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# Factors Influencing SMEs' Digital Transformation: The case study in Central Highlands in Vietnam

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**Abstract.** Digital transformation (DT) has become critical for the success and sustainability of small and medium-sized enterprises (SMEs). This study aimed to examine the factors influencing DT in SMEs, with a focus on technological, organizational, and environmental contexts. A survey was conducted with 380 SMEs in the Central Highlands region of Vietnam. The results showed that technological capability, organizational factors like structure and resources, and environmental elements including government regulations and competitive pressure positively influenced SMEs' digital transformation. Additionally, the study found that the leader's age and entrepreneurial experience moderated the relationships between these factors and digital transformation. The findings provide valuable insights for SME owners, managers, and policymakers in implementing strategies and initiatives to support the digital transformation of SMEs.

**Keywords:** Digital Transformation, SMEs, Factors influencing SMEs digitalization.

# 1. Introduction

International Labour Organization (2019) showed that smaller economic units play a substantial role in the creation of job possibilities. In fact, small businesses, newly established businesses, and individuals working for themselves account for more than two-thirds, or 70%, of the total workforce. In addition, the self-employed and micro-enterprises, when viewed separately from one another, make a sizeable contribution to the overall employment picture. Their combined share of the whole labour market accounts for between 80 – 90% of the total workforce in low-and middle-income nations. This suggests that the bulk of people who are working in these nations are either self-employed or work in enterprises that are relatively tiny in scale. South Asia stands out among other areas as having the greatest employment proportion that can be attributable to the self-employed and micro-enterprises. This lends credence to the notion that a significant proportion of the working population in South Asia is either self-employed or employed by a smaller-scale business of income in the region (International Labour Organization, 2019).

Thanks to the connectivity platforms made possible by Industry 4.0, established industries are undergoing a shift to a digital era. Today's machines, devices, and commodities can readily communicate, learn from one another, and quickly adjust to market shifts (Frank et al., 2019). This means that by adopting new technologies, SMEs can boost their production capacities and global competitiveness (Kraft et al., 2022; Malodia et al., 2023). In this light, Industry 4.0 technologies may provide a potent resource for companies seeking to sustain or improve their competitive standing in both domestic and international markets. Digital technologies have been shown in studies to improve enterprises' cost-efficiency and product differentiation strategies which can lead to expanded opportunities in the market and higher profits for SMEs. SMEs can benefit by customizing products and services to individual consumers, creating new services to meet unmet consumer needs, and better-controlling manufacturing processes to minimize costs. However, many SMEs continued to lag in adoption (OECD, 2021). Telukdarie et al. (2023) argued that SMEs have a hard time adopting digital technology because of a lack of management resources and financial constraints. Furthermore, Benitez et al. (2020) showed that despite efforts to remove financial barriers, SMEs may be slow to adopt digital technologies due to uncertainty about their return on investment or an inability to fully capitalize on the digital opportunities presented by Industry 4.0. It is important to note, therefore, that despite the fact that the accelerated adoption of digital tools may be a silver lining to the cloud that the crisis has cast, there is still a continuous need for advice, support, and guidance from reliable sources in order to cement the transition, address risks, and exploit the potential of the new tools.

The Central Highlands in Vietnam faced challenges regarding human resource quality, with the region experiencing the highest poverty rate and slowest economic development (General Statistics Office, 2022). The economic growth in this area was largely extensive and relied heavily on capital, cheap labor, and the exploitation of natural resources such as forests and hydropower, while advancements in technology and institutions played a minor role in contributing to overall productivity (Ngoc et al., 2021). Recognizing the need for change, localities, and businesses in Central Vietnam and Central Highlands have been developing strategies and action plans to promote green growth and facilitate digital transformation, seeking more environmentally friendly development models. To tackle these issues, Central Highlands' digital transformation requires essential IT infrastructure upgrades, the modernization and expansion of trade infrastructure to foster connections with domestic and international markets, and the promotion of e-commerce and logistics (Anh Huyen, 2022). With the emergence of Industry 4.0, science and technology have become crucial drivers of economic growth. It is an empirical gap in the context of digitalization in Central Highlands, Vietnam that need to be addressed.

## 2. Literature Review and Hypothesis Development

To assist in developing a model for digital transformation, the relevant literature on the Technology-Organization-Environment (TOE) framework, Innovation Diffusion Theory (DOI) were examined. Both DOI and TOE have had widespread application in studies of IT adoption, and both have received strong empirical support as shown in Table 1. DOI Theory as a helpful change model for leading technological innovation in which the innovation itself is updated and presented in ways that fit the demands of adopters at all levels (Rogers,1995). It also emphasizes the value of communication and peer networking during the adoption phase. By considering the characteristics of the innovation and the context in which it will be adopted, organizations can develop strategies to facilitate the diffusion of digital technologies and ensure their successful integration into their operations. In addition, TOE framework is a theoretical framework that investigates the factors influencing new technology adoption and deployment inside businesses (Tornatzky & Fleischer, 1990). The TOE approach acknowledges the complex interplay of technological, organizational, and environmental elements in affecting technology adoption and integration outcomes. The primary concentration of the technical environment is on the ways in which the qualities of the technology can have an effect on the adoption (Low et al., 2011). The organizational context is a description of the qualities of an organization that either limit or expand the ability of an organization to accept technological breakthroughs. The external environmental context is where a company operates its business (Yoon & George, 2013). Although the characteristics of the three contexts differ, Table 1 shows that the TOE framework has consistent empirical support across investigations (Low et al., 2011; Lutfi et al., 2016; Ramdani et al., 2013; Yoon & George, 2013). Furthermore, many researchers tested the TOE framework's applicability in understanding the factors that imply that IT innovation characteristics, organizational characteristics, and environmental variables influence organizational acceptance of IT innovation in SMEs and found it useful in determining the variables (Abed, 2020; Gutierrez et al., 2015; Oliveira et al., 2014). As a result, we adopted the TOE framework and applied it to the DT.

The utilization of technology, changes in value generation, organizational structural changes, and financial factors comprise DT. One of the most important aspects of DT is the adoption of modern technology. Digital technology is an integrated and required component of DT projects. As a result, determining the viability of new digital technology for DT is a critical first step toward a successful DT endeavor (Afriliana & Ramadhan, 2022). For SMEs, DT has become a vital strategic initiative aiming to remain competitive and thrive in the digital age.

*Technology–Organization–Environment (TOE) framework*

The technological context: Technology is undoubtedly a critical component of digital transformation (Tarute et al., 2018). Existing technologies of a company are significant in the adoption process because they establish a broad restriction on the breadth and pace of technological change that a company can undertake. Moreover, Information Technology (IT) has played a crucial role in assisting individuals and organizations in solving problems which coming from various resources provided by standard information systems, such as databases, software applications, and data analytics tools (Altarawneh & Tarawneh, 2023). Existing innovations that are not yet in use at the firm also impact innovation by defining the limits of what is feasible and demonstrating to firms how technology might enable them to change and adapt (Baker, 2012). DOI theory (Rogers,1995) defines compatibility as the degree to which an innovation is viewed as being consistent with past experiences, existing values, and the demands of potential adopters. Yoon & George (2013) hypothesized that compatibility could impact an organization's readiness to adopt a new transformation. The extent to which an innovation is seen to be consistent with the requirements of the already established practices of potential adopters is reflected by the invention's compatibility (Tornatzky & Fleischer, 1990). It also describes how well something fits in with the existing information technology (IT), values, work practices, and culture of an organization. Numerous researches examining the factors that influence IT innovation have concluded that compatibility is crucial (Abed, 2020; Lutfi et al., 2016; Wong et al., 2020).

*H1: The technological factor will positively influence digital transformation*

The organizational context: When deploying ICT and digital transformation, SMEs confront several problems, including financial, human, organizational structure, and capital constraints (Kraft et al., 2022). In addition, SMEs appear skeptical when it comes to the point when they must trust the fundamental technologies and instruments of the digital economy, such as issues over security and privacy. According to Leavitt (1965), industrial organizations are regarded to be complex systems that consist of at least four interdependent components. These aspects include people, technology, structure, and task. Leavitt believed that changes in any one of these four dimensions would have an effect on the other three. For workers to carry out tasks such as delivering services and manufacturing goods, they need to have the appropriate qualifications. Consequently, individuals find themselves embedded inside systems that govern aspects such as the communication process.

Although digital transformation is defined by technical features, the success of this process is contingent on the ability of corporate executives to modify their business models to take advantage of disruptive innovations in information and communications technology. In parallel, The technology-push innovation strategy is the primary foundation on which the Industry 4.0 movement is built, as it originates from direct competitors operating inside the same industry as the product firms themselves (Frank et al., 2019).

*H2: The organizational factor will positively influence digital transformation*

The environmental context: The final group (Environmental context in TOE framework) represents the outside influence on the digital transformation process in SMEs. It comprises the industry's structure, the pressures, and the regulatory setting. Firstly, government regulation may have either a positive or negative impact on innovation (Baker, 2012). Government rules and institutions, such as competence centers and research institutions, play a significant role in the success of the industry (Gašperlin et al., 2021). In addition, the level of pressure from competitors inside the environment in which the enterprises operate is referred to as competitive pressure (Lutfi et al., 2016). An effective business strategy aims to increase market competitiveness which has been regularly recognized as one of the elements influencing DT, as demonstrated by numerous research (Oliveira et al., 2014; Ramdani et al., 2013; Wong et al., 2020). In other words, when competitors begin to embrace DT, enterprises will be compelled to use it more widely as part of their efforts to maintain competitiveness. Thirdly, the preparedness of a company's suppliers and business partners is essential to the smooth rollout of digital technologies (Gutierrez et al., 2015). This is because there are crucial drivers for adopting inter-organizational systems within partner relationships. Businesses are more likely to adopt new technologies if their suppliers and partners have a high level of competence with these technologies (Abed, 2020). Adopting cutting-edge technology is heavily influenced by the expectations of one's commercial partners. Finally, encouragement, dedication, and pressure from customers, as well as trust between an organization and its customers, are key factors in technology adoption (Yoon & George, 2013). It has been shown that providing electronic customer services, which improve customer interaction, drives technology adoption in firms (Abed, 2020). Because customers expect it, companies are adopting new innovative technologies. Consumer pressure on technology adoption has been shown to be significant in several studies.

*H3: The environment factor will positively influence digital transformation.*

The TOE framework was put through a great amount of testing by researchers from a variety of countries and settings. Fig. 1 provides both a comprehensive list of factors as well as a list of significant variables based on their findings.

| Authors | Technological | Organizational | Environmental |
|---|---|---|---|
| Low et al. (2011) | Relative advantage<br>Complexity<br>Compatibility | Top Management Support<br>Firm size<br>Technological readiness | Competitive pressure<br>Trading partner pressure |
| Yoon & George (2013) | Relative Advantage<br>Compatibility<br>Security Concern | Top Management Support<br>Organization Readiness<br>Organization Size<br>Firm Scope | Normative Pressure<br>Coercive Pressure – Customers<br>Mimetic Pressure – Competitors<br>Intensity of Competition |
| Ramdani et al. (2013) | Relative Advantage<br>Compatibility<br>Complexity<br>Trialability<br>Observability | Top Management Support<br>Organizational readiness<br>ICT Experience<br>Size | Industry<br>Market scope<br>Competitive pressure<br>External ICT support |
| Oliveira et al. (2014) | Relative advantage<br>Complexity<br>Compatibility | Top management support<br>Firm size<br>Technological readiness | Competitive pressure<br>Regulatory support |
| Fosso Wamba et al. (2016) | Relative Advantage<br>Compatibility<br>Complexity | Firm size | Competitive Environment<br>Firm Geographic Location<br>Country |
| Lutfi et al. (2016) | Relative Advantage<br>Compatibility | Organization Readiness<br>Owner/Manager Commitment | Competitive pressure<br>Government support<br>Networking |
| Loukis et al. (2017) | ICT infrastructure sophistication | ICT investment reduction strategy<br>Innovation strategy<br>Employment of ICT personnel<br>ICT skills of employees<br>ICT outsourcing<br>Size | Price competition<br>Quality competition |
| Abed (2020) | Perceived Usefulness<br>Security Concern | Top Management Support<br>Organization Readiness | Consumer pressure<br>Trading partner pressure |
| Wong et al. (2020) | Relative Advantage<br>Complexity | Top Management Support<br>Cost | Market Dynamics<br>Competitive Pressure<br>Regulatory support |

Fig. 1: T-O-E Factors influencing IT Adoption/ Digital Transformation.

*Age of leader and age of enterprise*

According to Fosso Wamba et al. (2016), the characteristics of managers play a significant role in the adoption of any IT innovation by SMEs. Leader's SME are increasingly important due to limited resources. Only these professional executives make new decisions that need financial and organizational commitment, like digital transformation (Malodia et al., 2023). Age of leader (Zoppelletto et al., 2023), for instance, has been shown to influence the adoption and utilization of technologies. SMEs' digital transformation may be moderated by the CEO's and enterprise's ages (Fosso Wamba et al., 2016; Wang & Shih, 2009). Although younger businesses are more likely to digitalize their operations, more established companies will transition earlier. At the same time, younger business people who are more tech-savvy than their more seasoned counterparts are more willing to initiate digital transformation in their companies (Malodia et al., 2023). Young entrepreneurs are more professional and digitally self-sufficient. According to Wang & Shih (2009), age of entrepreneurs put out the hypothesis that acting as a barrier to the incorporation of digital transformation.

In a similar vein, the process of DT occurs more quickly in older companies when compared to younger companies. Malodia et al. (2023) stressed older firms are motivated to adopt digital transformation as a result of their experience, the number of years they have been in business, and the lessons they have learned. These two factors, which also contribute to the digital transformation process, act as a moderating influence on the level of digital capacity owned by SME owners. We postulate that the age of the organization and the age of the firm are two moderating variables that influence the link between TOE factors and digital transformation in SMEs.

*H4a-c: Age of entrepreneur moderates the correlation between Technologgy and Digital transformation; Organization and Digital transformation; Environment and Digital transformation.*

*H5a-c: Age of firm moderates the correlation between: Technology and Digital transformation; Organization and Digital transformation; Environment and Digital transformation.*

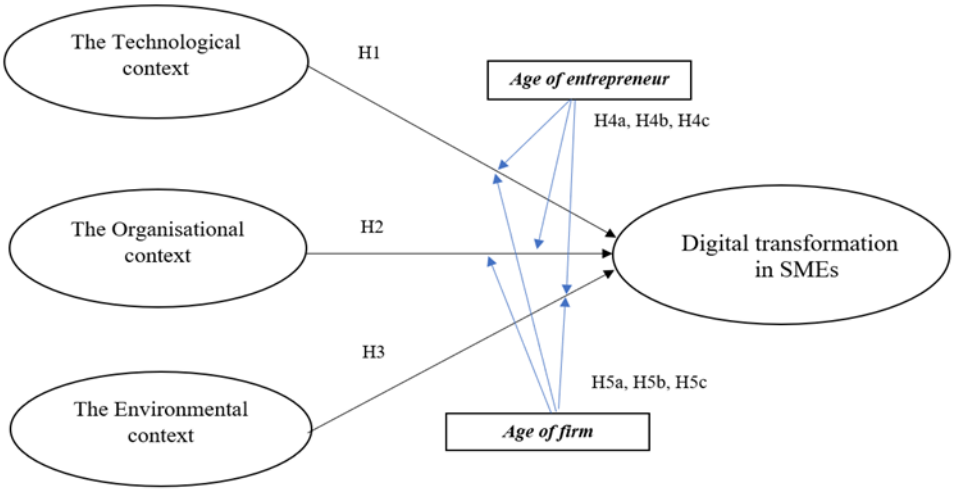


Fig. 2: Research framework.

## 3. Research Methodology

The research utilized a stratified random sampling technique based on data obtained from the Ministry of Planning and Investment of Vietnam's website, which involved a fee. The size of each firm was categorized as micro, small, or medium, determined by the number of employees and turnover volume (Oliveira et al., 2014).

A preliminary pilot study with 88 companies at five Central Highlands provinces, namely Lam Dong, Gia Lai, Kon Tum, Dak Lak, and Dak Nong was conducted to assess the constructs, and these companies were excluded from the main survey. The objects to be interviewed included business managers, owners, and specialists who perceived and grasped the firm's level of digital transformation. The results of the pilot study showed that the measurement scales used in the research were reliable and valid. Out of the 480 distributed questionnaires, 380 responses were considered valid for analysis. The Technology-Organization-Environment (TOE) framework was employed, and the questionnaire's items were directly drawn from existing research (see Appendix A). Each construct (technology, organization, environment) was measured using a five-point Likert scale, ranging from "strongly disagree" to "strongly agree." The data collection period spanned from January 2023 to May 2023.

To strengthen the validity of the findings and minimize self-reporting bias, Podsakoff et al. (2003) showed that Harman's one-factor (or single-factor) test is one of the most valuable strategies. The study will use this technique to determine the number of factors necessary to account for the variance in the variables.

Using covariance-based structural equation modeling (CB-SEM) was deemed appropriate based on the size of the sample and the soundness of the assumptions for performing multivariate analysis. Then, we created a measurement model using confirmatory factor analysis (CFA). The suggested study framework's path relations were then tested using SEM (Fornell, C., & Larcker, 1981). The CFA was used to examine the reliability and validity of the study framework's constructs. The SEM, on the other hand, was used to assess the strength and importance of the structural routes proposed in the research framework.

## 4. Result and Discussion

Table 1 shows the demographic details of the respondents. The majority of responders, 76.3%, range in age from 30 to over 50 years old. The participants who responded to the study revealed that 55% of them had managerial positions (director or CEO), compared to 36.6% who were owners and 8.4% who were experts. The majority of the businesses that participated in the study were classified as either small or medium-sized businesses (81%) with 10–200 employees, followed by extremely small organizations

(19%) with fewer than 10 workers. In total, 32.6% of them had been performing for three to five years, while 35.3% had been performing for five to ten years, 11.6% had been acting for less than three years, and 20.5% had been performing for more than ten years.

Table 1. Respondents' descriptive statistics.

| | | Frequency | Percentage |
|---|---|---|---|
| **Age of Firm** | < 3 years | 44 | 11.6 |
| | 3-less than 5 years | 124 | 32.6 |
| | 5-less than 10 years | 134 | 35.3 |
| | >10 years | 78 | 20.5 |
| **Age of Leader** | <30 years | 90 | 23.7 |
| | 30-less than 50 | 171 | 45.0 |
| | > 50 | 119 | 31.3 |
| **Job** | Expert | 32 | 8.4 |
| | Owners | 139 | 36.6 |
| | Managers | 209 | 55.0 |
| **Industry** | Agriculture | 34 | 8.9 |
| | Service | 133 | 35.0 |
| | Transportation | 87 | 22.9 |
| | Construction | 99 | 26.1 |
| | Others | 27 | 7.1 |
| **Number of Employees** | <10 | 72 | 18.9 |
| | 10-99 | 162 | 42.6 |
| | 100-199 | 146 | 38.4 |

*Common method bias (CMB):* The Harman single factor test was also used to calculate the explained variance and reveal common method bias. A single component explained just 23.815% of the variance. Because the explained variation was less than 50% (Podsakoff et al., 2003), there was no CMB.

*Discriminant validity:* The results of Table 2 show that every construct CR was higher than 0.7, which indicates that every measure may be regarded reliable. The AVEs value, the standardized loadings, and the t-values of the item loadings are what we look at in order to determine the convergent validity of the data. According to the findings of our investigation, each and every AVE calculated for a factor that loaded on its own independent construct was valid (it was greater than 0.5). In addition to this, the square root of the average variance extracted (AVE) for each construct that was included in the model was higher than the correlations that were discovered between that specific construct and the constructs of any other models. This was the case regardless of which models were being compared (Fornell, C., & Larcker, 1981).

Table 2: Result of Reliability Test

| | Cronbach's Alpha | C.R | AVE | TECH | ORG | EN | DT |
|---|---|---|---|---|---|---|---|
| **Technology** | 0.830 | 0.832 | 0.623 | **0.789** | | | |
| **Organization** | 0.868 | 0.868 | 0.524 | 0.089 | **0.724** | | |
| **Environment** | 0.825 | 0.825 | 0.541 | -0.053 | 0.098 | **0.735** | |
| **Digital transformation** | 0.821 | 0.822 | 0.606 | 0.487 | 0.386 | 0.453 | **0.778** |

*Model Fitness & Structural Model:* Indicators were utilized in order to assess the level of model fitness as follows: CMIN/df, CFI, SRMR, RMSEA and Pclose. As shown in Table 3, CMIN/df = 1.076 < 3; CFI = 0.997 > 0.95; SRMR = 0.035 < 0.08; RMSEA = 0.014<0.06, Pclose=1>0.05. Thus, the model matches the research hypothesis (Hu, L.T. & Bentler, 1999).

Table 3: Hypotheses Testing Result

| Hypothesis | | | | Estimate | Std Es | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|---|---|
| **H1** | DT | <--- | TECH | 0.429 | 0.485 | 0.051 | 8.474 | *** | Supported |
| **H2** | DT | <--- | ORG | 0.276 | 0.299 | 0.049 | 5.683 | *** | Supported |
| **H3** | DT | <--- | EN | 0.433 | 0.449 | 0.056 | 7.697 | *** | Supported |

Model Fit Statistics ($\chi 2$ = 105.442, CMIN/df =1.076, df = 98; CFI = 0.997, SRMR=0.035, RMSEA = 0.014, Pclose=1).

The study model included a total of 5 hypotheses; 3 of those hypotheses (H1, H2, and H3) were validated (see Table 3). Digital Transformation is favorably influenced by the technology context ($\beta$= 0.485, p<0.05), the organizational context ($\beta$ = 0.299, p <0.05), and the environment context ($\beta$ = 0.449, p<0.05), which provides support for hypotheses 1, 2, and 3. The conceptual model explains 61.419% of the variation in digital transformation in SME's.

*Moderation:*

The findings of the multiple regression showed a significant effect of technology on digital transformation ($\beta$=0.475, S.E=0.023, p<0.01), which indicated that higher levels of DT were connected with higher levels of technological capacity. The organization also significantly influenced DT ($\beta$=0.296, S.E=0.022, p<0.01). Similarly, the environment was favorable on DT with $\beta$=0.437, S.E=0.02, and p<0.01. On the other hand, these effects were moderated by a substantial moderation (age of leader) between technology, organization, environment, and DT (in turn $\beta$tech=-0.126, S.E=0.02, p<0.01; $\beta$org=-0.115, S.E=0.021, P<0.01, $\beta$en=-0.107, S.E=0.02, p<0.01). This indicates that the effect of these factors on DT differed according to the leader's age. Indeed, younger entrepreneurs recently tend to have grown up in the digital age. They are more likely to be comfortable with technology, better understand technological tools and platforms, and be open to adopting new technologies (Malodia et al., 2023). On the contrary, older leaders may bring a wealth of experience and industry knowledge. While they may not have grown up with digital technologies, their deep understanding of the business landscape can be invaluable when implementing digital strategies. They can provide valuable insights into how technology can align with existing processes and enhance efficiency. Fig. 3 and Fig. 4 provide a visualization of the moderation.

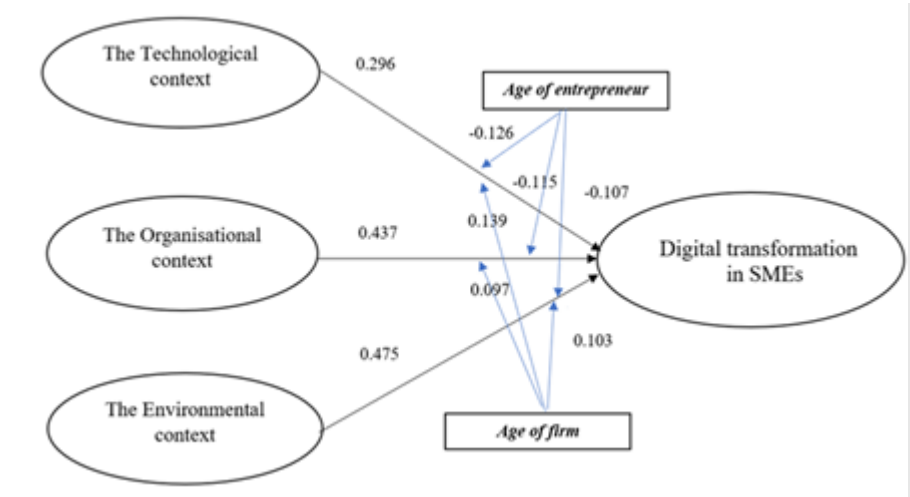


Fig 3. The outcomes of hypothesis

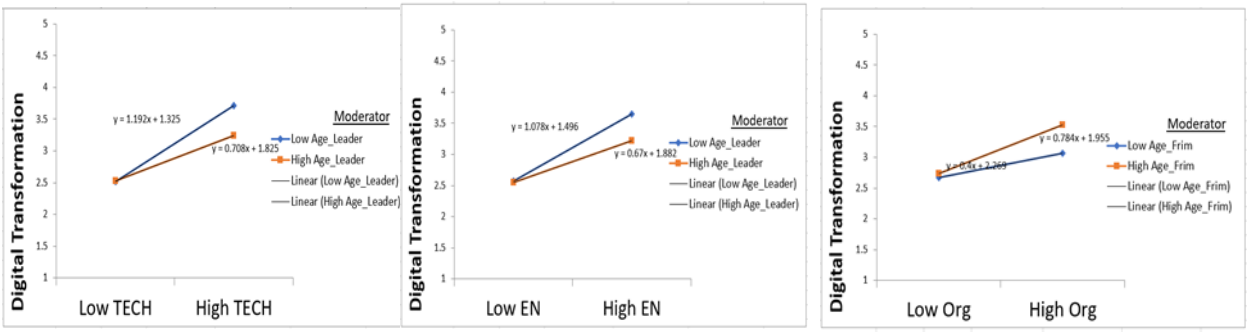


Fig 4. Moderation effect of age of the entrepreneur

The age of the firm, another moderation variable, moderated the association between TOE and DT (βtech = 0.139, S.E=0.024, p<0.01, βorg= 0.097, S.E=0.022, p<0.01, and βen=0.103, S.E=0.021, p<0.01 seen Fig. 5 and Fig. 3). As a result, older entrepreneurs and long-established firms may have a more traditional mindset, which can make them resistant to change and less inclined to invest in digital technologies.

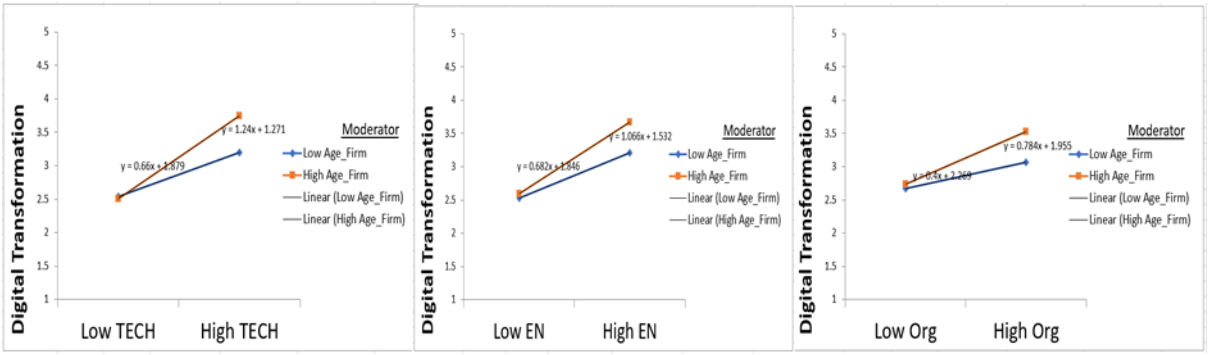


Fig 5. Moderation effect of age of the enterprise

# 5. Implications and Limitations

## 5.1. Implications

Firstly, the findings of this study emphasize the importance of creating an enabling environment for SMEs' digital transformation. Government regulations and policies should be designed to facilitate the adoption of digital technologies by SMEs. Financial incentives, training programs, and support services can encourage SMEs to invest in digital capabilities. Policymakers should also focus on improving digital infrastructure and connectivity in the Central Highlands region to enhance SMEs' access to digital resources.

Secondly, the study highlights the significance of technological capabilities and organizational factors in driving digital transformation. SME owners and managers should prioritize investing in digital skills and technologies to stay competitive in the rapidly evolving business landscape. Adopting innovative organizational structures and allocating resources strategically can help SMEs effectively integrate digital technologies into their operations.

Thirdly, the research indicates that the age and entrepreneurial experience of leaders can moderate the relationship between various factors and digital transformation. The moderating effects of age of entrepreneurs and firms suggest that individual and organizational characteristics can shape the impact of technological advancements on digital transformation. SME leaders should be encouraged to embrace lifelong learning and upskill themselves in digital technologies to effectively drive digitalization within their organizations. The research contributes to the existing literature on digital transformation in SMEs and provides valuable insights for academia, policymakers, and practitioners. Therefore, targeted training and development programs aimed at enhancing digital literacy and

entrepreneurial skills among SME leaders could yield positive outcomes in facilitating their digital transformation journey.

### 5.2. Limitations and future research

The research has certain limitations that need to be acknowledged. The first, the study's sample is confined to the Central Highlands region of Vietnam, which means that the findings may not fully represent the entire reality of Vietnam. Moreover, it would be interesting to compare the DT of SMEs in various socioeconomic contexts or to perform a cross-cultural study to compare and evaluate the results in other cultural situations (Zoppelletto et al., 2023).

The second, the speed of digitalization varies across industries due to their distinct characteristics, and this aspect should be considered in future studies. It is suggested that separate models be developed for each industry rather than a comprehensive one combining innovation characteristics. This would require additional research to estimate models similar to those developed for the manufacturing and services sectors (Oliveira et al., 2014).

Finally, besides two moderators (age of firm and age of leader), adding new moderating variables to the suggested framework, such as ownership structure (family-owned vs. professionally controlled) and business model (manufacturer vs. original equipment manufacturer) (Malodia et al., 2023), might be the new approach in the future.

## 6. Conclusion

Despite these limitations, the proposed model in this research serves as a strong foundation for future endeavors.

This study makes a contribution to individual differences among SME entrepreneurs as antecedents of digital transformation in their respective SMEs and outcomes that result from such transformation by empirically examining the relationships between digital transformation and the individual characteristics of SME entrepreneurs and enterprises themselves. Specifically, this study looks at the relationships between digital transformation and the likelihood that an SME will adopt new digital technologies in Vietnam. According to the findings of the study, the favorable influence of technology, organization, and environment on the digital transformation of SMEs was identified, the same result (Abed, 2020; Malodia et al., 2023; Wong et al., 2020).

Finance, structure, culture, people, communication, and readiness were discovered to be fundamental elements for fostering digital transformation in SMEs. In addition, the government regulatory, external pressures, and external support all have a favorable impact on DT as environment aspects. Specifically, this study focuses on the correlation between digital transformation and the level of innovation that SME entrepreneurs are able to bring to their companies. Based on the findings, it appears that technological capabilities contribute to the DT on of SMEs. Furthermore, the age of the firm and the leaders moderate the correlation between factors and digital transformation.

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# APPENDIX

| Variables | Scale | Description | Source |
|---|---|---|---|
| **Technology** | Compatibility | It is easy to incorporate new technologies into your firm. | Tornatzky & Fleischer (1990); Yoon & George (2013); Wong et al. (2020). |
| | Complexity | Does state-of-the-art of technologies deal with many objectives in your firm? | |
| | Characteristics | Your firm has the capacity to build and market innovative solutions in digital transformation. | |
| **Organization** | Financial resources | Can your firm spend on IT and Web-based? | |
| | Structure | Adopting digital transformation is consistent with your business strategy. | |
| | Culture | Adopting digital transformation fits your organizational culture. | |
| | Communication Processes | Adopting digital transformation, does your firm improve access to information and communication processes? | |
| | Human capital | The number of employees at your company is high compared to the industry. | |
| | Organizational readiness | To seek sales growth, your firm is willing to execute risky digital transformation projects. | |
| **Environment** | Government regulations | The government policies encourage your firm to adopt digital transformation. | |
| | Competitive pressure | You believe your firm will lose our market share if we do not adopt digital transformation. | |
| | Trading partner pressure | More partner firms in your industry have adopted in digital transformation | |
| | External support: Infrastructure | Does the government provide government procurements and contracts such as technical support, training, and funding for firms? | |
| **Digital Transformation in SMEs** | Adoption of e-commerce platforms | Does your firm motivate to adopt e-commerce for successful digital transformation? | Malodia et al. (2023) |
| | Adoption of digital marketing | Can your firm successfully connect with broad audiences via digital marketing channels such as social media, mobile applications and digital platforms? | |
| | Use of big data | Does your firm increase the collection and use of dedicated big data? | |