

The Influence of Digital Entrepreneurship and Digital Literacy on MSME Performance through Digital Technology Adoption in Indonesia

Imam Muhtadin¹, Zainal Arifin², Fenty Astrina³, Cikita Berlian Hakim⁴, Munzir⁵, Eko Sudarmanto⁶

¹ Universitas Muhammadiyah Jakarta

² Universitas Islam Indragiri

³ Universitas Muhammadiyah Palembang

⁴ Universitas Muhammadiyah Kudus

⁵ Akuntansi, Universitas Pendidikan Muhammadiyah Sorong

⁶ Universitas Muhammadiyah Tangerang

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ABSTRACT

This study aims to examine the effect of digital entrepreneurship and digital literacy on the performance of Micro, Small, and Medium Enterprises (MSMEs) through the adoption of digital technology in Indonesia. A quantitative research approach was employed using primary data collected from 155 MSME actors through a structured questionnaire measured on a Likert scale. The data were analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS 3) to evaluate both the measurement and structural models. The results indicate that digital entrepreneurship and digital literacy have positive and significant effects on MSME performance. Furthermore, both variables significantly influence the adoption of digital technology, which in turn has a strong positive impact on business performance. The findings also confirm that digital technology adoption plays a mediating role in strengthening the relationship between digital entrepreneurship and MSME performance, as well as between digital literacy and MSME performance. Among the variables, digital literacy shows a stronger influence on technology adoption, highlighting the importance of digital skills in driving digital transformation. This study contributes to the literature by providing an integrated model that explains how digital capabilities influence MSME performance through technology adoption in a developing country context. Practically, the findings suggest that enhancing digital literacy and promoting digital entrepreneurial orientation are essential strategies for improving MSME competitiveness and sustainability in the digital economy.

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Corresponding Author:

Name: Imam Muhtadin

Institution: Universitas Muhammadiyah Jakarta

Email: imam.muhtadin@umj.ac.id

1. INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) constitute the backbone of many emerging economies, particularly in Indonesia, where they play a critical role in fostering inclusive growth, employment generation, and economic resilience [1], [2]. MSMEs contribute substantially to national gross domestic product (GDP) and serve as a primary source of livelihood for a significant portion of the population. Beyond their economic contribution, MSMEs also function as instruments for reducing income inequality and promoting regional development [3]. However, despite their strategic importance, Indonesian MSMEs continue to face persistent structural constraints, including limited access to capital, technological resources, and managerial capabilities [4]. In the context of accelerating global digitalization, these challenges have become increasingly pronounced, as competitiveness is no longer driven solely by traditional operational efficiency but by the ability to integrate and leverage digital technologies effectively.

The ongoing digital transformation has fundamentally reshaped the competitive landscape across industries. The rapid diffusion of internet connectivity, mobile technologies, and platform-based ecosystems has enabled new forms of value creation, distribution, and consumption [5], [6]. Digital platforms such as e-commerce marketplaces, financial technology (fintech) services, and social media channels have redefined how businesses interact with customers and manage operations [7], [8]. In Indonesia, the expansion of the digital economy has created unprecedented opportunities for MSMEs to scale beyond geographical boundaries, enhance customer engagement, and optimize business processes. However, the adoption of digital technologies among MSMEs remains heterogeneous. A considerable proportion of MSMEs still operate within traditional business models, reflecting disparities in digital readiness and capability [9]. This uneven adoption underscores the necessity to identify the key drivers that facilitate digital transformation and their implications for business performance.

One of the primary determinants of MSME digital transformation is digital entrepreneurship. Digital entrepreneurship extends beyond conventional entrepreneurial activities by embedding digital technologies at the core of opportunity recognition, innovation, and value creation [10], [11]. It encompasses a strategic orientation characterized by proactiveness, adaptability, and the ability to exploit digital infrastructures for competitive advantage. MSMEs with strong digital entrepreneurial capabilities are more likely to experiment with innovative business models, utilize digital platforms for market expansion, and respond dynamically to environmental changes [12]. From a theoretical perspective, digital entrepreneurship can be conceptualized as a strategic resource within the Resource-Based View (RBV), enabling firms to achieve superior performance. Furthermore, within the lens of Dynamic Capability Theory, digital entrepreneurship reflects a firm's ability to sense, seize, and transform opportunities in rapidly evolving digital environments.

In parallel, digital literacy represents a foundational capability that determines the extent to which MSME actors can effectively engage with digital technologies. Digital literacy encompasses not only technical skills but also cognitive and critical competencies required to access, evaluate, and utilize digital information [13], [14]. For MSMEs, digital literacy is essential for operating digital platforms, managing online transactions, interpreting data analytics, and maintaining digital security. Higher levels of digital literacy reduce perceived complexity and uncertainty associated with technology adoption, thereby enhancing the likelihood of successful implementation [14]. This aligns with the Technology Acceptance Model (TAM), which posits that perceived ease of use and perceived usefulness are key determinants of technology adoption behavior [15], [16]. Consequently, digital literacy functions as both an enabling factor for digital transformation and a direct contributor to improved business performance.

Despite the growing recognition of the importance of digital entrepreneurship and digital literacy, prior research has predominantly examined these constructs in isolation. Limited attention has been given to their integrated effects on MSME performance, particularly through the mediating role of digital technology adoption. Moreover, empirical studies within the Indonesian context remain relatively scarce, especially those employing advanced analytical techniques such as Structural Equation Modeling–Partial Least Squares (SEM-PLS). This gap is particularly significant given the unique socio-economic and technological landscape of Indonesia, where MSMEs operate within a rapidly evolving yet uneven digital ecosystem. Addressing this gap is crucial for developing a comprehensive understanding of how digital capabilities interact to influence business outcomes.

Accordingly, this study aims to investigate the effect of digital entrepreneurship and digital literacy on MSME performance, with the adoption of digital technology serving as a mediating variable. By employing a quantitative approach based on data collected from 155 MSME actors in Indonesia and analyzed using SEM-PLS 3, this research seeks to provide robust empirical evidence on the mechanisms through which digital capabilities drive performance. The study contributes to the literature by proposing an integrated framework that links entrepreneurial orientation, digital competence, and technological adoption within a unified model. Practically, the findings are expected to inform policymakers, practitioners, and stakeholders in designing targeted interventions to enhance MSME digital readiness, strengthen innovation capacity, and ultimately improve competitiveness in the digital economy.

2. LITERATURE REVIEW

2.1 *Theoretical Foundation*

This study is grounded in key theoretical perspectives explaining how organizational capabilities influence performance in dynamic environments.

The Resource-Based View (RBV) highlights that firm performance depends on the effective use of valuable and inimitable resources [17], [18], where digital entrepreneurship and digital literacy act as strategic intangible assets for MSMEs. Dynamic Capability Theory further emphasizes the ability of firms to adapt by integrating and reconfiguring competencies, with digital technology adoption representing a crucial capability for responding to market changes. Meanwhile, the Technology Acceptance Model (TAM) explains that perceived usefulness and ease of use drive technology adoption [15], where digital literacy enhances ease of use and digital entrepreneurship strengthens perceived usefulness. Collectively, these perspectives support that digital capabilities significantly influence MSME performance, both directly and through the adoption of digital technology.

2.2 *Digital Entrepreneurship*

Digital entrepreneurship refers to entrepreneurial activities enabled or transformed by digital technologies, involving the creation of new business models, products, and services through digital platforms, tools, and infrastructures [19], [20]. Unlike traditional entrepreneurship, it emphasizes innovation, agility, and the ability to operate within a digitally interconnected ecosystem. In the context of MSMEs, digital entrepreneurship is reflected in the ability to leverage social media, e-commerce platforms, and digital marketing tools to create value and expand market reach [21], [22]. Entrepreneurs with strong digital orientation tend to experiment with new strategies, adopt emerging technologies, and respond quickly to market changes. Previous studies show that digital entrepreneurship positively influences business performance by enhancing innovation, customer engagement, and market access, while also being closely linked to technology adoption.

Therefore, digital entrepreneurship is expected to have both a direct impact on MSME performance and an indirect effect through the adoption of digital technology.

2.3 *Digital Literacy*

Digital literacy is defined as the ability to effectively access, understand, evaluate, and use digital technologies and information, encompassing technical skills, information processing, communication, and critical thinking in digital environments [23], [24]. In the context of MSMEs, digital literacy enables business owners to utilize digital platforms for marketing, financial management, and customer interaction, while also reducing barriers to technology adoption by increasing confidence and minimizing perceived complexity. MSME actors with higher digital literacy are better equipped to navigate digital ecosystems [14], [25], analyze online data, and optimize business operations. Empirical studies indicate that digital literacy significantly enhances business performance in terms of efficiency, productivity, and competitiveness, and also plays a crucial role in facilitating the adoption of digital technologies. Therefore, digital literacy is considered both a direct determinant of MSME performance and an important antecedent of digital technology adoption.

2.4 *Adoption of Digital Technology*

The adoption of digital technology refers to the extent to which businesses integrate digital tools and systems into their operations, including e-commerce platforms, digital payment systems, social media marketing, cloud computing, and data analytics [1], [2]. For MSMEs, this adoption serves as a key driver of transformation, enabling greater efficiency, competitiveness, and responsiveness in the digital economy. It enhances business performance by reducing operational costs, improving access to information, facilitating real-time customer communication, and

expanding market reach beyond geographical boundaries [4], [26]. From a theoretical perspective, digital technology adoption acts as a mediating mechanism that translates digital capabilities into tangible performance outcomes, as MSMEs with strong digital entrepreneurship and high digital literacy are more likely to adopt such technologies, ultimately leading to improved business performance.

2.5 *MSME Performance*

MSME performance refers to the extent to which small businesses achieve their organizational goals, both financially and non-financially, including indicators such as revenue growth, profitability, cost efficiency, customer satisfaction, market expansion, and innovation capability [27], [28]. In the digital era, MSME performance is increasingly influenced by the ability to integrate digital technologies into business processes, as digital transformation enables improvements in operational efficiency, customer experience, and the creation of new revenue streams. Consequently, business performance is no longer determined solely by traditional factors but also by digital capabilities and technological readiness [29], [30]. Previous studies consistently show that digital adoption and innovation significantly enhance MSME performance, although the magnitude of this impact largely depends on internal capabilities, particularly digital entrepreneurship and digital literacy.

2.6 *Hypothesis Development*

This study develops a conceptual framework that integrates digital entrepreneurship and digital literacy as independent variables, MSME performance as the dependent variable, and digital technology adoption as a mediating variable, assuming that both digital entrepreneurship and digital literacy influence MSME performance directly and indirectly through technology adoption. This integrated

model provides a comprehensive understanding of how digital capabilities contribute to MSME success in the digital economy, while also emphasizing the importance of strengthening entrepreneurial orientation and digital skills to maximize the benefits of digital transformation. Based on this theoretical framework and previous empirical findings, this study proposes several hypotheses.

H1: Digital entrepreneurship has a positive and significant effect on MSME performance.

H2: Digital literacy has a positive and significant effect on MSME performance.

H3: Digital entrepreneurship has a positive and significant effect on the adoption of digital technology.

H4: Digital literacy has a positive and significant effect on the adoption of digital technology.

H5: The adoption of digital technology has a positive and significant effect on MSME performance.

H6: The adoption of digital technology mediates the relationship between digital entrepreneurship and MSME performance.

H7: The adoption of digital technology mediates the relationship between digital literacy and MSME performance.

3. RESEARCH METHODS

3.1 Research Design

This study employs a quantitative research approach with an explanatory design to examine the causal relationships between digital entrepreneurship, digital literacy, adoption of digital technology, and MSME performance. This approach is appropriate as it enables the measurement of variables using numerical data and the testing of hypotheses through statistical analysis. The study aims to explain how digital entrepreneurship and digital literacy as independent variables influence MSME performance as the dependent variable, both directly and indirectly through the

mediating variable of digital technology adoption, thereby providing a comprehensive understanding of the relationships among these variables within the MSME context in Indonesia.

3.2 Population and Sample

The population of this study consists of Micro, Small, and Medium Enterprises (MSMEs) in Indonesia that are actively engaged in business activities and have potential exposure to digital technology. Due to the large and heterogeneous nature of this population, this study employs a non-probability sampling technique, specifically purposive sampling, to ensure that respondents meet certain relevant criteria aligned with the research objectives.

The criteria for selecting respondents include MSME owners or managers who are actively involved in business operations, businesses that have used or have access to digital platforms such as social media, e-commerce, or digital payment systems, and respondents who are willing to participate and provide complete information. Based on these criteria, a total of 155 respondents were selected as the research sample, which is considered adequate for analysis using Structural Equation Modeling–Partial Least Squares (SEM-PLS), particularly for models with moderate complexity and sample sizes.

3.3 Data Collection Technique

The data used in this study are primary data collected through a questionnaire survey distributed online to ensure broader reach and efficiency. The instrument was designed using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to measure respondents' perceptions of digital entrepreneurship, digital literacy, adoption of digital technology, and MSME performance. Prior to full distribution, the questionnaire was tested to ensure clarity, validity, and reliability, and all respondents were

informed about the purpose of the study and assured of the confidentiality of their responses [31].

3.4 Operational Definition of Variables

This study involves four main variables, each operationalized into measurable indicators. Digital Entrepreneurship (X1) refers to the ability of MSME actors to identify and exploit opportunities using digital technologies, reflected in innovation in digital-based products or services, utilization of digital platforms, adaptability to digital market changes, and implementation of digital business strategies. Digital Literacy (X2) refers to the ability to access, understand, and use digital technologies effectively, including the ability to operate digital devices, understand digital information, utilize social media and online platforms, and maintain awareness of digital security and ethics. Adoption of Digital Technology (Z) represents the extent to which MSMEs integrate digital tools into their operations, such as the use of e-commerce platforms, digital payment systems, digital marketing tools, and the integration of digital systems in business processes. Meanwhile, MSME Performance (Y) refers to the achievement of business outcomes, both financial and non-financial, including revenue growth, profitability, market expansion, and customer satisfaction.

3.5 Data Analysis Technique

This study uses Structural Equation Modeling–Partial Least Squares (SEM-PLS 3) as the main data analysis technique, as it is suitable for predictive analysis, does not require strict data normality assumptions, and is effective for analyzing complex models involving multiple variables [32]. The analysis is conducted in two main stages, namely the measurement model (outer model) evaluation and the structural model (inner model) evaluation. The outer model is used to assess the validity and reliability of the constructs, including convergent validity measured

through outer loadings (> 0.70) and Average Variance Extracted ($AVE > 0.50$), discriminant validity assessed using the Fornell-Larcker criterion and cross-loadings, and reliability evaluated using Composite Reliability and Cronbach's Alpha (both > 0.70).

The structural model (inner model) is used to evaluate the relationships between variables and test the proposed hypotheses. This includes assessing the coefficient of determination (R^2) to determine the model's explanatory power, path coefficients to examine the direction and strength of relationships, and t-statistics and p-values obtained through bootstrapping to test significance. Additionally, effect size (f^2) is used to measure the contribution of each exogenous variable, while predictive relevance (Q^2) assesses the model's predictive capability. Mediation analysis is also conducted to examine the indirect effects of digital entrepreneurship and digital literacy on MSME performance through the adoption of digital technology.

4. RESULTS AND DISCUSSION

4.1 Respondent Profile

A total of 155 MSME actors in Indonesia participated in this study and provided valid responses for analysis. The profiling of respondents is essential to understand the general characteristics of MSME actors and to support the interpretation of the research findings. Based on gender, respondents were relatively balanced, consisting of 52.9% male and 47.1% female, indicating active participation from both groups in MSME activities. In terms of age, the majority of respondents were in the 25–35 years category (43.2%), followed by 36–45 years (24.5%), under 25 years (18.1%), and above 45 years (14.2%), suggesting that MSMEs are predominantly managed by individuals in their productive and digitally adaptive age group. Regarding education level, most respondents had a high school

background (38.1%), followed by bachelor’s degree holders (33.5%), diploma (23.2%), and postgraduate (5.2%), indicating that MSME actors generally possess sufficient educational capacity to engage with digital technologies.

From a business perspective, the culinary sector dominated the sample (38.1%), followed by fashion (27.1%), services (20.0%), and other sectors (14.8%), reflecting the diversity of MSME activities in Indonesia. In terms of business duration, most MSMEs had been operating for 1–5 years (45.8%), while 32.3% had operated for more than 5 years and 21.9% for less than 1 year, indicating a mix of growing and established businesses. Regarding digital platform usage, social media was the most widely utilized (33.5%), followed by e-commerce (26.5%) and digital payment systems (18.1%), while 21.9% of respondents used a combination of digital platforms. This distribution

highlights a growing trend of digital adoption among MSMEs, although the level of integration varies across businesses.

4.2 Measurement Model (Outer Model) Evaluation

The measurement model (outer model) evaluation aims to assess the validity and reliability of the constructs used in this study. This evaluation ensures that the indicators used to measure each latent variable are accurate, consistent, and suitable for further analysis. The assessment includes convergent validity, discriminant validity, and reliability testing.

a. Convergent Validity

Convergent validity is evaluated by examining the outer loading values and Average Variance Extracted (AVE). Indicators are considered valid if the outer loading value is greater than 0.70, while AVE values should exceed 0.50.

Table 1. Outer Loadings and AVE

Variable	Indicator	Outer Loading	AVE
Digital Entrepreneurship (X1)	DE1	0.812	0.643
	DE2	0.845	
	DE3	0.801	
	DE4	0.776	
Digital Literacy (X2)	DL1	0.834	0.667
	DL2	0.859	
	DL3	0.821	
	DL4	0.790	
Adoption of Digital Technology (Z)	ADT1	0.871	0.702
	ADT2	0.888	
	ADT3	0.842	
	ADT4	0.798	
MSME Performance (Y)	MP1	0.865	0.689
	MP2	0.847	
	MP3	0.823	
	MP4	0.801	

Table 1 shows that all indicators have outer loading values above the recommended threshold of 0.70, indicating strong convergent validity and confirming that each indicator reliably represents its respective construct. Specifically, Digital Entrepreneurship (X1)

indicators range from 0.776 to 0.845 with an AVE of 0.643, Digital Literacy (X2) ranges from 0.790 to 0.859 with an AVE of 0.667, Adoption of Digital Technology (Z) ranges from 0.798 to 0.888 with an AVE of 0.702, and MSME Performance (Y) ranges from 0.801 to

0.865 with an AVE of 0.689. All AVE values exceed the minimum threshold of 0.50, indicating that each construct explains more than half of the variance of its indicators. These results confirm that the measurement model meets the requirements for convergent validity and that the indicators used in this study are valid and suitable for further structural model analysis.

b. Discriminant Validity

Discriminant validity is used to ensure that each construct is distinct from other constructs. In this study, discriminant validity is assessed using the Fornell-Larcker criterion, where the square root of AVE for each construct must be greater than its correlations with other constructs.

Table 2. Fornell-Larcker Criterion

Variable	X1	X2	Z	Y
Digital Entrepreneurship (X1)	0.802			
Digital Literacy (X2)	0.621	0.817		
Adoption of Digital Technology (Z)	0.673	0.701	0.838	
MSME Performance (Y)	0.658	0.684	0.732	0.830

Table 2 presents the Fornell-Larcker Criterion results, showing that the square root of AVE for each construct (diagonal values) is higher than the correlations with other constructs, thereby confirming adequate discriminant validity. Specifically, Digital Entrepreneurship (0.802), Digital Literacy (0.817), Adoption of Digital Technology (0.838), and MSME Performance (0.830) all exceed their respective inter-construct correlations. For example, the correlation between Digital Entrepreneurship and Digital Literacy is 0.621, which is lower than their respective square root of AVE

values, and similarly, the correlation between Adoption of Digital Technology and MSME Performance (0.732) remains below the diagonal values. These findings indicate that each construct is empirically distinct and measures a unique concept, ensuring that there is no significant overlap between variables and that the measurement model satisfies discriminant validity requirements.

c. Cross Loading Analysis

To further validate discriminant validity, cross loading values are examined to ensure that each indicator loads higher on its own construct than on others.

Table 3. Cross Loadings

Indicator	X1	X2	Z	Y
DE1	0.812	0.521	0.548	0.533
DE2	0.845	0.566	0.579	0.561
DE3	0.801	0.497	0.531	0.514
DE4	0.776	0.482	0.512	0.498
DL1	0.542	0.834	0.601	0.588
DL2	0.566	0.859	0.624	0.603
DL3	0.521	0.821	0.593	0.572
DL4	0.498	0.790	0.561	0.544
ADT1	0.601	0.633	0.871	0.662
ADT2	0.624	0.658	0.888	0.684
ADT3	0.587	0.621	0.842	0.653
ADT4	0.552	0.593	0.798	0.621
MP1	0.612	0.638	0.701	0.865

Indicator	X1	X2	Z	Y
MP2	0.589	0.614	0.673	0.847
MP3	0.566	0.598	0.651	0.823
MP4	0.544	0.572	0.629	0.801

Table 3 presents the cross loading results, indicating that each indicator has the highest loading on its respective construct compared to other constructs, thereby confirming strong discriminant validity. For instance, indicators of Digital Entrepreneurship (DE1–DE4) show higher loadings on X1 (0.776–0.845) than on X2, Z, or Y, while Digital Literacy indicators (DL1–DL4) load highest on X2 (0.790–0.859). Similarly, Adoption of Digital Technology indicators (ADT1–ADT4) demonstrate the strongest loadings on Z (0.798–0.888), and MSME Performance indicators (MP1–MP4) load highest on Y (0.801–0.865). Although there are

moderate correlations between constructs, none of the cross-loadings exceed the primary loading of each indicator on its intended construct. These results confirm that each measurement item distinctly represents its respective latent variable, ensuring that the model satisfies the requirements of discriminant validity and can be reliably used for further structural analysis.

d. Reliability Test

Reliability is assessed using Cronbach's Alpha and Composite Reliability (CR). A construct is considered reliable if both values exceed 0.70.

Table 3. Reliability Results

Variable	Cronbach's Alpha	Composite Reliability
Digital Entrepreneurship (X1)	0.812	0.878
Digital Literacy (X2)	0.835	0.889
Adoption of Digital Technology (Z)	0.861	0.904
MSME Performance (Y)	0.847	0.898

Table 3 presents the reliability results, showing that all constructs meet the recommended thresholds for internal consistency, with Cronbach's Alpha and Composite Reliability values exceeding 0.70. Specifically, Digital Entrepreneurship (0.812; 0.878), Digital Literacy (0.835; 0.889), Adoption of Digital Technology (0.861; 0.904), and MSME Performance (0.847; 0.898) all demonstrate strong reliability. The consistently high Composite Reliability values further indicate that the indicators within each construct are highly consistent in measuring the same latent variable. These findings confirm that the measurement instruments used in

this study are reliable and stable, ensuring that the constructs can be used confidently for subsequent structural model analysis.

4.3 Structural Model (Inner Model) Evaluation

The structural model (inner model) evaluation aims to examine the relationships between latent variables and to test the proposed hypotheses. This stage assesses the predictive power of the model and the significance of the causal relationships among variables. The evaluation includes the coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and hypothesis testing using path coefficients.

a. Coefficient of Determination (R^2)

The coefficient of determination (R^2) measures the

extent to which endogenous variables are explained by exogenous variables in the model, where higher values indicate stronger explanatory power. The results show that the R^2 value for Adoption of Digital Technology (Z) is 0.564, indicating a moderate level of explanation, while the R^2 value for MSME Performance (Y) is 0.621, indicating a moderate to strong explanatory power. This means that digital entrepreneurship and digital literacy explain 56.4% of the variance in digital technology adoption, and

together with digital technology adoption, they explain 62.1% of MSME performance. Overall, these findings suggest that the model has good explanatory capability in capturing the relationships among the studied variables.

b. Effect Size (f^2)

Effect size (f^2) evaluates the contribution of each exogenous variable to the endogenous variable. According to the guidelines, f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively.

Table 4. Effect Size (f^2)

Relationship	f^2	Effect Size
X1 → Z	0.168	Medium
X2 → Z	0.245	Medium
X1 → Y	0.091	Small
X2 → Y	0.118	Small
Z → Y	0.276	Medium

Table 4 presents the effect size (f^2) results, indicating the contribution of each exogenous variable to the endogenous variables in the model. The findings show that Digital Entrepreneurship (X1 → Z = 0.168) and Digital Literacy (X2 → Z = 0.245) have medium effect sizes on the adoption of digital technology, with digital literacy demonstrating a stronger influence. Meanwhile, the direct effects of Digital Entrepreneurship (X1 → Y = 0.091) and Digital Literacy (X2 → Y = 0.118) on MSME performance are

categorized as small, suggesting that their impact is partially realized through other mechanisms. In contrast, the effect of Adoption of Digital Technology on MSME Performance (Z → Y = 0.276) is moderate, highlighting its significant role as a key driver of performance.

c. Predictive Relevance (Q^2)

Predictive relevance (Q^2) is used to evaluate the model's predictive capability using the blindfolding procedure. A Q^2 value greater than zero indicates that the model has predictive relevance.

Table 5. Predictive Relevance (Q^2)

Endogenous Variable	Q^2
Adoption of Digital Technology (Z)	0.372
MSME Performance (Y)	0.401

Table 5 presents the predictive relevance (Q^2) results, showing that the Q^2 values for Adoption of Digital Technology (0.372) and MSME Performance (0.401) are both greater than zero, indicating that the model has strong

predictive relevance. These values suggest that the structural model is capable of accurately predicting the endogenous constructs and has good out-of-sample predictive power. Furthermore, the relatively high Q^2 values imply that the model not only

explains the relationships among variables but also possesses robust predictive capability, reinforcing the suitability of the proposed model for analyzing MSME performance in the context of digital transformation.

d. Hypothesis Testing (Path Coefficients)

Hypothesis testing is conducted using bootstrapping to examine the significance of path coefficients. A hypothesis is accepted if the t-value > 1.96 and p-value < 0.05.

Table 6. Path Coefficients and Hypothesis Testing

Hypothesis	Path	Coefficient	t-value	p-value	Result
H1	X1 → Y	0.245	2.987	0.003	Supported
H2	X2 → Y	0.281	3.214	0.001	Supported
H3	X1 → Z	0.332	4.102	0.000	Supported
H4	X2 → Z	0.417	5.236	0.000	Supported
H5	Z → Y	0.398	4.887	0.000	Supported

Table 6 presents the results of path coefficients and hypothesis testing, indicating that all proposed hypotheses are supported with positive and statistically significant relationships ($p < 0.05$). Digital Entrepreneurship has a significant effect on MSME Performance ($\beta = 0.245$; $t = 2.987$) and on Adoption of Digital Technology ($\beta = 0.332$; $t = 4.102$), while Digital Literacy shows an even stronger influence on both MSME Performance ($\beta = 0.281$; $t = 3.214$) and Adoption of Digital Technology ($\beta = 0.417$; $t = 5.236$). Furthermore, Adoption of Digital Technology has a strong and significant effect on MSME Performance ($\beta = 0.398$; $t = 4.887$),

indicating its central role in improving business outcomes. These findings suggest that both digital entrepreneurship and digital literacy not only directly enhance MSME performance but also indirectly contribute through increased adoption of digital technology, with digital literacy emerging as the more dominant driver of technology adoption.

e. Mediation Analysis

Mediation analysis is conducted to examine whether the adoption of digital technology acts as a mediating variable between independent and dependent variables.

Table 7. Indirect Effects (Mediation Testing)

Hypothesis	Indirect Path	Coefficient	t-value	p-value	Result
H6	X1 → Z → Y	0.132	3.765	0.000	Supported
H7	X2 → Z → Y	0.166	4.012	0.000	Supported

Table 7 presents the results of the indirect effects (mediation testing), showing that both mediation hypotheses are supported with positive and significant coefficients ($p < 0.05$). The indirect effect of Digital Entrepreneurship on MSME Performance through Adoption of Digital Technology ($\beta = 0.132$; $t = 3.765$) indicates that digital

entrepreneurship contributes to performance not only directly but also by encouraging technology adoption. Similarly, Digital Literacy demonstrates a stronger indirect effect on MSME Performance through digital technology adoption ($\beta = 0.166$; $t = 4.012$), highlighting its critical role in facilitating digital transformation. These findings

confirm that Adoption of Digital Technology acts as a significant mediating variable, strengthening the impact of digital capabilities on MSME performance, with digital literacy showing a more dominant mediating pathway compared to digital entrepreneurship.

4.4 Discussion

This study provides robust empirical evidence on the role of digital capabilities in enhancing MSME performance within the context of Indonesia's evolving digital economy. The findings confirm that all hypothesized relationships are statistically significant, reinforcing the central premise that digital entrepreneurship and digital literacy function as critical strategic resources that drive business performance both directly and indirectly through the adoption of digital technology [33], [34]. From a theoretical standpoint, the results substantiate the integration of the Resource-Based View (RBV), Dynamic Capability Theory, and the Technology Acceptance Model (TAM), offering a comprehensive explanation of how internal capabilities and behavioral factors interact to shape firm-level outcomes in digitally transforming environments.

The significant positive effect of digital entrepreneurship on MSME performance highlights the importance of entrepreneurial orientation in leveraging digital opportunities. MSMEs that exhibit proactiveness, innovativeness, and risk-taking behavior in digital contexts are better positioned to create value and sustain competitive advantage. This aligns with RBV, where digital entrepreneurial capability can be conceptualized as a valuable and inimitable resource [11], [35]. Moreover, the relatively moderate coefficient ($\beta = 0.245$) suggests that while digital entrepreneurship is important, its impact is amplified when combined with complementary capabilities, particularly

those related to digital skills and technology utilization. This finding also resonates with prior studies emphasizing that digital entrepreneurship enhances market responsiveness, innovation outcomes, and customer engagement in small business settings.

In contrast, digital literacy demonstrates a stronger direct and indirect influence on both technology adoption and MSME performance ($\beta = 0.281$ for performance; $\beta = 0.417$ for adoption), indicating that technical competence is a more immediate driver of digital transformation. This finding provides important nuance to TAM, as it empirically confirms that perceived ease of use—rooted in digital literacy—plays a more dominant role in facilitating adoption behavior than perceived usefulness alone [36]. In developing country contexts such as Indonesia, where digital inequality persists, this result underscores that improving digital skills is not merely supportive but foundational to enabling MSMEs to participate effectively in the digital economy. It also suggests that without adequate literacy, even strong entrepreneurial orientation may not translate into effective technology utilization.

Furthermore, the strong effect of digital technology adoption on MSME performance ($\beta = 0.398$) reinforces its role as a key mediating mechanism linking capabilities to outcomes. This supports Dynamic Capability Theory, where the ability to integrate and reconfigure digital tools into business processes enables firms to respond to environmental changes more effectively. The mediation results ($\beta = 0.132$ and $\beta = 0.166$) further indicate that digital entrepreneurship and digital literacy exert their greatest impact when translated into actual technology usage. This implies that capability alone is insufficient; it must be operationalized through digital adoption to generate tangible performance gains. The stronger

indirect effect of digital literacy also highlights that skill-based readiness accelerates the realization of digital benefits.

From a broader perspective, these findings contribute to the literature by advancing an integrated model of MSME digital transformation that captures both capability-driven and technology-driven pathways. Unlike prior studies that treat digital entrepreneurship and digital literacy independently, this research demonstrates their complementary and interdependent roles within a unified framework. Practically, the results suggest that policy interventions should move beyond infrastructure provision toward capability development, particularly through targeted digital literacy programs and support for digital entrepreneurial ecosystems. Initiatives such as training in e-commerce management, digital marketing analytics, and financial technology utilization can significantly enhance MSME readiness and performance.

In conclusion, this study confirms that MSME success in the digital era is fundamentally shaped by the synergy between entrepreneurial mindset, digital competence, and effective technology adoption. The integration of these elements not only enhances operational efficiency and market expansion but also ensures long-term sustainability in an increasingly competitive and technology-driven business environment.

5. CONCLUSION

This study concludes that digital entrepreneurship and digital literacy are critical determinants of MSME performance in Indonesia, both directly and indirectly through the adoption of digital technology. Digital entrepreneurship enhances performance by fostering innovation and enabling business actors to identify and exploit digital opportunities, while digital literacy strengthens the ability to effectively utilize digital tools, improving operational efficiency and decision-making. The findings further reveal that the adoption of digital technology plays a central mediating role in linking digital capabilities to business outcomes, as MSMEs that adopt platforms such as e-commerce and digital payment systems are better able to expand market reach, enhance customer engagement, and increase profitability. Notably, digital literacy emerges as a stronger driver of technology adoption compared to digital entrepreneurship, emphasizing the importance of technical skills in the digital transformation process. Overall, the study highlights that MSME success in the digital era depends on the integration of entrepreneurial mindset and digital competence with effective technology utilization, and therefore policymakers and stakeholders are encouraged to promote digital literacy, support digital innovation, and improve access to digital infrastructure to accelerate MSME transformation and ensure sustainable economic growth in Indonesia.

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