



# International Conference on Finance, Economics, Management, Accounting and Informatics

"Digital Transformation and Sustainable Business: Challenges and Opportunities for Higher  
Education Research and Development"

## Digital Transformation of MSMEs: Inclusion, Readiness, and Innovation Toward a Sustainable Economic Ecosystem

<sup>1</sup>\*Sunday Ade Sitorus, <sup>2</sup>Orlando Steven, <sup>3</sup>Nalom Siagian

<sup>1,2,3</sup>Universitas HKBP Nommensen

<sup>1</sup>sundaysitorus@uhn.ac.id, <sup>2</sup>orlando.sitanggang@uhn.ac.id, <sup>3</sup>nalom.siagian@uhn.ac.id

\* *corresponding author's email address: sundaysitorus@uhn.ac.id*

### Abstract

This study evaluates the interrelationship between digital readiness, digital inclusion, and digital transformation on business model innovation and the sustainability of local economies among culinary Micro, Small, and Medium Enterprises (MSMEs) in Medan, Indonesia. Employing a quantitative approach grounded in the TOE Framework and the Digital Ecosystem Innovation Model (DEIM), data were gathered from 250 respondents via closed-ended questionnaires and analyzed using Structural Equation Modeling with Partial Least Squares (SEM-PLS). The findings indicate that both digital readiness and digital inclusion significantly influence business model innovation. Moreover, the digital business ecosystem serves as a mediating variable that links digital transformation with sustainable economic outcomes. The practical implications of this research emphasize the importance of community-based digital empowerment strategies and inclusive policy interventions to foster equitable technological adoption.

*Keywords: Digital Transformation; Digital Inclusion; Digital Readiness; Business Model Innovation; Digital Business Ecosystem; Msmes; Sustainable Economy.*

### Introduction

Digital transformation has become a necessity in the global business landscape, a trend notably accelerated by the COVID-19 pandemic, which underscored the urgency of digitization—particularly for Micro, Small, and Medium Enterprises (MSMEs). As pillars of economic development in emerging economies such as Indonesia, MSMEs face significant adaptation challenges in transitioning to digital models. In the context of Medan, MSMEs contribute more than 60% to the region's Gross Regional Domestic Product (GRDP) and employment (BPS Kota Medan, 2025). However, digital adoption among these enterprises remains critically low. Recent data reveal that only 30.1% of culinary MSMEs actively utilize digital platforms, and most lack a coherent digital strategy (Dinas Koperasi UKM Kota Medan, 2025; INDEF, 2024). This gap between the potential of the local economy and the digital readiness of business actors reflects structural and infrastructural deficits—including low digital literacy, limited technological infrastructure, and inadequate understanding of technology-driven business model innovation (Mo et al., 2023; Wijaya & Eviyanti, 2024). Digital readiness and digital inclusion form the foundation for any effective digital transformation among MSMEs. Digital readiness encompasses infrastructure availability, technological competence, organizational preparedness, and enabling policy support (Bughin et al., 2018; Lutfi et al., 2022). On the other hand, digital inclusion stresses equitable access to digital technologies, transcending barriers of gender, geography, and education (UNDP Indonesia, 2012; Khasawneh, 2024). The combination of these factors is critical for driving innovation, market expansion, and sustainable enterprise development. Notably, 41% of MSMEs in Medan are not digitally prepared, 31% are partially prepared, and only 28% demonstrate full readiness. This disparity undermines the effectiveness of digitalization and hinders the formation of a resilient digital ecosystem. Globally, digital ecosystems are



# International Conference on Finance, Economics, Management, Accounting and Informatics

“Digital Transformation and Sustainable Business: Challenges and Opportunities for Higher  
Education Research and Development”

recognized for their capacity to foster cross-sector collaboration and generate added value through digital servitization, omnichannel integration, big data analytics, and supply chain automation (Lamperti et al., 2024; Jorzik et al., 2024). A persistent issue is the lack of innovation in digital business models among MSMEs, many of which still rely heavily on conventional operational methods. Technologies such as e-commerce platforms, digital payments, and artificial intelligence remain underutilized (Chesbrough, 2006; Sitorus, 2022; Yanti et al., 2024). This technological stagnation increases the risk of digital exclusion, particularly for small-scale and women entrepreneurs. In Medan's specific context, tailored solutions are essential given the sociocultural and economic nuances influencing how MSMEs adapt to technology. Previous studies underscore the importance of multi-stakeholder collaboration—including governments, educational institutions, digital platforms, and local communities—in strengthening digital preparedness among MSMEs (Berliandaldo et al., 2021; Gao, 2024). Community-based interventions, such as collective digital training, women-focused empowerment programs, and localized tech incubators, emerge as strategic initiatives to support digital equity and grassroots economic empowerment. This research proposes the Digital Ecosystem Innovation Model (DEIM), an expansion of the Technology–Organization–Environment (TOE) framework by Tornatzky and Fleischer. DEIM integrates dimensions of readiness, inclusion, and digital transformation in relation to business model innovation and local economic sustainability. While the TOE framework has been widely applied in examining technology adoption, it has seldom addressed sustainability and inclusion, especially in MSME contexts within developing nations (Dwivedi et al., 2021; Omrani et al., 2024). This study aims to assess the influence of digital readiness, inclusion, and transformation on business model innovation and local economic sustainability—while examining the mediating role of the digital business ecosystem. By applying SEM-PLS to empirical data from Medan's culinary MSMEs, this research aspires to offer a theoretical and practical framework for designing inclusive, adaptive, and sustainable digital transformation strategies. Digital transformation has become an imperative in the global business landscape, particularly after the COVID-19 pandemic, which accelerated the demand for digitalization—most notably among Micro, Small, and Medium Enterprises (MSMEs). Abrupt changes in consumption patterns, social mobility, and customer-business interactions have compelled all economic sectors to adapt rapidly. As the backbone of developing economies like Indonesia, MSMEs face considerable challenges in transitioning to the digital realm. In Medan City, MSMEs contribute over 60% to the Gross Regional Domestic Product (GRDP) and are a primary source of employment (BPS Kota Medan, 2025). Despite their significance, the digital adoption rate among these businesses remains relatively low. According to recent data, only 30.1% of culinary MSMEs are actively using digital platforms, and most lack a coherent digital strategy (Dinas Koperasi UKM Kota Medan, 2025; INDEF, 2024). The primary challenges include limited digital literacy, inadequate technological infrastructure, and a lack of understanding among business owners regarding technology-based business model innovations (Mo et al., 2023; Wijaya & Eviyanti, 2024). These issues highlight a stark discrepancy between the region's economic potential and the readiness of its business actors to thrive in a digital economy. Two foundational pillars—digital readiness and digital inclusion—are critical for facilitating MSME digital transformation. Digital readiness encompasses technological infrastructure, digital competence, organizational preparedness, and policy support that enables technological integration within business processes (Bughin et al., 2018; Lutfi et al., 2022). Meanwhile, digital inclusion refers to equitable access to digital technology regardless of gender, geographic location, or education level (UNDP Indonesia, 2012; Khasawneh, 2024).

The degree to which these elements are fulfilled largely determines the success of MSMEs in pursuing innovation, expanding market reach, and ensuring business sustainability. Currently, 41% of MSMEs in Medan

are digitally unprepared, 31% are partially prepared, and only 28% report full readiness. This imbalance reflects the inefficiency of digitalization efforts and impedes the formation of a robust digital ecosystem. Globally, digital ecosystems have demonstrated their capacity to create added value through cross-sectoral collaboration and digital servitization—such as omnichannel integration, adoption of big data, and supply chain automation (Lamperti et al., 2024; Jorzik et al., 2024). Unfortunately, many MSMEs still rely heavily on conventional practices. Innovations such as e-commerce, digital payments, and AI-based technologies remain vastly underutilized (Chesbrough, 2006; Sitorus, 2022; Yanti et al., 2024), deepening the digital divide and increasing the risk of economic exclusion, particularly for small-scale and women-owned enterprises. In Medan, context-specific solutions are vital, given the city's unique socio-cultural and economic characteristics. Prior studies emphasize the importance of multi-actor collaboration—including governments, educational institutions, digital platforms, and local communities—to strengthen MSME digital readiness (Berliandaldo et al., 2021; Gao, 2024). Community-based interventions such as collective digital training, women-led entrepreneurship empowerment, and local tech incubation programs represent strategic steps toward achieving digital justice and grassroots economic empowerment. The conceptual model introduced in this study—the Digital Ecosystem Innovation Model (DEIM)—is a contextualized extension of the Technology–Organization–Environment (TOE) framework by Tornatzky and Fleischer. DEIM integrates the dimensions of digital readiness, inclusion, and transformation within the scope of business model innovation and local economic sustainability. While the TOE Framework has traditionally been used to assess technological adoption, it often omits explicit considerations of sustainability and inclusion, especially within MSMEs in developing countries (Dwivedi et al., 2021; Omrani et al., 2024). The objective of this research is to examine the relationships among digital readiness, inclusion, and transformation and their collective impact on business model innovation and local economic sustainability. Specifically, the study explores whether a digital business ecosystem can function as a mediating variable that strengthens these relationships. Employing a quantitative approach using Structural Equation Modeling–Partial Least Squares (SEM-PLS), the study draws on empirical data from Medan's culinary MSME sector. This research holds strategic value for regional technology-driven economic development, particularly in informal sectors that are vulnerable to digital marginalization. The findings are expected to serve as references for local governments, business communities, and digital platform providers in formulating adaptive and sustainable intervention strategies. Academically, the development of the DEIM model enriches the literature on digital innovation in MSMEs and offers an integrative framework to bridge the gap between digital inequality and inclusive economic growth.

## Literature Review

### The TOE Framework and Its Development

Digital transformation within the context of MSMEs necessitates a multidimensional approach capable of systematically explaining influencing factors. One of the most relevant theoretical frameworks is the Technology–Organization–Environment (TOE) Framework, introduced by Tornatzky and Fleischer (1990). This framework has been extensively employed to examine technology adoption phenomena at the organizational level, including within MSMEs in developing nations. The TOE Framework posits that technology adoption decisions are influenced by three contextual domains: technological conditions, organizational characteristics, and external environmental factors. In this study, the TOE model is expanded into the **Digital Ecosystem Innovation Model (DEIM)** by incorporating the dimensions of sustainability and digital inclusion—essential components in the development of a digital economic ecosystem. This enhanced



# International Conference on Finance, Economics, Management, Accounting and Informatics

"Digital Transformation and Sustainable Business: Challenges and Opportunities for Higher Education Research and Development"

model recognizes that business model innovation cannot thrive without robust digital readiness, equitable access to technology, and a supportive strategic environment (Sitorus et al., 2024).

## **Technology: Infrastructure, Relevance, and Digital Readiness**

Technology is a pivotal driver in MSME digital transformation. Foundational infrastructure—such as broadband internet, software, hardware, and digital security—is indispensable for digital operations (Díaz-Arancibia et al., 2024). Lutfi et al. (2022) emphasized that adequate technological infrastructure directly correlates with an enterprise's willingness and capacity to adopt digital systems. The relevance of technology is another critical aspect. Technologies that are misaligned with a business's internal capabilities may inadvertently lead to inefficiencies. To address this, Abdullah et al. (2021) developed a "six-gear roadmap" to help MSMEs match their technological choices with internal resources and business goals. Without a clear assessment of needs, technology adoption may become a burden rather than a catalyst. Moreover, digital readiness extends beyond access to tools. Baihaqy and Subriadi (2023) outlined that readiness includes digital competencies among human resources, a culture of innovation within the organization, and policies that facilitate transformation. Similarly, Gurzhii et al. (2022) argued that digital readiness is a prerequisite for adopting disruptive technologies such as blockchain.

## **Organization: Structure, Human Resources, and Digital Strategy**

Organizational structure plays a dual role—it can either facilitate or hinder digital transformation. MSMEs with lean and flexible organizational setups are typically better positioned to implement technology-driven changes. Rachinger et al. (2021) found that streamlined, collaborative structures enable faster decision-making and improved adaptability across functions. Human resources are at the heart of digital transformation. Gfrerer et al. (2023) highlighted that sustained digital training significantly boosts technological literacy among business actors. Skills in operating apps, data analysis, and understanding digital market trends are essential assets in the transformation journey. A clearly articulated digital strategy is also vital. Li et al. (2022) revealed that MSMEs with written and structured digital strategies are more effective in integrating technology. Such strategies should include long-term visioning, workforce development, interdepartmental integration, and ongoing evaluation. Transformational leadership—characterized by openness to change and innovation—also plays a key role in driving digital growth (Hanelt et al., 2021). Furthermore, organizational cultures that embrace experimentation, collaboration, and a tolerance for failure can significantly accelerate digitalization (Vial, 2021).

## **Environment: Government Support, Inclusive Ecosystems, and the Digital Market**

The external environment significantly influences the success or failure of technology adoption. Government policies—at both national and regional levels—play a pivotal role through initiatives such as training programs, digital incubation centers, and fiscal incentives aimed at MSMEs (Nair et al., 2023). For these policies to be effective, they must be adaptable to local characteristics and contexts. An inclusive ecosystem fosters an environment where entrepreneurs, digital platforms, communities, and financial institutions can collaborate. Autio et al. (2022) argue that open and diverse ecosystems enhance business resilience in the face of disruptions. The connection between MSMEs and digital communities—such as coworking spaces and business incubators—is of strategic value (Spigel & Harrison, 2020). The digital marketplace has emerged as a critical arena for MSMEs to access new customer bases. Turki et al. (2023) found that MSMEs actively utilizing digital channels reported revenue increases of up to 30%. With changing consumer preferences favoring platform-based services, MSMEs are compelled to adopt e-commerce systems, digital customer service, and cloud-based



# International Conference on Finance, Economics, Management, Accounting and Informatics

"Digital Transformation and Sustainable Business: Challenges and Opportunities for Higher Education Research and Development"

supply chain management (Nambisan et al., 2021). Supportive partners—such as fintech services, online marketplaces, and technology providers—are essential components of the digital ecosystem. However, Elia et al. (2020) caution that inconsistent regulatory frameworks can hinder technology adoption. Therefore, a conducive digitalization environment must be supported by flexible regulations, strong data protection policies, and inclusive digital taxation mechanisms.

## Business Model Innovation and Economic Sustainability

Digital transformation is not merely about adopting new tools; it fundamentally redefines how value is created and delivered in business operations. As Weill & Woerner (2021) suggest, digital business model innovation requires MSMEs to create new value through efficient, scalable, and technology-driven mechanisms. These innovations may include subscription models, e-commerce, freemium strategies, and the use of AI for product personalization. Economic sustainability has become a core focus in the development of MSMEs in the digital era. Torres et al. (2023) provide evidence that MSMEs with high digital readiness indices exhibit stronger resilience during crises and disruptions. Gallego and Gutierrez (2020) further argue that digital inclusion allows underdeveloped regions to participate more fully in the digital economy, reducing structural inequalities. Kraus et al. (2022) introduced the concept of the "green digital business model" as a simultaneous strategy for achieving both transformation and sustainability. In local contexts like Medan, integrating digital innovation with local cultural identity offers a unique market differentiation strategy. In summary, this literature review underscores the importance of cross-dimensional integration—technology, organization, and environment—as foundational elements in building digital ecosystems that support innovative business models and sustainable economic growth.

## Methods

This study adopts a quantitative research design using a survey method to empirically test the relationships among variables within the Digital Ecosystem Innovation Model (DEIM). The main objective is to obtain systematic, measurable insights into how digital readiness, digital inclusion, and digital transformation influence business model innovation and the sustainability of local economies among MSMEs. A quantitative approach is appropriate because it facilitates the evaluation of causal relationships through standardized instruments and statistical analysis based on structural modeling. The population of this study comprises culinary MSME actors in Medan City. This segment was selected due to its high vulnerability during the COVID-19 pandemic, coupled with promising digitalization potential—particularly via online food delivery platforms, digital payment systems, and social media marketing strategies. According to data from the Department of Cooperatives and MSMEs in Medan (2024), there are over 7,000 legally and informally active culinary MSMEs. The sampling technique employed was **accidental sampling**, a method that selects readily available participants who meet predefined criteria. Although this technique limits generalizability, it is relevant given pandemic constraints and limited in-person access. The study collected responses from 250 culinary MSME actors across 21 districts in Medan. The inclusion criteria were:

1. Operating for a minimum of one year,
2. Using at least one digital platform (e.g., GoFood, Tokopedia, ShopeeFood),
3. Willing to complete the survey voluntarily.

Data were collected using a closed-ended questionnaire with a five-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree." The questionnaire was developed based on previously validated indicators and adapted for the local MSME context. The study measured six main variables:

- **Digital Readiness (DR):** Infrastructure, internet connectivity, owner/operator digital competence, and internal business preparedness (Lutfi et al., 2022).



- **Digital Inclusion (DI):** Access to technology, digital literacy, and participation in digital communities (UNDP, 2012; Mo et al., 2023).
- **Digital Transformation (DT):** Digitization of business processes, platform adoption, and process automation (Bughin et al., 2018).
- **Innovation in Business Models (IBM):** Sales model diversification, digitalized value chains, and customer services (Chesbrough, 2006).
- **Digital Business Ecosystem (DBE):** Engagement with digital platforms, collaboration, and policy support (Spigel & Harrison, 2020).
- **Sustainable Local Economy (SEL):** Business resilience, contribution to the local economy, and revenue growth through technology (Torres et al., 2023).

The questionnaires were distributed online via Google Forms and with the help of local MSME digital community partners such as SAKA and Medan Go-Digital, during February–March 2025. Instrument validity was tested through **outer loading** and **Average Variance Extracted (AVE)** using SmartPLS 3.5. All indicators demonstrated outer loading scores above 0.7 and AVE values above 0.5—indicating satisfactory convergent validity (Hair et al., 2021). Cronbach's Alpha and Composite Reliability scores exceeded 0.7 for each construct, affirming internal consistency and reliability. Data analysis was conducted using **Structural Equation Modeling–Partial Least Squares (SEM-PLS)** with SmartPLS version 3.5. SEM-PLS is advantageous for handling complex models with multiple latent constructs and indicators, and it performs well even when data do not follow a normal distribution. The analysis comprised two main stages:

- **Measurement Model Evaluation (Outer Model):** Examined indicator reliability, convergent validity (AVE), and discriminant validity using the Fornell-Larcker criterion and HTMT ratio.
- **Structural Model Evaluation (Inner Model):** Used R-Square ( $R^2$ ) values to determine predictive strength, and path coefficient significance was assessed using bootstrapping with 5,000 subsamples.

The conceptual model DEIM includes both direct and indirect paths between variables. Twelve hypotheses were derived from the literature:

- H1: Digital Readiness → Innovation in Business Models
- H2: Digital Readiness → Digital Business Ecosystem
- H3: Digital Inclusion → Innovation in Business Models
- H4: Digital Inclusion → Digital Business Ecosystem
- H5: Digital Transformation → Innovation in Business Models
- H6: Digital Transformation → Digital Business Ecosystem
- H7: Innovation in Business Models → Sustainable Local Economy
- H8: Digital Business Ecosystem → Sustainable Local Economy
- H9–H12: Indirect effects of DR, DI, and DT on SEL via IBM and DBE as mediators

The research model is visualized in Figure 1, which illustrates the causal relationships and directionality among variables—serving as the foundation for structural path analysis via SEM-PLS.

## Results

### Respondent Characteristics

The study involved 250 culinary MSME respondents from Medan City. In terms of demographic distribution, 62% of participants were female and 38% male. Most respondents (54%) were aged between 31 and 45, while 29% were under 30 years old, and the remaining were over 45. Regarding education, 78% had completed senior high school or its equivalent, and only 10% had attained higher education qualifications. In terms of business experience, 63% had been operating for more than three years, and only 12% had recently established their enterprises (within the past year). Digitally, 42% actively used more than one digital platform—such as online marketplaces (Shopee, Tokopedia), food delivery services (GoFood, GrabFood), and social media (Instagram, Facebook). However, only 28% reported having a structured digital strategy.

### Measurement Model Evaluation (Outer Model)

Evaluation of the measurement model confirmed the validity and reliability of all indicators for their respective constructs. All indicators recorded outer loading values above 0.7, indicating that they significantly explained their corresponding

latent variables. The Average Variance Extracted (AVE) for each construct exceeded 0.5, confirming good convergent validity. The Composite Reliability (CR) ranged between 0.867 and 0.945, and Cronbach’s Alpha exceeded 0.8 across constructs, suggesting high internal consistency. Discriminant validity was assessed using the Fornell-Larcker criterion, where the square root of AVE values was greater than inter-construct correlations—fulfilling the required condition.

## Structural Model Evaluation (Inner Model)

The inner model evaluation included path coefficient analysis, R-Square ( $R^2$ ) values, and significance testing via bootstrapping. The  $R^2$  value for the Innovation Business Model (IBM) construct was 0.841, indicating that 84.1% of the variance in IBM was explained by Digital Readiness, Digital Inclusion, and Digital Transformation. For the Sustainable Local Economy (SEL) construct, the  $R^2$  value was 0.870—implying that 87% of the variation in local economic sustainability was accounted for by the model. Additionally, collinearity diagnostics revealed all Variance Inflation Factor (VIF) values to be below 5, ruling out multicollinearity issues.

## Direct Hypothesis Testing

The results of direct hypothesis testing are presented below:

Hypothesis	Path	Coefficient ( $\beta$ )	t-statistic	p-value	Result
H1	DR → IBM	0.301	4.987	0.000	Significant
H2	DR → DBE	0.267	3.812	0.000	Significant
H3	DI → IBM	0.425	6.723	0.000	Significant
H4	DI → DBE	0.308	4.209	0.000	Significant
H5	DT → IBM	0.376	5.589	0.000	Significant
H6	DT → DBE	0.249	3.721	0.000	Significant
H7	IBM → SEL	0.442	7.412	0.000	Significant
H8	DBE → SEL	0.387	6.129	0.000	Significant

All paths were statistically significant at the  $p < 0.05$  level, confirming all proposed hypotheses.

## Indirect Effects and Mediation Analysis

To examine the mediating role of Innovation in Business Models (IBM) and the Digital Business Ecosystem (DBE) in the relationship between Digital Readiness (DR), Digital Inclusion (DI), and Digital Transformation (DT) on Sustainable Local Economy (SEL), bootstrapping was employed.

The analysis revealed significant indirect effects for all tested paths:

- DR → IBM → SEL:  $\beta = 0.133$ ;  $p = 0.000$
- DI → IBM → SEL:  $\beta = 0.188$ ;  $p = 0.000$
- DT → IBM → SEL:  $\beta = 0.166$ ;  $p = 0.000$
- DR → DBE → SEL:  $\beta = 0.103$ ;  $p = 0.001$
- DI → DBE → SEL:  $\beta = 0.119$ ;  $p = 0.002$
- DT → DBE → SEL:  $\beta = 0.096$ ;  $p = 0.003$

These findings emphasize the importance of both IBM and DBE as mediating variables that bridge the digitalization process and the sustainable outcomes for local MSMEs.

## Goodness-of-Fit and Predictive Relevance

The  $Q^2$  predictive relevance value for SEL was 0.521, and for IBM, it was 0.462—indicating strong predictive accuracy of the model. The Goodness of Fit (GoF) value was calculated to be 0.689, exceeding the minimum threshold of 0.36 for large models (Tenenhaus et al., 2005). This signifies that the proposed structural model fits the observed data exceptionally well and supports its robustness.

Based on the empirical testing, the following key insights were identified:

1. Digital Readiness and Digital Inclusion significantly drive innovation in business models among MSMEs.
2. A well-developed Digital Business Ecosystem facilitates the transition from digital transformation to sustainable local economies.
3. The DEIM model (Digital Ecosystem Innovation Model) demonstrated both theoretical and empirical validity in explaining the digitalization dynamics of urban MSMEs.

4. Both IBM and DBE serve as effective mediators, reinforcing the transformation impact on economic resilience and growth.

## Discussion

### Digital Readiness as the Foundation of Transformation

The findings affirm that **digital readiness** significantly influences both innovation in business models and the development of digital business ecosystems. This reinforces the premise that technological infrastructure and internal competencies are foundational prerequisites for successful digital transformation in MSMEs. This aligns with prior research by Lutfi et al. (2022) and Abdullah et al. (2021), which stress the importance of infrastructure, digital skills training, and risk management for effective technology adoption.

In the context of Medan, many MSMEs still rely on manual systems for financial records, inventory management, and marketing. The lack of digital tools and limited technological literacy are major obstacles. Therefore, digital readiness must be developed systematically through regular training, technology adoption incentives, and community-based transformation programs.

### Digital Inclusion and Equitable Access

Digital inclusion was also found to be a critical driver of innovation and the formation of inclusive digital ecosystems. Access to technology, stable internet connectivity, and device availability greatly affect MSMEs' ability to participate in the digital economy. This supports studies by Mo et al. (2023) and the UNDP (2012), which warn that digital exclusion poses a real threat to micro-entrepreneurs in developing countries.

While platforms like Shopee, Tokopedia, and GoFood have created new business opportunities, technological penetration remains uneven among MSMEs. Enterprises located in peripheral urban areas or disconnected from digital communities tend to lag behind. Thus, policy interventions should prioritize equitable access, institutional support such as digital learning communities, and technology facilitators.

### Digital Transformation and Business Model Innovation

Digital transformation significantly contributes to business model innovation. Digitized processes lead to operational efficiency, market expansion, and enhanced customer satisfaction. MSMEs that adopt digital systems for ordering, delivery, and payment often report increases in revenue and customer loyalty.

This finding echoes Vial (2021) and Bughin et al. (2018), who argue that digital transformation is multidimensional and demands a paradigm shift in business thinking. Technologies like point-of-sale systems, QRIS payments, and content-driven marketing are redefining how MSMEs operate.

Nevertheless, technology adoption is not always linear. Business owners encounter hurdles such as subscription costs, complexity of new systems, and lack of technical understanding—highlighting the need for not just technological tools, but also cultural and organizational readiness.

### Mediating Role of Ecosystem and Innovation

The study confirmed that **innovation in business models** and **digital business ecosystems** mediate the relationship between digital readiness, inclusion, and sustainable local economies. Innovation enables MSMEs to respond effectively to digital market dynamics. Enterprises that build models around subscriptions, community partnerships, or supply chain digitization show greater economic resilience (Chesbrough, 2006; Rachinger et al., 2021).

Digital business ecosystems involve a multi-actor network—local governments, e-commerce platforms, digital financial institutions (fintech), and user communities. The research reveals that MSME participation in such ecosystems accelerates innovation and promotes collaborative growth. This corroborates findings from Autio et al. (2022) and Spigel & Harrison (2020), who argue that inclusive ecosystems enhance innovation diffusion and local economic structures.

### Implications for Local Economic Sustainability





# International Conference on Finance, Economics, Management, Accounting and Informatics

"Digital Transformation and Sustainable Business: Challenges and Opportunities for Higher Education Research and Development"

The fact that both IBM and DBE significantly influence sustainable local economies supports the argument that digital transformation must be aligned with broader development agendas. Sustainability here refers not only to long-term survival but also to adaptability, job creation, and enhanced socio-economic capacity at the grassroots level (Torres et al., 2023). MSMEs that leverage digital tools demonstrated greater resilience during the pandemic, quicker recovery, and more flexibility in responding to demand fluctuations—highlighting that technology adoption is not merely strategic, but essential for economic continuity.

## Conceptual Reflection: Validating the DEIM Model

Conceptually, the findings validate the DEIM as a robust extension of the traditional TOE Framework. The model not only emphasizes technology, organization, and environment but also incorporates the critical roles of ecosystems and sustainability. This is consistent with the works of Kraus et al. (2022) and Gallego & Gutiérrez (2020), who advocate for integrated models in MSME digital transformation.

Using SEM-PLS, the model successfully explained 87% of the variance in local economic sustainability, with high predictive accuracy and goodness-of-fit—demonstrating its relevance for digitally transforming urban economies like Medan.

## CONCLUSION

Digital transformation is no longer an option—it is a necessity for the continuity and growth of MSMEs in today's technology-driven economy. This study affirms that digital readiness, digital inclusion, and digital transformation play critical roles in fostering business model innovation and strengthening local economic sustainability, particularly within the culinary MSME sector in Medan. The findings, based on SEM-PLS analysis of 250 MSMEs, reveal that these variables interact significantly within the conceptual framework of the Digital Ecosystem Innovation Model (DEIM). The DEIM model successfully explained up to 87% of the variance in economic sustainability, indicating strong structural and predictive validity. Digital Readiness positively influences both business model innovation and the digital business ecosystem. Without adequate infrastructure, skills, and organizational support, digitalization efforts are likely to falter. Digital Inclusion directly supports innovation and ecosystem engagement. Equitable access, digital literacy, and community involvement are key drivers of MSME participation in the digital economy. Digital Transformation reshapes business processes and enhances collaboration within digital ecosystems—resulting in more adaptive, efficient, and connected models of operation. Innovation in Business Models (IBM) mediates the relationship between readiness/inclusion and economic sustainability. MSMEs adopting tech-driven models experience increased efficiency, market reach, and business resilience. Digital Business Ecosystems (DBE) act as strategic connectors among business actors, governments, technology providers, and communities—promoting cross-sector innovation and integration. Sustainable Local Economies (SEL) are directly enhanced by innovation and ecosystem participation. MSMEs integrated into digital ecosystems exhibit higher adaptability and growth potential. This research contributes to the digitalization literature of MSMEs by presenting DEIM as a novel conceptual model integrating readiness, inclusion, transformation, ecosystem participation, and sustainability. It extends the classical TOE Framework with new mediating paths (via IBM and DBE), offering a more holistic understanding of how MSMEs digitally evolve. The model demonstrates that quantitative approaches using SEM-PLS are effective in exploring the complex, non-linear relationships between technological adoption and business outcomes in microeconomic sectors. Future studies may build on DEIM for more specialized or localized applications. Local governments should invest in inclusive digital ecosystems through improved ICT infrastructure, subsidized internet access, and routine, measurable digital literacy training. Digital platforms and fintech providers must transition from being mere service vendors to collaborative partners in MSME innovation development. Community hubs and incubators should serve as intermediaries—offering not just capital, but mentorship and digital upskilling opportunities. Universities have a role to play through community service programs, co-developing MSME empowerment schemes grounded in digital transformation. MSMEs themselves must shift their mindset—viewing digitalization not as a crisis response, but a long-term strategy.



# International Conference on Finance, Economics, Management, Accounting and Informatics

"Digital Transformation and Sustainable Business: Challenges and Opportunities for Higher  
Education Research and Development"

Internal digital roadmaps should be formulated based on workforce capacity, market conditions, and potential partnerships.

## ACKNOWLEDGMENT

I gratefully acknowledge the Ministry of Higher Education, Science, and Technology, Directorate General of Research and Development for granting me the opportunity to participate in the 2025 Regular Fundamental Research Grant Program and for fully funding the research project presented in this study. Their generous support has played a vital role in enabling the successful execution of this research, and I am deeply honored to be one of the recipients of this esteemed funding initiative.

## REFERENCES

- Abdullah, N. S., et al. (2021). Enhancing Digital Business Capability in SMEs: A Six-Gear Roadmap. *Journal of Small Business Strategy*, 31(4), 101–117.
- Autio, E., Nambisan, S., Thomas, L. D. W., & Wright, M. (2022). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 16(1), 10–38. <https://doi.org/10.1002/sej.1403>
- Baihaqy, A., & Subriadi, A. P. (2023). Digital readiness assessment framework for MSMEs in Indonesia. *Indonesian Journal of Information Systems*, 6(1), 15–28.
- Berliandaldo, A., Harahap, R., & Yusuf, M. (2021). The Role of Local Communities in Digitalizing SMEs in Indonesia. *Jurnal Ekonomi dan Pembangunan Indonesia*, 22(2), 67–79.
- BPS Kota Medan. (2025). *Statistik UMKM Kota Medan*. Badan Pusat Statistik Kota Medan.
- Bughin, J., Manyika, J., & Woetzel, J. (2018). *Unlocking Success in Digital Transformation*. McKinsey Global Institute.
- Chesbrough, H. (2006). *Open Business Models: How to Thrive in the New Innovation Landscape*. Harvard Business Press.
- Díaz-Arancibia, L. A., et al. (2024). Digital infrastructure as an enabler for SME competitiveness: Evidence from Latin America. *Journal of Technology Management & Innovation*, 19(1), 33–49.
- Dwivedi, Y. K., et al. (2021). Setting the future of digital and social media marketing research: Perspectives and research propositions. *International Journal of Information Management*, 59, 102168. <https://doi.org/10.1016/j.ijinfomgt.2020.102168>
- Elia, G., Margherita, A., & Passiante, G. (2020). Digital business models and maturity levels in SMEs: A case study analysis. *Journal of Business Research*, 113, 245–256.
- Gallego, M. D., & Gutiérrez, Á. (2020). Digital transformation and sustainable development: Two sides of the same coin. *Sustainability*, 12(3), 1015.



# International Conference on Finance, Economics, Management, Accounting and Informatics

"Digital Transformation and Sustainable Business: Challenges and Opportunities for Higher  
Education Research and Development"

- Gao, Y. (2024). Understanding community-based digital enablement: Case studies in ASEAN micro-enterprises. *Asia Pacific Journal of Innovation and Entrepreneurship*, 18(2), 210–225.
- Gfrerer, N., et al. (2023). Building digital capabilities in SMEs: A multilevel model of training effects. *Journal of Business Research*, 156, 113451.
- Gurzhii, A., et al. (2022). Blockchain readiness in SMEs: A multidimensional approach. *Technological Forecasting and Social Change*, 180, 121721.
- Hair, J. F., et al. (2021). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (3rd ed.). SAGE Publications.
- Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C. (2021). A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change. *Journal of Management Studies*, 58(5), 1159–1197.
- INDEF. (2024). *Laporan Ekonomi Digital UMKM Indonesia*. Institute for Development of Economics and Finance.
- Jorzik, M., Hess, T., & Legner, C. (2024). Servitization of digital platforms: Business model innovation in SMEs. *Electronic Markets*, 34(1), 1–20.
- Khasawneh, R. (2024). Bridging the digital divide in developing economies: Challenges and strategic pathways. *Information Systems Frontiers*. <https://doi.org/10.1007/s10796-023-10329-5>
- Kraus, S., et al. (2022). Digital transformation and environmental sustainability: A review and research agenda. *Technovation*, 107, 102348.
- Lamperti, F., et al. (2024). Digital ecosystems for inclusive innovation in SMEs. *Small Business Economics*, 63(2), 225–245.
- Li, F., Wang, X., & Tang, Y. (2022). Strategic digital transformation in SMEs: A framework and empirical evidence. *Journal of Small Business Management*, 60(1), 131–152.
- Lutfi, A., Almomani, A., Alshira'h, A. F., & Shishan, F. A. (2022). Antecedents of digital transformation in Jordanian SMEs: The mediating role of environmental uncertainty. *Technological Forecasting and Social Change*, 173, 121094.
- Mo, H., Sun, R., & Zhang, J. (2023). Digital Inclusion, Inequality, and Resilience of Small Enterprises. *International Journal of Entrepreneurial Behavior & Research*, 29(4), 689–712.
- Nair, S. R., et al. (2023). Government policy and digital adoption in emerging markets. *Government Information Quarterly*, 40(1), 101782.
- Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2021). Digital innovation management: Reinventing innovation governance in the digital age. *MIS Quarterly*, 45(1), 223–239.



# International Conference on Finance, Economics, Management, Accounting and Informatics

“Digital Transformation and Sustainable Business: Challenges and Opportunities for Higher  
Education Research and Development”

- Omran, N., et al. (2024). Revisiting the TOE Framework in Digital Context: A Meta-Review and Research Agenda. *Information Systems Journal*, 34(2), 191–210.
- Rachinger, M., Rauter, R., Müller, C., Vorraber, W., & Schirgi, E. (2021). Digitalization and its influence on business model innovation. *Journal of Manufacturing Technology Management*, 32(3), 579–602.
- Sitorus, T., et al. (2022). Inovasi model bisnis digital UMKM pasca pandemi: Studi di sektor kuliner urban. *Jurnal Manajemen Teknologi*, 21(1), 33–45.
- Spigel, B., & Harrison, R. (2020). Toward a process theory of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 14(1), 1–21.
- Tenenhaus, M., et al. (2005). PLS path modeling. *Computational Statistics & Data Analysis*, 48(1), 159–205.
- Torres, F., et al. (2023). Sustainable entrepreneurship and the digital economy: Evidence from Latin America. *Sustainability*, 15(1), 514.
- Turki, S., et al. (2023). Digital marketing capabilities and SME performance in the post-COVID-19 era. *Journal of Business Research*, 159, 113686.
- UNDP Indonesia. (2012). *Fostering Inclusive Digital Society in Indonesia: A Strategy Paper*. United Nations Development Programme.
- Vial, G. (2021). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, 30(2), 101–135.
- Weill, P., & Woerner, S. L. (2021). *What's Your Digital Business Model?* Harvard Business Review Press.
- Wijaya, A., & Eviyanti, F. (2024). Analisis Tingkat Literasi Digital UMKM di Sumatera Utara. *Jurnal Ekonomi dan Kebijakan Publik*, 18(2), 101–115.
- Yanti, R., et al. (2024). Strategi UMKM Menghadapi Ekonomi Digital. *Jurnal Pemberdayaan Masyarakat*, 5(1), 45–59.