

Understanding the digital ecosystem of MSMEs: An evaluative-descriptive content analysis of readiness, integration, and sustainable transformation

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Abstract

Digital transformation in micro, small, and medium-sized enterprises (MSMEs) is no longer limited to technology adoption but encompasses organizational readiness, technology integration, business model transformation, and sustainability within digital ecosystems. This study aims to evaluate and synthesize the literature on the development of MSME digital ecosystems, their components and actors, and MSME readiness and strategies for digital transformation. The study employs an evaluative-descriptive design using *directed qualitative content analysis* of relevant literature. The findings indicate that MSME digital transformation progresses from technology access and adoption toward *digital maturity*, process integration, capability development, business model innovation, and *sustainable transformation*, shaped by organizational conditions, ecosystem support, adaptive capabilities, and continuous learning. This study contributes by integrating these dimensions into a more comprehensive understanding of how MSMEs develop and sustain digital transformation within interconnected business environments.

Keywords: MSME digital ecosystem; Digital readiness; Digital maturity; Technology integration; Sustainable digital transformation.

Abstrak

Transformasi digital UMKM tidak lagi terbatas pada adopsi teknologi, tetapi mencakup kesiapan organisasi, integrasi teknologi, perubahan model bisnis, dan keberlanjutan dalam ekosistem digital. Penelitian ini bertujuan mengevaluasi dan mensintesis literatur mengenai perkembangan ekosistem digital UMKM, komponen dan aktornya, serta kesiapan dan strategi UMKM dalam menghadapi transformasi digital. Penelitian menggunakan desain evaluatif-deskriptif dengan pendekatan *directed qualitative content analysis* terhadap literatur yang relevan. Hasil menunjukkan bahwa transformasi digital UMKM berkembang dari akses dan adopsi teknologi menuju *digital maturity*, integrasi proses, penguatan kapabilitas, inovasi model bisnis, dan *sustainable transformation*; proses tersebut dipengaruhi oleh kondisi organisasi, dukungan ekosistem, kemampuan adaptasi, dan pembelajaran berkelanjutan. Penelitian berkontribusi dengan mengintegrasikan berbagai dimensi tersebut dalam pemahaman yang lebih utuh mengenai transformasi digital UMKM.

Kata Kunci: Ekosistem digital UMKM; Kesiapan digital; Kematangan digital; Integrasi teknologi; Transformasi digital berkelanjutan.

Introduction

Digital transformation has changed how micro, small, and medium-sized enterprises (MSMEs) conduct business activities, create value, and interact with markets. These changes encompass digital marketing, electronic transactions, information management, customer service, and business model development. Li et al. (2018) demonstrate that digital transformation among seven MSMEs engaged in cross-border e-commerce through the Alibaba platform involved the renewal of managerial cognition, the development of social capital, business team formation, and organizational capability building. This finding indicates that digitalization does not stop at the use of devices or applications but involves changes in how organizations operate. Therefore, the MSME digital ecosystem needs to be understood as an environment that brings together technologies, organizational capabilities, business actors, and resources, enabling technology to generate tangible changes and business value for MSMEs.

This discussion is important because MSMEs face resource constraints that may affect their ability to undertake digital transformation. Eller et al. (2020), through a survey of 193 SMEs, found that information technology resources, employee skills, and digital strategy were positively associated with digitalization, while digitalization was positively associated with financial performance. Becker and Schmid (2020) showed that the design and implementation of digital strategies are also important in addressing digital change in SMEs and large-scale enterprises. These findings indicate that technology availability does not automatically produce organizational change. MSMEs need to align technology investments with human capabilities, strategy, and business processes in a structured and sustainable manner. Without such alignment, technology use may remain limited to tool adoption without producing deeper integration, process transformation, or meaningful business model renewal.

Digital transformation should therefore be viewed as a gradual process that connects technology adoption with capabilities, integration, and value creation. Garzoni and De Turi (2020) developed a four-level approach to explain digital transformation in SMEs, positioning transformation as a process that develops across multiple levels rather than as a single condition. Matarazzo et al. (2021) demonstrated that *sensing* and *learning* capabilities help *Made in Italy* SMEs use digital technologies to transform customer value creation processes. Accordingly, the digital development of MSMEs cannot be adequately measured by the number of technologies they use, but rather by their ability to integrate technologies into business processes, manage organizational change, develop new capabilities, and transform digital resources into business value that can be sustained amid changing markets, customer needs, and digital competition.

Research on MSME digital transformation has been conducted from diverse perspectives. Li et al. (2018) emphasized the development of *entrepreneurial capabilities*, whereas Eller et al. (2020) demonstrated the role of technological resources, employee skills, and digital strategy. Garzoni and De Turi (2020) explained transformation through multiple levels, while Matarazzo et al. (2021) connected it with *dynamic capabilities* and customer value creation. Denicolai et al. (2021), through a survey of 438 SMEs, found that digitalization and *sustainability* were positively associated, but could represent competing growth paths when firms pursued internationalization. Hermann et al. (2024) highlighted external support through a taxonomy of digital innovation projects. However, de Mattos et al. (2024) found that the literature remains fragmented in explaining technology assimilation and business model innovation. Mick et al. (2024a, 2024b) further demonstrated the need to connect *roadmaps*, *digital maturity*, and *strategic alignment* in sustainable transformation.

Based on these gaps, this study aims to evaluate and synthesize the literature on MSME digital ecosystems by connecting technological development, organizational readiness, capabilities, digital integration, business model innovation, and sustainable transformation. The urgency of this study lies in the need to explain the relationships among these dimensions in a more integrated manner, as previous studies have largely examined specific aspects separately. de Mattos et al. (2024) identified fragmentation in the literature between technology assimilation and business model innovation, while Mick et al. (2024a) identified limitations in sustainable digital transformation *roadmaps* specifically aligned with SME needs. Mick et al. (2024b) subsequently integrated *digital maturity* and *strategic alignment* into the development of a *roadmap*. Accordingly, this study seeks to map how MSMEs move from technology adoption toward integration, capability development, business model innovation, and sustainable value creation.

Method

This study employs an evaluative-descriptive design using a *directed qualitative content analysis* approach to analyze literature on MSME digital ecosystems (Purba et al., 2024). This approach was selected because the study not only summarizes previous research but also evaluates how the literature explains the development of digital ecosystems, their components and actors, and MSME readiness and strategies for addressing digital transformation. *Directed qualitative content analysis* enables the use of initial categories based on the study's conceptual focus, which are subsequently elaborated through the content of the literature analyzed (Hsieh & Shannon, 2005). The unit of analysis comprises previous studies on MSME digitalization and digital transformation, with attention to their research focus, context, concepts, approaches, findings, and implications for the development of MSME digital business.

The analysis was conducted through the stages of preparation, organization, and interpretation, following the principles of qualitative content analysis proposed by Elo and Kyngäs (2008). The literature was organized into three main areas: the development and characteristics of MSME digital ecosystems; the components and actors within MSME digital ecosystems; and MSME readiness and strategies within digital ecosystems. Subsequently, concepts such as *digital readiness*, *digital maturity*, *technology integration*, *organizational conditions*, *ecosystem support*, *digital capabilities*, *digital business model innovation*, and *sustainable transformation* were compared and synthesized based on the object, context, methods, and findings of each study. The evaluative analysis then connected conceptually related findings while preserving differences across publications, ensuring that the synthesis went beyond mapping the literature to develop an understanding of how readiness, technology integration, organizational capabilities, business innovation, and sustainability are interconnected in MSME digital transformation.

Results and Discussion

The concept and development of the digital ecosystem for MSMEs

Digital transformation has changed how micro, small, and medium-sized enterprises (MSMEs) create, deliver, and capture value. In this context, a digital ecosystem can be understood as an environment that brings together technologies, platforms, data, organizations, and various interconnected actors involved in value creation. Nerbel and Kreutzer (2023), through an integrative review of 148 articles, explain that digital platform ecosystems develop through relationships between core platforms and various complementary actors that contribute to value creation. This perspective indicates that digitalization cannot be adequately understood as the individual use of applications. Chaffey and Ellis-Chadwick (2022) also explain that digital marketing operates through the interconnectedness of various channels, including search engines, social media, content, analytics, and automation. Thus, digital ecosystems position technology within broader relationships with business activities and markets.

The development of digital ecosystems can be understood as a shift from basic digitalization toward increasingly extensive connectivity. At the initial stage, MSMEs may use technology for communication, promotion, or transactions without changing the overall structure of their business activities. As technology use increases, the relationships among digital devices, customers, platforms, data, and external partners become increasingly important. Nerbel and Kreutzer (2023) show that digital platform ecosystems develop through emergence processes that connect platforms with various actors and forms of complementarity. Chaffey and Ellis-Chadwick (2022) likewise position search engines, social media, content, analytics, and marketing automation as interconnected components of the digital environment. Therefore, MSME digital development is not only characterized by an increase in the number of technologies

used but also by increasing interconnectedness among activities, actors, and resources. This development is summarized in Table 1.

Table 1. Development of the digital ecosystem for MSMEs

Development stage	Main focus	Characteristics	Position in the digital ecosystem
Digitalization	Use of technology in business activities	Technology is used for communication, promotion, transactions, and basic operational activities	Serves as the initial point of MSME engagement in the digital environment
Technology adoption	Acceptance and use of relevant technologies	MSMEs begin selecting and using digital technologies according to their business needs	Expands access to markets, consumers, and digital resources
Digital integration	Interconnection of technology and business activities	Marketing, sales, transactions, data, and business processes begin to become interconnected	Establishes stronger relationships between internal activities and the digital environment
Digital ecosystem	Interaction between technology and multiple actors	MSMEs become connected with platforms, consumers, partners, financial institutions, government, and supporting institutions	Positions digitalization as a network-based process involving multiple actors and resources

Source: Authors' synthesis.

The transition from digital adoption to digital transformation represents an important development in the MSME ecosystem. Adoption primarily refers to the use of technology, whereas transformation encompasses broader changes in business processes and value creation. Skare et al. (2023), using Digital Economy and Society Index data from European countries, demonstrate the relationship between digitalization and the activities and market positions of small and medium-sized enterprises. Among Malaysian MSMEs, Fang et al. (2024) found that digital capabilities positively influence digital business model innovation, encompassing value creation, value proposition, value delivery, and value capture. Meanwhile, Saeedikiya et al. (2024), through multiple case studies of SMEs in the mobility sector in Australia, show that digital transformation requires organizational and strategic changes. These findings emphasize that digital transformation extends beyond merely adding devices or applications.

The development of MSME digital transformation is influenced by technological, organizational, and environmental conditions. Hoang (2024) examined SMEs in Da Nang, Vietnam, using the Technology–Organization–Environment (TOE) framework and PLS-SEM analysis. The results indicate that cybersecurity and technology integration capabilities, customer and partnership factors, as well as top management

support and governance play roles in digital transformation adoption. These findings demonstrate that technology decisions cannot be separated from internal capabilities and the business environment. Clemente-Almendros et al. (2024) also examined the determinants of digital transformation and heterogeneity according to firm size. Their study indicates that managerial educational background, internationalization, and firm size are associated with digital adoption, although the effect of firm size may vary according to managerial conditions and the level of internationalization. Thus, MSMEs do not have uniform starting points for digital transformation.

Beyond access to technology, digital transformation requires capabilities that enable MSMEs to recognize changes, exploit opportunities, and adapt resources. Saeedikiya et al. (2024) demonstrate through multiple case studies of SMEs in the Australian mobility sector that dynamic capabilities play a role in the digital transformation process, particularly when firms face resource constraints and technological changes. Meanwhile, Civelek et al. (2023), through a study of SMEs in Czechia using Ordinal Logistic Regression analysis, examined the relationship between dynamic capabilities and the digital transformation process and found no significant positive relationship. This finding indicates that internal capabilities do not automatically lead to digital transformation without considering organizational conditions and other supporting factors. In this context, capabilities can be understood as the ability to identify relevant technologies, select opportunities, allocate resources, and adapt business processes. Thus, digital transformation is determined not only by technology ownership but also by the organization's ability to connect technology with business action.

Digitalization can create opportunities for MSMEs when technology connects business activities with strategic decision-making. Hassan et al. (2024), using data from 1,100 German SMEs from the Mannheim Innovation Panel, found that digital technology diffusion is associated with improved innovation performance, while absorptive capacity moderates this relationship. Ojha et al. (2023), through a survey of manufacturing SMEs in the United States, showed that virtual integration is associated with more flexible partnerships, business continuity planning, market insight, and strategic planning. Meanwhile, Khurana et al. (2022), through case studies of eight entrepreneurs in India during the COVID-19 pandemic, showed that digital technology adoption contributed to resilience through changes at the entrepreneurial, organizational, and entrepreneurial ecosystem levels. Thus, digitalization can expand MSME innovation, flexibility, and resilience.

Although it offers various opportunities, the development of digital ecosystems also presents challenges that may constrain the sustainability of MSME transformation. Rupeika-Apoga and Petrovska (2022) identified various barriers to sustainable digital transformation in micro-, small-, and medium-sized enterprises, indicating that digital change does not end with technology acquisition. Civelek et al. (2023) also emphasized

the importance of organizational capabilities in explaining the digital transformation process, suggesting that technology investment needs to be accompanied by strengthened internal capabilities. Meanwhile, Šimberová et al. (2022), through research on SMEs in the Czech Republic, examined the opportunities and threats associated with digital transformation in relation to sustainability. Therefore, MSMEs need to consider skills, resources, security, adaptive capabilities, and sustainability simultaneously. Overall, a digital ecosystem is an evolving environment in which the use of technology develops into interconnected activities, actors, and resources for creating sustainable value.

Components and actors in the digital ecosystem for MSMEs

The MSME digital ecosystem is built from various interconnected components, ranging from market platforms to supporting actors outside the firm. Laudon and Traver (2023) explain that e-commerce provides a digital space that brings sellers and buyers together while supporting information exchange, transactions, and business relationships. For MSMEs, digital platforms and marketplaces provide access to a broader consumer base without requiring them to independently establish market channels. Su et al. (2023), through a longitudinal case study of public platform adoption for digital marketing among SMEs, identified a development pattern from *validation* to *cloning* and then *foresight*. This finding indicates that platforms can be used incrementally to identify market needs, develop marketing activities, and expand customer relationships. Thus, digital platforms serve as an important entry point in the formation of MSME business ecosystems.

Social media complements the functions of commerce platforms by providing a space for direct communication between MSMEs and customers. Abbasi et al. (2022) examined 214 SMEs in Malaysia and found that social media marketing adoption was associated with perceived relative advantage, cost, managerial support, competitive pressure, and pressure from service providers. These findings indicate that social media adoption is influenced by both internal firm conditions and the business environment. Solomon et al. (2024) examined SMEs in Lagos, Nigeria, and Nairobi, Kenya, with approximately 100 firms in each location, to investigate factors influencing social media adoption. Their findings highlight the role of knowledge and *learning-by-doing* in social media use, particularly for promotion and customer information. Therefore, social media within the MSME ecosystem functions not only as a promotional tool but also as a space for interaction, information dissemination, and identification of market needs.

Once markets and communication channels are established, the digital ecosystem requires transaction systems that enable the practical and secure exchange of value. Thathsarani and Jianguo (2022) examined digital finance using the Technology Acceptance Model and linked it to financial inclusion and SME performance. This

perspective indicates that the acceptance of digital financial services forms part of expanding MSMEs' access to financial services. In a more specific context, Phoong et al. (2022) examined mobile payment implementation among SMEs in Malaysia using the Technology–Organization–Environment framework. The study showed that technological, organizational, and environmental factors play roles in mobile payment implementation, with particular attention to security concerns, relative advantage, and top management support. These findings demonstrate that digital payment is not merely a choice of transaction tool but a component that connects sales activities with financial services and MSME business processes in a more integrated manner.

Digital transactions then need to be supported by logistics and supply chain systems so that information exchange can be accompanied by the movement of goods. Al Mashalah et al. (2022), through a review of 153 publications from 1999 to 2019, demonstrated the close relationship between digital transformation, e-commerce, supply chains, and logistics. Their review emphasizes that digital commerce cannot be separated from the distribution processes that support it. Empirical evidence of this relationship was provided by Kilay et al. (2022) through a study of 164 MSMEs in Indonesia, covering Jakarta, Surabaya, Makassar, Padang, Manado, Pontianak, and Ambon. Using multiple linear regression analysis, the study found that e-payment and e-commerce had positive and significant effects on MSME supply chain performance. This indicates that digital components of transactions are also connected to MSMEs' ability to manage distribution processes and supply chain relationships.

The components and actors that constitute this ecosystem can be summarized to illustrate the functional relationship of each element, as presented in Table 2.

Table 2. Components and actors in the digital ecosystem for MSMEs

Group	Components/actors	Function in the ecosystem	Contribution to MSMEs
Market access	Digital platforms and marketplaces	Connect sellers with consumers	Expand market reach and sales channels
Communication and engagement	Social media	Build communication and interaction with customers	Support promotion, information dissemination, and customer interaction
Transactions	Digital payments and fintech	Facilitate transactions and financial services	Simplify payments and access to financial services
Distribution	Logistics and supply chain systems	Connect transactions with the movement of goods and information	Support distribution and supply chain coordination

Infrastructure	Internet, devices, data systems, and digital services	Provide connectivity and support	Connect MSMEs with digital services and actors
Institutions	Government supporting institutions and	Provide regulations, information, and facilities	Create a supportive environment for digital activities
Finance	Banks, fintech, and financing providers	Provide transaction services and financing resources	Support the financial needs of business activities
Knowledge and collaboration	Communities, universities, incubators, associations, and business partners	Facilitate the exchange of knowledge, technology, and resources	Strengthen learning and collaborative relationships

Source: Authors' synthesis.

In addition to platforms and transaction systems, the digital ecosystem requires infrastructure that enables all activities to operate in an interconnected manner. Holl and Rama (2024) analyzed spatial patterns and drivers of SME digitalization, demonstrating that the development of digitalization is associated with regional conditions and the supporting environment in which firms operate. This indicates that technology use depends not only on the applications available but also on connectivity and digital infrastructure within the business environment. Zhang et al. (2023) extend this perspective through an ecosystem approach, showing that the relationship between digital technology and entrepreneurship is strengthened by supportive cultures, institutions, policies, accessible resources, and the service sector. Thus, digital infrastructure functions as a foundation that connects MSMEs with markets, services, information, and other actors within the digital economy ecosystem.

The digital ecosystem also involves governments, financial institutions, and supporting organizations that provide the institutional environment for business activities. Zhang et al. (2023) show that institutions, policies, culture, resources, and the service sector constitute environmental elements that can strengthen technology-based entrepreneurial activities. Meanwhile, Rupeika-Apoga and Petrovska (2022) identified various barriers to sustainable digital transformation among micro-, small-, and medium-sized enterprises, demonstrating that internal and environmental conditions can constrain technology utilization. In this context, governments and supporting institutions can contribute through regulations, information, facilities, and broader and more targeted access to resources. Financial institutions and digital service providers also serve as intermediaries connecting MSMEs with transaction services, financing, and the technologies required to conduct their economic activities in a more interconnected manner.

The final component that strengthens relationships within the ecosystem is the knowledge and collaboration network connecting MSMEs with communities, universities, associations, incubators, suppliers, and business partners. Sagala and Óri (2024), through a systematic literature review and thematic analysis, identify organizational learning, collaboration, digital marketing, and digitalization processes/models as important themes in the literature on SME digital transformation. They also emphasize the importance of understanding initial conditions, limitations, continuous learning, and incremental digitalization processes. Consistent with this perspective, Kilay et al. (2022) discuss open innovation as an approach for supporting MSME digitalization through the exchange of knowledge and technology with external parties. These relationships demonstrate that digital ecosystems consist not only of technologies but also of networks of actors that exchange knowledge, resources, services, and opportunities for business collaboration.

MSME readiness and strategies in the digital ecosystem

Digitalization does not always lead to substantive digital transformation. Many MSMEs have adopted social media, digital payments, *e-commerce*, and various business applications, but such use does not necessarily change how organizations operate, make decisions, create value, or sustain their businesses. The issue is therefore no longer merely whether technology has been adopted, but whether MSMEs have the capacity to understand technological changes, develop them in accordance with organizational conditions, integrate them into business activities, and direct them toward sustainable change. From this perspective, digital transformation is more appropriately understood as a process of capacity development rather than merely a process of technology adoption. This perspective is important because MSMEs develop digital capabilities under different conditions, influenced by human resources, organizational characteristics, the business environment, and the ability to continuously learn and adapt.

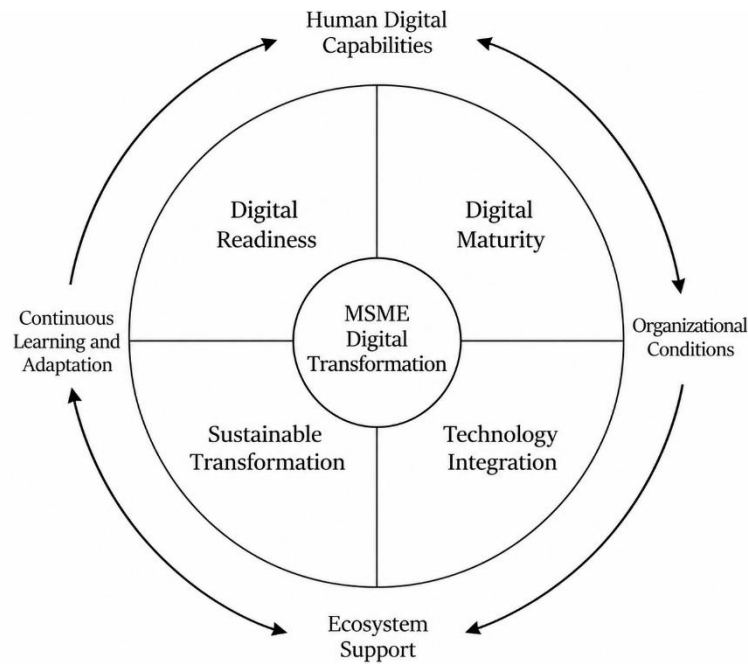


Figure 1. MSME digital readiness, maturity, integration, and sustainable transformation framework

Source: Developed by the authors.

Figure 1 is used as a conceptual framework to summarize the scope of the discussion concerning MSME readiness and strategies for digital transformation. The framework connects four main aspects, namely Digital Readiness, Digital Maturity, Technology Integration, and Sustainable Transformation, with the accompanying factors of Human Digital Capabilities, Organizational Conditions, Ecosystem Support, and Continuous Learning and Adaptation. The placement of these aspects helps establish the analytical boundaries: the discussion examines not only MSMEs' ability to use technology but also the development of their capabilities, their application in business activities, and the direction of the resulting changes. This framework subsequently serves as a starting point for examining the more substantive issue of how MSMEs develop digital capabilities and transform those capabilities into valuable business practices. Thus, the discussion focuses on the dynamics of digital transformation itself, while the figure functions as a conceptual device for organizing the dimensions under examination.

The first issue concerns MSME readiness to respond to technological change. Pingali et al. (2023) developed the *digital readiness* construct through several studies involving SME owners in *emerging markets* and identified three main dimensions: *technological sensemaking*, *agility*, and *implementation*. These findings demonstrate that digital readiness extends beyond the ability to possess or use technology and encompasses the ability to understand technological developments, respond to change, and translate decisions into implementation. This perspective is further illustrated by Amaya et al. (2024), who examined MSMEs in Ecuador using data from Chequeo Digital. They found that *sensing* and *seizing capabilities* had positive and significant

effects on digitalization, while firm age negatively moderated the relationship between *sensing* and digitalization. Together, these studies indicate that readiness is fundamentally a matter of capacity to act: MSMEs need to recognize changes, assess opportunities, and determine how technology can be used according to business needs. Without such capabilities, technology adoption risks remaining limited to tool use without strategic change.

Once initial capabilities have been established, the next issue is no longer merely readiness but the extent to which digitalization develops into organizational maturity. Sagala and Óri (2024), through a *systematic literature review*, demonstrate that successful SME digital transformation needs to consider initial conditions, limitations, and the specific characteristics of each organization. They also emphasize incremental digitalization, education, and continuous learning. This perspective is important because digital maturity cannot be standardized through measures that assess only the number of technologies used. MSMEs with limited resources may have different levels of maturity from firms with larger organizational structures and greater resources, even when both use the same digital platform. At this point, *digital maturity* is more appropriately understood as an organization's ability to develop technology use incrementally and according to its needs. In other words, maturity is not a matter of how sophisticated the technology is, but of how effectively the technology is understood, adapted, and developed as part of organizational capabilities.

Change becomes more meaningful when technology begins to integrate with how the organization conducts its business. Saeedikiya et al. (2024), through a *multiple case study* of SMEs in the mobility sector in Australia, position *dynamic capabilities* in relation to enabling factors, barriers, and outcomes of digital transformation. This perspective indicates that technology produces change when organizations have the ability to manage transformation processes, rather than when technology is simply added to existing activities. Roffia and Dabić (2024) illustrate this issue from the perspective of organizational resilience through a study of 143 SMEs in Verona and Vicenza, Italy. They found that *budgeting*, *business continuity tools*, *supplementary financial resources*, and entrepreneur resilience contributed to *resilience*, while greater ERP use was also associated with organizational resilience. These findings demonstrate that digital integration is related to how organizations manage resources, maintain continuity, and respond to disruptions. Technology therefore generates value when it is connected to organizational processes and mechanisms rather than functioning as a device separate from business activities.

However, internal capabilities alone are insufficient to explain variations in digital transformation across MSMEs. The environmental context in which firms operate also shapes how technology can be utilized. N'Dri and Su (2024) examined *Technology–Organization–Environment* factors among export-oriented manufacturing SMEs using

PLS-SEM and fsQCA. The study identified five configurations associated with successful digital transformation, indicating that there is no single combination of conditions that applies uniformly across all firms. This finding is important because it demonstrates that digital transformation is configurational: technology, organization, and environment can produce different outcomes when combined under different conditions. For MSMEs, these contexts may include internal capabilities, market characteristics, customer demands, digital infrastructure, and business-environment conditions. Therefore, an effective digital strategy cannot be developed simply by imitating the practices of other firms. MSMEs need to interpret and apply technology according to the needs and conditions of their own ecosystems. These contextual differences help explain why the adoption of the same technology does not always produce the same business outcomes.

At the strategic level, digitalization begins to have an impact when technology changes how MSMEs create and capture value. Fang et al. (2024), through a study of 132 SME management respondents in Malaysia, found that *digital capability* positively affects four components of *digital business model innovation*: *value creation*, *value capture*, *value proposition*, and *value delivery*. However, *value creation*, *value proposition*, and *value capture* were found to strengthen competitiveness, whereas *value delivery* did not demonstrate the same effect. This difference indicates that technology use does not automatically generate identical benefits across every component of a business model. Setiawan et al. (2025) extend this issue by examining digital skills, digital transformation, *dynamic capabilities*, and *organizational agility* in relation to MSME performance. Thus, the strategic value of digitalization emerges when human and organizational capabilities transform technology into innovation and adaptive capacity. Technology is not an end in itself but a resource that acquires value when translated into new ways of creating, offering, and capturing business value.

This orientation then needs to be extended from competitiveness toward business sustainability and the long-term impact of transformation. Le et al. (2024) provide a clear illustration through a study of 405 respondents from the food and beverage sector in Vietnam. Using PLS-SEM, the study found positive relationships among digitalization, *green innovation*, *green supply chain management*, and *sustainable corporate performance*, while *green innovation* and *green supply chain management* served as mediators. These findings indicate that digitalization can have broader consequences when technology is used to transform production practices, supply chains, and environmental innovation. Thus, digital transformation should not be evaluated solely in terms of increased efficiency or the ability to reach digital markets. A more important question is whether digital capabilities generate changes that can be sustained over the long term. In the MSME context, sustainability refers to the ability to maintain economic value while developing business practices that are more adaptive and responsible toward the environment and value chains.

Overall, the discussion demonstrates that MSME digital transformation occurs through the continuous development of capabilities shaped by organizational and environmental contexts. Readiness determines the initial ability to understand and respond to technology; maturity indicates how these capabilities develop according to MSME conditions; integration explains how technology becomes embedded in business processes and management; while a sustainability orientation indicates the extent to which these changes can generate value that endures over the long term. At the same time, human skills, organizational conditions, the ecosystem environment, and continuous learning determine how this process unfolds. Previous studies also demonstrate that no single pattern of digitalization can be applied identically across all MSMEs. Therefore, digital transformation strategies need to begin with the actual capabilities and needs of each business and then develop incrementally through technology integration, capability strengthening, business model innovation, and continuous adaptation. From this perspective, digitalization becomes a process of business change, rather than merely a process of technology use.

Conclusion

This study demonstrates that MSME digital transformation is determined not merely by the presence of technology but by the ability of MSMEs to transform technology into tangible capabilities and business changes. This transformation encompasses digital readiness, the development of digital maturity, the integration of technology into organizational processes, business model innovation, and a sustainability orientation. The process occurs through strengthening human capabilities to understand and respond to technology, gradually developing organizational capabilities, integrating technology into processes and decision-making, and translating digital capabilities into value creation and sustainable business practices. Thus, digital transformation is more appropriately understood as a process of developing adaptive and context-specific capabilities rather than simply as a measure of how much technology MSMEs have adopted.

This study contributes by developing a conceptual framework that integrates *digital readiness*, *digital maturity*, *technology integration*, and *sustainable transformation* to explain the complexity of MSME digital transformation. Its limitation lies in the evaluative-descriptive nature of the study, which relies on a synthesis of previous research; consequently, the relationships among the components have not been empirically tested in a specific MSME context. Differences in sectors, regions, firm sizes, and ecosystem conditions across previous studies also limit the generalizability of the findings. Future research could empirically test this framework by considering the sectoral and regional characteristics of MSMEs and employing a longitudinal approach to examine the development of digital capabilities over time. Such an

approach could clarify how readiness develops into technology integration, business innovation, resilience, and sustainable performance.

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