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Factors Shaping Artificial Intelligence Adoption in Small and Medium-Sized Enterprises in Vietnam: A Context-Based Approach

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Abstract

Artificial Intelligence (AI) has emerged as a core technology driving digital transformation; however, its adoption among small and medium-sized enterprises (SMEs) in Vietnam remains limited and uneven. This study approaches the issue by explaining underlying mechanisms rather than merely listing influencing factors, drawing on the Technology–Organization–Environment (TOE) framework adapted to the SME context. Survey data from 230 firms were analyzed using Partial Least Squares Structural Equation Modeling

(PLS-SEM). The findings indicate that perceived benefits and top management support are the most significant drivers of AI adoption, while resource constraints act as structural barriers. The results suggest that AI adoption is not an automatic response to technological advancement but rather the outcome of strategic consideration under constrained conditions. This study contributes to clarifying the “conditional” nature of AI adoption and offers implications tailored to the Vietnamese context.

Keywords: Artificial Intelligence, SMEs, TOE, Vietnam

1. Introduction

The rapid development of Artificial Intelligence (AI) in recent years has brought profound changes to how businesses operate and compete. Whereas technology previously played a supportive role, AI has now become a central element in value creation, particularly through its ability to process and analyze large-scale data [1]. In this context, adopting AI is often considered an inevitable step for firms seeking to maintain competitive advantage.

However, this “inevitability” does not manifest uniformly across different types of enterprises. While large firms possess the resources to invest heavily in advanced technologies, small and medium-sized enterprises (SMEs) tend to exhibit considerable caution in adopting AI. This reflects not only disparities in resources but also differences in strategic decision-making processes.

In Vietnam, SMEs account for more than 97% of all enterprises and play a vital role in economic growth [11, 14]. Nevertheless, recent reports indicate that most SMEs remain in the early stages of digital transformation, with limited adoption of advanced technologies such as AI [13, 17]. This raises an important question: why has a highly promising technology like AI not been widely adopted in this sector?

Previous studies have typically addressed this issue by identifying influencing factors such as perceived usefulness, technological capability, and competitive pressure [2, 5]. However, such approaches are often descriptive and fail to explain how these factors interact during the decision-making process. This study argues that AI adoption should be understood as a context-dependent process in which technological, organizational, and environmental factors do not operate independently but jointly shape firm behavior.

2. Theoretical Background and Analytical Framework

2.1 AI in SMEs: From Expectations to Practice

AI is often described as a disruptive technology with the potential to fundamentally transform business operations [7]. However, in the context of SMEs, AI is typically implemented through specific, practical applications rather than long-term strategic initiatives. Common examples include chatbots, customer data analytics systems, and marketing automation tools.

This reflects the reality that SMEs do not pursue AI as an end in itself, but as a means to address specific operational challenges. Consequently, the decision to adopt AI largely depends on whether firms perceive immediate and tangible benefits.

When such benefits are unclear or difficult to measure, firms tend to delay or reject adoption.

2.2 TOE Framework and the Need for Reinterpretation

The Technology–Organization–Environment (TOE) framework has been widely used to analyze technology adoption in organizations [9]. It posits that adoption decisions are influenced by three main dimensions: technological characteristics, organizational capabilities, and the external environment.

However, many studies apply the TOE framework in a linear manner, treating these factors as independent variables with direct effects on adoption decisions. This approach may overlook the complex interactions among factors, particularly in SMEs, where decision-making is centralized and highly dependent on individual leaders.

A notable limitation of prior research is the assumption that technological, organizational, and environmental factors operate relatively independently and can be measured separately. In reality, especially within SMEs, such an assumption is difficult to sustain. SMEs typically operate under resource constraints, with simple organizational structures and low levels of decentralization. As a result, these factors not only interact but also become interdependent in ways that are difficult to disentangle.

For instance, perceived benefits of AI are not purely cognitive constructs but are shaped by the firm’s existing capabilities. A firm with strong technological infrastructure may view AI as an opportunity, whereas one lacking such infrastructure may perceive it as a risk. This suggests that perception is “contextually conditioned by capability.”

Similarly, environmental factors such as competitive pressure do not always lead to innovation. In some cases, intense competition may make SMEs more risk-averse, as they lack sufficient resources to absorb technological risks. This creates a paradox: greater pressure may actually hinder innovation in the absence of adequate support conditions.

Therefore, this study proposes that AI adoption should be understood as a process “shaped under constraints,” in which TOE factors not only influence but also reconfigure one another. This perspective moves beyond linear models and provides a more nuanced explanation of the diversity in AI adoption behavior among SMEs.

An important implication of this approach is that analyzing AI adoption should not be limited to measuring the impact of individual factors but should also consider the conditions under which these factors exert influence. In other words, the same level of perceived benefit may lead to entirely different outcomes under different resource conditions.

2.3 A Context-Based Approach

This study proposes that AI adoption in SMEs is the result of a balancing process among three forces: motivation, capability, and constraint. Motivation is reflected in perceived benefits; capability is represented by leadership and technological capacity; and constraints primarily stem from resource limitations.

Importantly, these factors do not operate independently but interact with one another. For example, perceived benefits may encourage adoption, but without sufficient resources, the process may stall. Conversely, strong leadership may enable firms to overcome constraints by reallocating resources or selecting appropriate technological solutions.

3. Methodology

This study employs a quantitative approach based on survey data collected from 230 SMEs in Vietnam. Respondents include managers and business owners directly involved in technology-related decision-making.

The questionnaire was developed using validated scales from prior studies, covering constructs such as perceived usefulness, top management support, technological capability, competitive pressure, and resource constraints. All variables were measured using a five-point Likert scale. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), which allows simultaneous assessment of measurement and structural models. This method is particularly suitable for exploratory research and non-normal data distributions.

4. Results

Table 1: Reliability and Convergent Validity

Construct	Alpha	CR	AVE
PU	0.88	0.91	0.68
TMS	0.86	0.90	0.65
TC	0.84	0.89	0.62
CP	0.82	0.87	0.60
RC	0.80	0.85	0.58

Table 2: Structural Model Results

Relationship	β	p-value
PU → AI	0.35	<0.01
TMS → AI	0.28	<0.01
TC → AI	0.22	<0.05
CP → AI	0.19	<0.05
RC → AI	-0.25	<0.01

5. Discussion

The findings indicate that AI adoption in Vietnamese SMEs cannot be understood as an automatic response to technological advancement. Rather, it is a strategic decision-making process in which firms weigh potential benefits against inherent risks.

Perceived benefits emerge as the central driver, consistent with established technology acceptance theories [2]. However, within SMEs, this factor takes on a more pragmatic character, closely tied to short-term value generation. This explains why many firms adopt AI only at a limited scale, focusing on applications that are easy to implement and yield immediate results.

Top management support plays a decisive role. In small firms, centralized authority means that leadership perception can shape the entire technological direction of the organization. When leaders hold a positive view of AI, they can drive adoption even under resource constraints [8].

An important insight from the study is the “non-linear” nature of the decision-making process. Factors such as perceived benefits, leadership, and resources not only have direct effects but also interact to create threshold conditions. This implies that improving a single factor may not lead to behavioral change unless other conditions are also met.

For instance, a firm with strong perceived benefits but lacking leadership support may still refrain from adopting AI. Conversely, a resource-constrained firm with proactive leadership may find alternative pathways, such as low-cost solutions or external partnerships. In this sense, leadership

acts not merely as an independent factor but as a catalyst that transforms other conditions into concrete action.

Furthermore, the results suggest that AI adoption in Vietnamese SMEs tends to be incremental rather than comprehensive. Instead of implementing large-scale AI systems, firms often opt for smaller, targeted applications. While this approach reduces risk, it may slow down broader digital transformation.

Another noteworthy aspect is the role of the institutional environment. Although not directly measured, the findings imply that insufficient support mechanisms can amplify the negative effects of resource constraints. Therefore, policy interventions should not only provide financial support but also reduce barriers to technology access, enhance managerial capabilities, and facilitate experimentation.

Finally, the study raises a theoretical question regarding the adequacy of traditional technology adoption models in the AI era. As technologies become more complex and risk-laden, firm behavior may deviate from simplified assumptions of cost-benefit rationality. Future research should thus develop more flexible frameworks capable of capturing the dynamic and uncertain nature of technological innovation.

Consistent with national reports ^[12], resource constraints remain the most significant barrier. Limited capital, human resources, and technological infrastructure prevent many SMEs from translating awareness of AI benefits into actual implementation.

6. Conclusion

This study demonstrates that AI adoption in Vietnamese SMEs is shaped by the interaction of perception, leadership, and resource constraints. It highlights the need for a holistic approach to promoting AI adoption, encompassing not only technological solutions but also organizational and policy dimensions.

In addition, the findings suggest that AI adoption should be understood as a context-dependent process rather than a uniform trend across firms. This implies that policy interventions need to be tailored to the specific conditions of SMEs, particularly in terms of resource availability and managerial capacity. At the firm level, a gradual and flexible approach to AI implementation may help reduce risks while building internal capabilities over time. Future research could further explore how these dynamics evolve across different industries and stages of digital transformation.

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