as digital transformation objectives outlined in the business strategy, the establishment of electronic offices as part of the company's strategic plan, the implementation of database systems, a focus on changing the operational model, and an emphasis on optimizing the customer experience on digital platforms (Nguyen and Nguyen, 2022; Singhdong et al., 2021).

Depending on the business conditions, employees, as well as managers, must develop the ability to perceive and adapt within the context of digital networks and connectivity (Brennen and Kreiss, 2016; Daniel and Wilson, 2003). Employee capability is manifested in their proficiency in using information technology applications, the provision of training by the company for employees in digital applications, a positive attitude of employees toward new technology applications, empowerment of employees within the organization, and the presence of specialized IT personnel within the company (Nguyen and Nguyen, 2022; Singhdong et al., 2021).

The digital transformation of businesses necessitates the establishment of a corporate culture that prioritizes data validation and sharing (Dremel et al., 2017). Besides, this transformation may also introduce cultural tensions, as noted by Kohli and Johnson (2011), with younger, tech-savvy employees potentially clashing with more experienced colleagues who are less familiar with digital technologies. A digital transformation culture is characterized by various elements, including a willingness among individuals to share their knowledge, a commitment to mutual learning, proactive engagement in tasks, recognition of data as a shared organizational asset, stringent data validation practices, and effective collaboration among employees (Nguyen and Nguyen, 2022; Singhdong et al., 2021; Stoianova et al., 2020).

The process of digital transformation brings about changes in job structures (Loebbecke and Picot, 2015) as well as the roles and requirements within the workplace (White, 2012). Digital connectivity enables the emergence of cross-functional teams throughout the entire organization. In this context, traditional hierarchical job structures are gradually fading, and new opportunities are extending beyond the scope of the enterprise (Loebbecke and Picot, 2015). A digital workplace must be adaptable, principled, imaginative, and not contingent on physical location (White, 2012). The technological foundation for digital transformation is understood as how a company employs its website for information dissemination, facilitates employees' usage of personal electronic devices for work purposes, implements internal interactive systems to reduce direct task assignment, leverages cloud computing techniques for internal management, and establishes a digital workspace (Nguyen and Nguyen, 2022).

Digital transformation pressure refers to the actions that businesses need to take during the process of digital transformation in order to create greater value. These actions include the utilization of digital technology applications to enhance customer interactions, optimize operational and managerial processes, foster improved interdepartmental collaboration, efficiently utilize resources, and innovate in product or service development to better serve customer needs hàng (Nguyen and Nguyen, 2022; Singhdong et al., 2021).

3. Methodology

3.1. Conceptual framework

Based on the comprehensive review of the research findings and theoretical foundations presented above, we outline the research framework of this study, as shown in Fig. 1. With this conceptual framework, we simultaneously examine the impact of various factors on the digital transformation process of SMEs in Hanoi using two mechanisms: (1) direct impact and (2) indirect impact through the intermediary variable 'Digital Transformation Intention.' We hypothesize that the indirect impact mechanism will yield stronger results compared to the direct mechanism, as the behavior of decision-makers is often heavily influenced by their intention to carry out such actions.

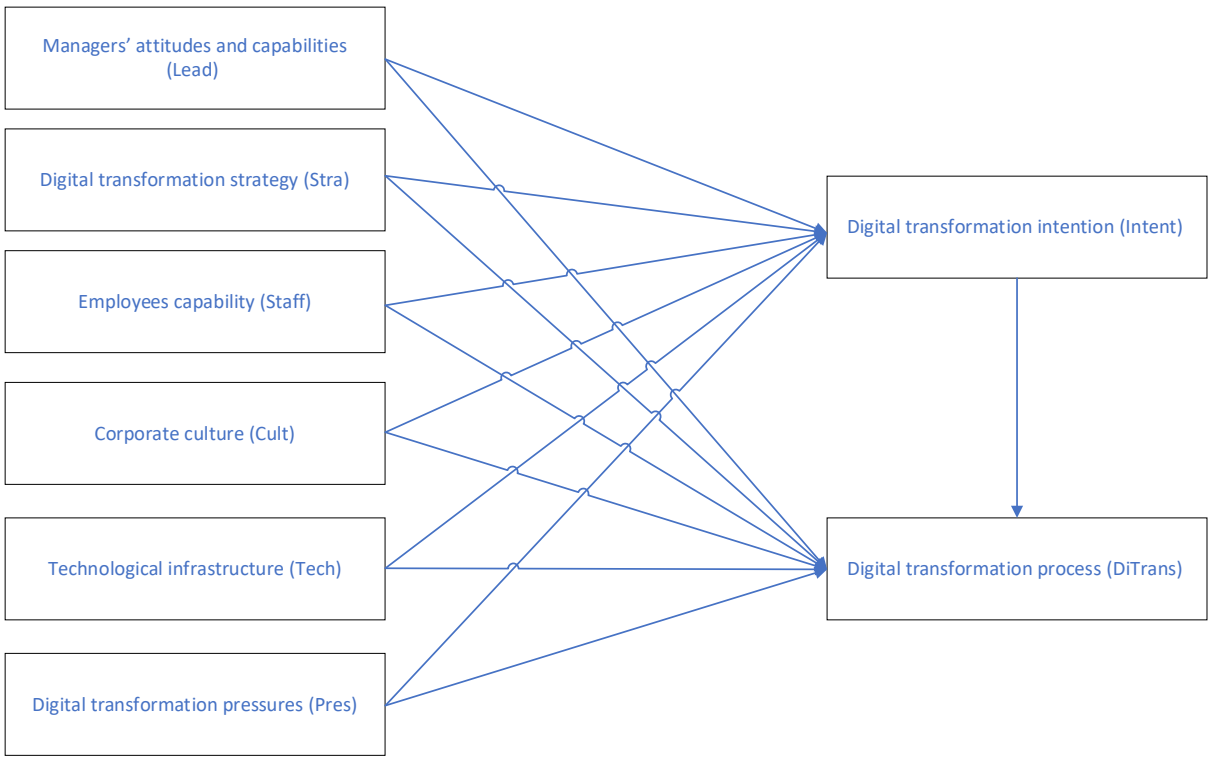

Fig. 1: Conceptual framework of factors affecting digital transformation process

3.2. Data collection

In this study, we rely on the number of questions to calculate a sample size that is both appropriate and reliable (Hair et al., 1998). Therefore, with a questionnaire containing content related to the research model comprising 36 observed variables, the minimum number of valid responses should be 180 or, ideally, 360 valid responses.

Based on sample size requirements, 500 survey forms were sent to small and medium-sized enterprises in Hanoi by direct contact and meeting. The result was 456 valid entries (more than 360 required), while 29 were invalid due to incomplete information. The response rate reached 91.2% (>90%), which confirms that representatives of small and medium-sized enterprises in Hanoi are very open when participating in the survey, and the answers are serious and trustworthy (Neuman, 2014). The detailed breakdown of the valid responses is shown in Table 1.

Table 1: Survey sample structure

Criteria	Structure	Number	Percentage (%)
By sector	Industry	161	35.3
	Agriculture	124	27.2
	Commerce/services	171	37.5
By labor scale	< 10 workers	96	21.1
	10-50 workers	140	30.7
	50-100 workers	149	32.7
	100-150 workers	48	10.5
	>150 workers	23	5.0
By revenue	< 3 billion VND	48	10.5
	3 – 10 billion VND	100	21.9
	10 – 50 billion VND	113	24.8
	50 – 100 billion VND	97	21.3
	100 – 150 billion VND	45	9.9
	150 – 200 billion VND	31	6.8
	>200 billion VND	22	4.8
Total		456	100

Table 1 shows that the sample structure in terms of sector is currently dominated by businesses operating in the commerce/services sector, with 171 enterprises accounting for 37.5%. Next is 161 enterprises operating in the industrial sector, accounting for 35.3%. Finally, there are 124 enterprises operating in the agricultural sector, accounting for 27.2%. This is understandable, as Hanoi is the economic and political center of the country, and the number of businesses operating in the commerce/services sector is much higher than in the other two sectors. Therefore, this sample structure is appropriate.

The outcome of the Exploratory Factor Analysis (EFA) employing the Principal Axis Factoring method with Promax rotation and a stopping criterion of eigenvalues greater than one was applied to analyze 36 observed variables. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of 0.833, signifying high adequacy, with a significance level of 0.000. Moreover, the eigenvalues reached 71.741, indicating substantial variance explained when the analysis terminated at a factor eigenvalue of 1.062. Notably, the rotation matrix revealed that the measurement items in the study consistently converged into six factors, aligning seamlessly with the originally proposed research model. Additionally, the reliability assessment of the concepts and research measures demonstrated that all factors exhibited Cronbach's Alpha coefficients exceeding the acceptable threshold of 0.6, affirming the suitability of the measurement scales employed in the study.

The measurement model with df=565 was assessed using CFA, and the results indicate that the model is compatible with the research dataset. The goodness-of-fit statistics are as follows: Chi-square=1568.149 (p=0.000), cmin/df=2.775, CFI=0.915, GFI=0.846, TLI=0.905, and RMSEA=0.062. These statistics collectively suggest a satisfactory model fit. Moreover, all standardized loadings of observed variables are greater than 0.5, and the unstandardized loadings of variables are statistically significant, affirming the convergence of measurement scales. The correlation coefficients between concepts are all less than one unit, indicating that the concepts are distinct. Overall, the measurement model is well-suited to the research dataset, with no significant correlations among measurement errors, ensuring model parsimony.

4. Results and discussions

4.1. The results of testing the model using SEM

The current state of relationships between factors influencing the digital transformation process in SMEs in Hanoi is estimated by an SEM model. The results are shown in Table 2.

Table 2: Results of standardized estimation of parameters in the theoretical model

Relationship between concepts	Standardized estimation	Unstandardized estimation	Standard deviation	t-value	p-value
R^2 of digital transformation intention=0.466					
Intent<--- Lead	0.155	0.145	0.038	3.791	0.000
Intent <--- Stra	0.199	0.185	0.048	3.866	0.000
Intent <--- Staff	0.201	0.240	0.067	3.560	0.000
Intent <--- Cult	0.059	0.051	0.039	1.314	0.189
Intent <--- Tech	0.509	0.434	0.055	7.874	0.000
Intent <--- Pres	-0.117	-0.099	0.050	-1.954	0.051
R^2 of digital transformation process=0.537					
Intent<--- Lead	0.128	0.136	0.041	3.314	0.000
Intent <--- Stra	-0.022	-0.024	0.052	-0.460	0.645
Intent <--- Staff	0.101	0.138	0.073	1.887	0.059
Intent <--- Cult	0.046	0.045	0.042	1.068	0.285
Intent <--- Tech	0.161	0.156	0.064	2.441	0.015
Intent <--- Pres	-0.001	-0.001	0.055	-0.017	0.986
DiTrans<--- Intent	0.546	0.621	0.075	8.267	0.000

The model estimation results illustrate that the impact of various factors on the "Digital Transformation Intention" within SMEs in Hanoi is reflected in an estimated model fit with an R-squared value (R2) of 0.466. This signifies that approximately 46.6% of the variation in "Digital Transformation Intent" among SMEs in Hanoi can be elucidated by six key factors: (1) The attitude and capabilities of managers; (2) Digital Transformation Strategy; (3) Employee Capability; (4) Corporate Culture; (5) Technology Infrastructure; and (6) Digital Transformation Pressure.

Similarly, the model estimation results indicate that the dependence of the "Digital Transformation Process" of SMEs in Hanoi on various factors, both through direct and indirect mechanisms, results in an R-squared value (R2) of 0.537. This implies that as much as 53.7% of the variation in the "Digital Transformation Process" among SMEs in Hanoi is accounted for by the factors within the model, while the remaining 46.3% is attributable to external factors not included in the model and random error.

4.2. Discussion

According to statistics from Market Research Future, a market research company, global investment in digital transformation in 2018 reached 205.65 billion USD. It is estimated that by 2025, this number will reach about 817.05 billion USD with an average annual investment growth rate of 18.87%. In Vietnam, less than 40% of businesses have enough financial capacity to meet the requirement of moderate to complete digital transformation to be

able to undertake consulting and solutions in the field of digital transformation. On the contrary, up to 43.3% of businesses plan to invest their budget in digital transformation, but in reality, they do not meet the actual needs of the business. More ominously, up to 20% of businesses certainly have no budget plan to invest in digital transformation. A lack of budget for digital transformation is also a common challenge for businesses in Vietnam, especially small and medium-sized enterprises.

Currently, Hanoi is home to approximately 360,000 businesses, with SMEs making up over 97.2% of this total. These SMEs contribute more than 45% to the city's gross regional products (GRDP) and provide employment for over 50% of the workforce.

To evaluate the current state of digital transformation at SMEs in Hanoi, researchers used statistical analysis to measure the average values of observed variables related to the "Transformation Process" factor. The study included 456 SMEs in Hanoi. Results indicate that the average values for this factor range from 3.29 to 3.82, with an overall average of 3.52 (Table 3). The highest scoring criterion, with an average of 3.82, was "Enterprises are fully capable of digitizing all business and management processes." This was followed by the criterion "Enterprises have a digital transformation strategy to offer new values and experiences to customers using digital technology platforms," which had an average score of 3.64. The third criterion, "Enterprises are transforming business models to enhance business efficiency," scored an average of 3.34. The lowest scoring criterion, "Enterprises are enhancing their management capabilities to improve business efficiency following successful digital transformation," had an average score of 3.29.

Table 3: Descriptive statistics on the current status of the digital transformation process at small and medium-sized enterprises in Hanoi

No.	Observed variable	Sample	Mean	Standard deviation
1.	Enterprises are fully capable of digitizing all business and management processes	456	3.82	0.83
2.	Enterprises have a digital transformation strategy to bring new values and experiences to customers on digital technology platforms	456	3.64	0.84
3.	Enterprises are digitally transforming their business models to achieve higher business efficiency	456	3.34	0.89
4.	Enterprises are digitally transforming their management capabilities to achieve higher business efficiency after successful digital transformation	456	3.29	0.87
5.	Average	456	3.52	0.86

This result shows that the level of digital transformation process at small and medium-sized enterprises in Hanoi is currently at an average level (3.52), in which they affirm that their business has the ability to digitize all business and management processes (3.82 out of 4-Agree), meaning they definitely have the ability to digitally transform at level 1, but they are not really sure whether their business can completely and successfully digital transform, because of the level of digital transformation confirmation at level 3 is quite low (3.29 out of 3-Normal).

The attitude and capabilities of managers have a positive impact on the intention to engage in digital transformation and, consequently, positively influence the digital transformation process of SMEs in Hanoi. Accepting this hypothesis with a 99% confidence level (p=0.000) and a standardized Beta value of 0.155 implies that if the attitude and capabilities of managers of SMEs in Hanoi possess awareness, determination, and a desire for digital transformation within their businesses, intention to implement digital transformation will be higher. Consequently, this intention indirectly contributes positively to the enterprise's overall digital transformation process. This result aligns with the Theory of Planned Behavior (TPB), where behavioral intention is strongly influenced by individuals' perceptions and attitudes, emphasizing the pivotal role of the attitude and capabilities of managers in fostering digital transformation within SMEs. This is further explained in studies on the emotions of decision-makers affecting the intention to apply new management methods. For example, if the leader is a modern person, the intention to apply will be stronger than in the case of leaders with traditional tendencies (Mai et al., 2009; Kim and Kim, 2022).

Digital transformation strategy has a positive impact on the intention to engage in digital transformation and consequently positively influences the digital transformation process of SMEs in Hanoi. This hypothesis is accepted with a confidence level exceeding 99%, as indicated by a p-value of 0.000 and a standardized Beta value of 0.199. Notably, this ranks as the third highest among the influencing factors. This suggests that if SMEs in Hanoi adopt clear digital transformation strategies, their intention to pursue digital transformation is higher. However, it is essential to note that the majority of these enterprises currently lack a well-defined digital transformation strategy (scoring 2.84 on average). This is also the reality that exists in many Vietnamese businesses today (small and medium-sized enterprises do not have clear strategies and directions) (Hai et al., 2021). This is a significant observation, emphasizing the need for policies and initiatives to promote the digital transformation process among SMEs in Vietnam in general and specifically in Hanoi.

Corporate culture has a positive impact on the intention to digitally transform and thereby positively impacts the digital transformation process

of small and medium-sized enterprises in Hanoi. Based on the estimation results, there is not enough basis to conclude this relationship. In other words, this study shows that corporate culture has no relationship to influencing the digital transformation intention of small and medium enterprises in Hanoi (p_value=0.189). This is consistent with the fact that small and medium-sized enterprises with small scale and low seniority, where the role of corporate culture is still quite blurred in organizational issues.

Technology infrastructure has a positive impact on the intention to engage in digital transformation and, consequently, positively influences the digital transformation process of SMEs in Hanoi. This hypothesis is accepted with a confidence level exceeding 99%, as indicated by a p-value of 0.000, and it holds the highest standardized Beta value among the influencing factors, at 0.509. However, the current state of this factor reflects that the technology infrastructure supporting the digital transformation in SMEs in Hanoi is relatively low, with an average factor score of only 3.07. This underscores the importance of addressing technology infrastructure challenges to facilitate and enhance digital transformation efforts among SMEs in the Hanoi region.

Digital transformation pressure has a positive impact on the intention to engage in digital transformation and, consequently, positively influences the digital transformation process of SMEs in Hanoi. This hypothesis is rejected with a confidence level slightly above 90% (p-value=0.051), and it has a standardized Beta value of -0.117. This implies that as digital transformation pressure increases, the intention to engage in digital transformation decreases or vice versa. This result aligns with the statistical findings where the average score for the "Digital Transformation Pressure" factor is 2.89, while the average score for the digital transformation intent factor is 3.63. It suggests that there may be a negative association between the perceived pressure to digitally transform and the actual intention to do so among SMEs in Hanoi.

The attitude and capabilities of managers have a positive impact on the digital transformation process of SMEs in Hanoi. This hypothesis is accepted with a confidence level exceeding 99% (p-value=0.000), and it achieves a standardized Beta value of 0.128. These findings align with previous research, including the study conducted by Nguyen and Nguyen (2022), which reported a p-value of 0.000 and a standardized Beta value of 0.32. Many other studies also support this consensus, indicating that the attitude and capabilities of managers play a significant role in influencing the digital transformation process of SMEs in Hanoi. This underscores that whether a business undergoes digital transformation and the pace at which it occurs is heavily dependent on the manager's awareness and determination.

Digital transformation strategy has a positive impact on the digital transformation process of SMEs in Hanoi. However, it's important to note that the findings regarding this relationship are inconclusive. In other words, this research did not find a significant impact of digital transformation strategy on the digital transformation process of SMEs in Hanoi (p-value=0.645). This result is not consistent with the study conducted by Nguyen and Nguyen (2022), which reported a p-value of 0.000 and a standardized Beta value of 0.26 for this relationship. This discrepancy might be explained by the fact that many SMEs currently do not have a well-established digital transformation strategy and often focus on yearly financial plans instead.

Employee capability has a positive impact on the digital transformation process of SMEs in Hanoi. This hypothesis is accepted with a confidence level exceeding 90% (p-value=0.059), and it achieves a standardized Beta value of 0.101, indicating a positive relationship between employee capability and the digital transformation process of SMEs in Hanoi. These results align with the study conducted by Nguyen and Nguyen (2022), which reported a p-value of 0.000 and a standardized Beta value of 0.5 for this relationship, although the effect is somewhat weaker. This difference may be explained by the specific characteristics of the research sample, which primarily consists of small-scale businesses with low employee counts and revenue levels.

The corporate culture has a positive impact on the digital transformation process of SMEs in Hanoi. However, it is important to note that the findings regarding this relationship are inconclusive. In other words, this research did not find a significant impact of corporate culture on the digital transformation process of SMEs in Hanoi (p-value=0.285). This result is not consistent with the study conducted by Nguyen and Nguyen (2022), which reported a p-value of 0.000 and a standardized Beta value of 0.18 for this relationship. This can be explained by the influence of Asian cultural factors that create people with a perfectionist personality and less tolerant of change (Mai et al., 2009), leading to poor decision making to apply new management methods to the organization of business leaders (Dung et al., 2023).

Technology infrastructure has a positive impact on the digital transformation process of SMEs in Hanoi. This hypothesis is accepted with a confidence level exceeding 95% (p-value=0.015), and it achieves a standardized Beta value of 0.161. These results align with the study conducted by Nguyen and Nguyen (2022), which reported a p-value of 0.000 and a standardized Beta value of 0.38 for this relationship. Once again, this reaffirms the crucial role of technology infrastructure in the digital transformation process of SMEs in Hanoi. In fact, some businesses have applied digital technology, but mainly in some specific operations, which have not been deployed synchronously and comprehensively. In terms of software usage in business activities, accounting is the profession in which SMEs in Hanoi have the largest proportion, with nearly 40% of businesses using digital technology at a high level and frequently. The current situation of vehicle management and freight transportation in

businesses in Hanoi shows that 64% of businesses only use digital software to a very small extent or very rarely. Enterprises that regularly apply digital software in this activity account for a low rate, only 18.25%. More than 40% of businesses currently do not or rarely use digital software in warehouse, order, customer, and human resource management activities (Le Viet and Dang Quoc, 2023).

Digital transformation pressure has a positive impact on the digital transformation process of SMEs in Hanoi. However, it is important to note that the findings regarding this relationship are inconclusive. In other words, this research did not find a significant impact of digital transformation pressure on the digital transformation process of SMEs in Hanoi (p-value=0.986). This result is not consistent with the study conducted by Nguyen and Nguyen (2022), which reported a p-value of 0.000 and a standardized Beta value of 0.33 for this relationship.

The intention to undergo digital transformation has a positive impact and, consequently, positively influences the digital transformation process of SMEs in Hanoi. This hypothesis is accepted with high confidence, with a p-value of 0.000 and a significantly high standardized Beta value of 0.546. This finding suggests that the indirect causal mechanism has a stronger influence on the relationship between factors and the digital transformation process of SMEs in Hanoi than the direct causal mechanism. It indicates the importance of considering the intention to undergo digital transformation as a crucial driver for successful digital transformation processes in SMEs in Hanoi.

5. Conclusion

Through our research on the factors influencing the digital transformation process of SMEs in Vietnam, based on data collected from 456 SMEs in Hanoi, we have examined and validated six factors affecting this process through both direct and indirect causal mechanisms. The results demonstrate that the influence of these factors on the digital transformation process is stronger through the indirect causal mechanism mediated by "digital transformation intention" than through direct causation. This finding further supports the Theory of Planned Behavior (TPB) and provides theoretical and practical foundations for conducting future research on the digital transformation process of businesses. The results of this study may be applicable not only to SMEs in Vietnam but also to similar developing countries, given the similarities in economic, social, and technological conditions.

List of abbreviations

Lead	*The attitude and capabilities of managers*
Stra	*Digital transformation strategy*
Staff	*Employee capability*
Cult	*Corporate culture*
Tech	*Technology infrastructure*
Pres	*Digital transformation pressure*
Intent	*Digital transformation intention*
DiTrans	*Digital transformation process*

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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