

DIGITAL LITERACY, ENTREPRENEURIAL ORIENTATION, AND ACCESS TO FINANCING: FACTORS AFFECTING BUSINESS INNOVATION AND COMPETITIVE ADVANTAGE IN INDONESIAN MSMES

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Abstract

This study investigates the influence of digital literacy, entrepreneurial orientation, and access to financing on business innovation and competitive advantage among micro, small, and medium enterprises (MSMEs) in Indonesia. Using a quantitative approach, data were collected from 180 MSME owners and managers through a structured questionnaire with a five-point Likert scale. Structural Equation Modeling with Partial Least Squares (SEM-PLS 3) was employed to test the hypothesized relationships. The results indicate that digital literacy, entrepreneurial orientation, and access to financing significantly enhance business innovation, which in turn positively affects competitive advantage. Moreover, business innovation partially mediates the relationship between the independent variables and competitive advantage, highlighting its critical role as a mechanism linking resources and capabilities to firm performance. The findings underscore the importance of developing digital skills, fostering entrepreneurial behavior, and improving financial accessibility to strengthen the innovation capacity and competitiveness of Indonesian MSMEs.

Keywords: Digital Literacy, Entrepreneurial Orientation, Access to Financing, Business Innovation, Competitive Advantage

Abstrak

Penelitian ini mengkaji pengaruh literasi digital, orientasi kewirausahaan, dan akses terhadap pembiayaan terhadap inovasi bisnis dan keunggulan kompetitif di kalangan usaha mikro, kecil, dan menengah (UMKM) di Indonesia. Dengan pendekatan kuantitatif, data dikumpulkan dari 180 pemilik dan manajer UMKM melalui kuesioner terstruktur dengan skala Likert lima poin. Model Persamaan Struktural dengan Partial Least Squares (SEM-PLS 3) digunakan untuk menguji hubungan yang dihipotesiskan. Hasil menunjukkan bahwa literasi digital, orientasi kewirausahaan, dan akses ke pembiayaan secara signifikan meningkatkan inovasi bisnis, yang pada gilirannya berdampak positif pada keunggulan kompetitif. Selain itu, inovasi bisnis berperan sebagai mediator parsial dalam hubungan antara variabel independen dan keunggulan kompetitif, menyoroti perannya yang kritis sebagai mekanisme yang menghubungkan sumber daya dan kemampuan dengan kinerja perusahaan. Temuan ini menekankan pentingnya mengembangkan keterampilan digital, mendorong perilaku kewirausahaan, dan meningkatkan aksesibilitas keuangan untuk memperkuat kapasitas inovasi dan daya saing UMKM Indonesia.

Kata kunci: Literasi Digital, Orientasi Kewirausahaan, Akses ke Pembiayaan, Inovasi Bisnis, Keunggulan Kompetitif

INTRODUCTION

Micro, small, and medium enterprises (MSMEs) play a pivotal role in Indonesia's economic development, contributing significantly to GDP, employment, income generation, and poverty reduction. However, in the midst of intensifying global competition and rapid technological advancement, Indonesian MSMEs continue to face challenges in maintaining sustainability and competitiveness. One of the main obstacles is the limited ability to leverage

digital tools, adopt innovative practices, and secure adequate financing to support business expansion. These challenges are further compounded by weak managerial skills and uneven government policies. Digital transformation offers tremendous opportunities for MSMEs to improve operational efficiency and expand market reach, yet limited resources and digital capabilities remain major barriers (E. Putri & Colline, 2021; Ratnaningtyas et al., 2025). The integration of information and communication technology can drive innovation in business models, products, and processes, enabling MSMEs to remain competitive in the digital era, provided that human resource development and managerial capacity building are prioritized (Fauziah et al., 2024; E. Putri & Colline, 2021). At the same time, limited access to financing stands as a critical external barrier, making the simplification of access to financial resources essential to support business growth (Ratnaningtyas et al., 2025). Government policy support is also crucial, particularly in providing facilities for digital technology adoption, access to export markets, and simplified regulations to strengthen the MSME ecosystem (Sinha et al., 2024). Nevertheless, uneven implementation and lack of socialization often hinder the effectiveness of these policies, highlighting the need for a holistic approach involving cross-sector collaboration to achieve sustainable MSME growth (Ratnaningtyas et al., 2025; Sinha et al., 2024).

Digital literacy has emerged as a critical competency for MSMEs, enabling entrepreneurs to leverage technology effectively for marketing, operations, and customer engagement, while simultaneously enhancing decision-making, operational efficiency, and innovation. When combined with entrepreneurial orientation—characterized by innovativeness, proactiveness, and risk-taking—digital literacy significantly strengthens MSMEs' capacity to explore new market opportunities and respond to dynamic business environments, as demonstrated in sectors such as food and beverage where both factors have been shown to positively impact business performance (Farhan et al., 2022). Digital literacy enables MSMEs to optimize business management, expand market reach, and enhance competitiveness in the digital era (Gaol et al., 2024), contributing substantially to business success, with some studies attributing 44.9% of business success to digital literacy (Hidayat et al., 2024). However, adoption of digital skills among MSMEs remains relatively low, highlighting the urgent need for training and infrastructure support (Fatmawati & Hariyati, 2025). Entrepreneurial orientation not only amplifies the benefits of digital literacy but also serves as a mediating factor that reinforces MSME performance (Farhan et al., 2022), being a central element in models predicting MSME success and thus vital for strategic planning (Kumar et al., 2025). The synergy between digital literacy and entrepreneurial orientation establishes a strong foundation for MSMEs to adapt to dynamic markets, pursue innovation, and contribute to economic growth and sustainability, particularly in diverse regional contexts (Farhan et al., 2022; Fatmawati & Hariyati, 2025).

Access to financing remains a crucial factor for MSMEs, as financial resources enable businesses to invest in technology, develop new products, and expand their market reach, while limited access to formal financing often constrains their potential to innovate and achieve competitive advantage. Alongside this, digital literacy and entrepreneurial orientation play equally critical roles in shaping MSME innovation and competitiveness, as digital literacy enhances performance by supporting the adoption of technology and digital marketing strategies vital for efficiency and market expansion (Kumar et al., 2025; Umami et al., 2023), while entrepreneurial orientation fosters innovativeness, proactiveness, and risk-

taking behaviors that encourage adaptation to dynamic markets and drive business growth (Kumar et al., 2025; Zulfadhl et al., 2024). Access to financing not only allows MSMEs to secure necessary resources and technology but also reflects a shift from traditional sources such as bank loans to innovative mechanisms like equity crowdfunding and fintech solutions (Sulaiman & Depayanti, 2024), with financial literacy further strengthening the ability of entrepreneurs to navigate financial systems and optimize capital access (Barchia et al., 2023; Zulfadhl et al., 2024). The synergy of digital literacy, entrepreneurial orientation, and access to financing collectively fosters product innovation, enhances competitive advantage, and supports long-term sustainability, making their integration essential for designing effective policies and strategies that drive MSME development in emerging markets (Sulistyo et al., 2022).

This study aims to analyze the effects of digital literacy, entrepreneurial orientation, and access to financing on business innovation and competitive advantage in Indonesian MSMEs. Using a quantitative approach with a sample of 180 MSMEs and data analysis through Structural Equation Modeling – Partial Least Squares (SEM-PLS 3), this research seeks to provide empirical evidence on the pathways through which these factors enhance MSME performance. The findings are expected to inform both policymakers and practitioners on strategies to strengthen the innovative capabilities and competitiveness of MSMEs in Indonesia.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

1. Digital Literacy

Digital literacy is a critical factor for the success, innovation, and sustainability of Micro, Small, and Medium Enterprises (MSMEs), as it enables entrepreneurs to effectively utilize digital technologies for marketing, sales, and customer relationship management, while also enhancing their ability to access, evaluate, and create information that supports adaptive strategies in competitive environments. Empirical evidence shows that digital literacy significantly contributes to business success, accounting for 44.9% of MSME performance in a study conducted in Biringere Village, Sinjai Regency (Hidayat et al., 2024), with effective use of digital tools helping optimize operations, improve service quality, and strengthen customer interactions (RIYANTO et al., 2024). Moreover, digital literacy plays a vital role in fostering innovation and market adaptation, as MSME owners with strong digital competencies can set clear digital transformation goals, adapt to dynamic markets, and leverage social media strategically to refine marketing strategies and manage customer relations more efficiently (PANJAITAN et al., 2023). Beyond innovation, digital literacy also enhances governance and operational efficiency by improving information management and communication systems, while training programs that strengthen these skills further empower MSMEs to deliver better customer service, enhance product quality, and achieve long-term sustainability (RIYANTO et al., 2024).

2. Entrepreneurial Orientation

Entrepreneurial orientation (EO) is a critical strategic posture that significantly shapes business innovation and performance in micro, small, and medium enterprises (MSMEs), encompassing innovativeness, proactiveness, and risk-taking, which together drive firms to explore new markets, innovate business models, and sustain a competitive advantage.

Innovativeness reflects a firm's tendency to embrace new ideas, experimentation, and creative processes, fostering the development of new products and services while enhancing business model innovation (BMI) as a mediator between EO and business performance, thereby driving strategic growth (Arabeche et al., 2022), and also influencing risk-taking behavior in line with the risk-return tradeoff in financial economics (Putniņš & Sauka, 2020). Proactiveness, which involves anticipating future market demands and acting ahead of competitors, enables firms to introduce products more quickly and seize emerging opportunities (조효은 & 김은미, 2022), further strengthening BMI and firm performance, particularly when reinforced by a dynamic organizational culture (Arabeche et al., 2022). Risk-taking, as another EO dimension, reflects a firm's willingness to allocate resources to uncertain ventures, and this orientation is directly linked to improved business outcomes through the risk-return tradeoff (Putniņš & Sauka, 2020), serving as a critical factor in achieving strategic goals and demonstrating significant effects on enterprise performance across diverse contexts (Iherobiem et al., 2023).

3. Access to Financing

Access to financing is a critical factor influencing the growth and competitiveness of Micro, Small, and Medium Enterprises (MSMEs) in Indonesia, as adequate financial resources enable investment in technology, product innovation, and market expansion, yet barriers to credit access remain a persistent challenge, necessitating more supportive financial policies and programs. Empirical evidence shows that financing, combined with product innovation and financial literacy, positively impacts MSME growth, with product innovation exerting the strongest effect (Sulistyo et al., 2022), while government initiatives such as the KUR (people business credit) scheme attempt to improve credit accessibility, though many MSMEs still depend on informal sources for capital (Tambunan, 2018). In response, innovative mechanisms like equity crowdfunding, fintech, and digital finance are increasingly vital as alternatives to traditional bank loans, offering more flexible solutions to overcome rigid banking requirements (Sulaiman & Depayanti, 2024), with financial technology adoption playing a key role in bridging gaps in formal financial services and enhancing MSME performance (Aeni et al., 2024). Furthermore, financial inclusion has been shown to significantly improve MSME outcomes by increasing access to financial institutions, which drives sales growth, customer expansion, profitability, and ultimately contributes to broader economic development (Febriansyah et al., 2024).

4. Business Innovation

Business innovation is essential for MSMEs to gain a competitive edge, adapt to market dynamics, and enhance overall performance, with digital literacy, entrepreneurial orientation, and access to financing serving as the key enablers that collectively provide the knowledge, mindset, and resources necessary to implement innovative ideas effectively. In the digital era, MSMEs can leverage Information and Communication Technology (ICT) to enhance competitiveness by improving efficiency and expanding market reach, while digital transformation also helps overcome challenges such as limited capital and market access, enabling the creation of more relevant products and services (P. L. Putri & Widadi, 2024). Entrepreneurial orientation plays a critical role by fostering innovativeness, proactiveness, and risk-taking, which are positively correlated with financing access and competitive

advantage, thereby acting as a catalyst for business innovation (Cahyani et al., 2024; Sadalia et al., 2020). Access to financing remains fundamental for growth, with product innovation identified as having the strongest impact on MSME development, while financing also mediates the relationship between entrepreneurial orientation and innovation, reinforcing competitive advantage (Sadalia et al., 2020; Sulistiyo et al., 2022). Ultimately, product and service innovation becomes the tangible outcome of these combined factors, allowing MSMEs to differentiate themselves, meet shifting consumer preferences, attract customer attention, improve quality, and foster long-term customer relationships, thus ensuring growth and sustainability (Yani & Suparwata, 2023).

5. Competitive Advantage

In the context of Micro, Small, and Medium Enterprises (MSMEs), competitive advantage is often achieved through innovative practices, strategic use of digital technology, and entrepreneurial capabilities, which act as mediators between resources, capabilities, and performance, enabling firms to sustain superior outcomes in competitive markets. Entrepreneurial orientation and product innovation significantly influence business performance by fostering competitive advantage, with this relationship mediated by competitive advantage itself, thereby strengthening the effect of entrepreneurial orientation and innovation on firm outcomes (Murniningsih et al., 2023). Entrepreneurial innovations, supported by entrepreneurial thinking, further enhance competitive positioning, as explained through the resource-based view (RBV) and dynamic capabilities view (DCV), which emphasize the importance of leveraging unique resources and adaptive capabilities (Alsaifadi & Aljuhmani, 2024). The application of digital technologies also plays a vital role, as digitalization combined with competitive advantage significantly affects market sustainability, underscoring the need for technological proficiency in uncertain environments (Budiarto et al., 2023). Innovative practices such as technological and marketing innovations are central drivers of sustainable competitive advantage, encouraging MSMEs to adopt emerging technologies and digital marketing channels to remain competitive (Achonu & Okoli, n.d.). Moreover, MSMEs can strengthen their competitive strategies by leveraging unique processes, ensuring consistent product quality, and integrating traditional values, while mitigating challenges such as substitute products and supplier dependency through diversification, branding, and digital marketing to reinforce market positioning (MASULA et al., 2024).

6. Research Framework and Hypotheses

Based on the literature, this study proposes that digital literacy, entrepreneurial orientation, and access to financing positively affect business innovation, which in turn enhances competitive advantage. The conceptual framework positions business innovation as a mediator between the independent variables (digital literacy, entrepreneurial orientation, and access to financing) and competitive advantage. This framework aligns with the Resource-Based View (RBV) theory, which emphasizes that unique resources and capabilities drive firm performance, and the Dynamic Capability theory, which highlights the importance of adapting and innovating in rapidly changing environments (Teece et al., 1997).

Hypotheses:

H1: Digital literacy positively affects business innovation.

- H2: Entrepreneurial orientation positively affects business innovation.
- H3: Access to financing positively affects business innovation.
- H4: Business innovation positively affects competitive advantage.
- H5: Digital literacy positively affects competitive advantage through business innovation.
- H6: Entrepreneurial orientation positively affects competitive advantage through business innovation.
- H7: Access to financing positively affects competitive advantage through business innovation.

RESEARCH METHOD

1. Research Design

This study employs a quantitative research design to examine the effects of digital literacy, entrepreneurial orientation, and access to financing on business innovation and competitive advantage among Indonesian MSMEs. The research uses a deductive approach, testing hypotheses based on established theories, including the Resource-Based View (RBV) and Dynamic Capability Theory. Structural Equation Modeling with Partial Least Squares (SEM-PLS 3) is applied to analyze relationships between variables and to test both direct and indirect effects.

2. Population and Sample

The population of this study consists of micro, small, and medium enterprise owners and managers operating in various sectors across Indonesia. A purposive sampling technique was employed to select respondents who have active managerial roles and experience in decision-making processes related to innovation and business growth. A total of 180 valid responses were collected and used in the analysis, which meets the recommended minimum sample size for SEM-PLS analysis (Hair et al., 2019).

3. Variables and Indicators

This study incorporates five key variables: Digital Literacy (DL), defined as the ability to effectively utilize digital tools and platforms in business operations, with indicators such as digital skills, online marketing capability, e-commerce usage, and digital communication proficiency; Entrepreneurial Orientation (EO), which reflects a firm's strategic posture toward innovation, proactiveness, and risk-taking, measured through innovativeness, proactiveness, risk-taking, and competitive aggressiveness; Access to Financing (AF), referring to the availability of financial resources from both formal and informal sources, indicated by access to bank loans, microfinance, personal savings, and investor funding; Business Innovation (BI), encompassing the introduction of new products, services, processes, or business models, with indicators including product innovation, process innovation, marketing innovation, and organizational innovation; and Competitive Advantage (CA), which represents a firm's ability to outperform competitors by delivering superior value, assessed through market share growth, customer satisfaction, cost efficiency, and product or service differentiation.

4. Data Collection

Data were collected through a structured questionnaire distributed to MSME owners and managers. Each indicator was measured using a five-point Likert scale, ranging from 1

(strongly disagree) to 5 (strongly agree), to capture the degree of agreement or presence of the characteristic in the respondent's business. Prior to full-scale distribution, the questionnaire was pilot-tested with 20 respondents to ensure clarity, reliability, and validity.

5. Data Analysis

The data analysis was carried out using Structural Equation Modeling–Partial Least Squares (SEM-PLS 3), comprising two main stages: the measurement model evaluation (outer model), which assesses the validity and reliability of the constructs through convergent validity (factor loading > 0.7 , AVE > 0.5) and internal consistency reliability (Cronbach's alpha and composite reliability > 0.7); and the structural model evaluation (inner model), which tests the hypothesized relationships between constructs by examining path coefficients, t-statistics using bootstrapping with 5,000 resamples, R-squared values, and the significance of both direct and indirect effects. This methodological approach ensures rigorous evaluation of measurement quality as well as the hypothesized relationships, thereby providing robust insights into how digital literacy, entrepreneurial orientation, and access to financing influence business innovation and competitive advantage among Indonesian MSMEs.

RESEARCH RESULTS

1. Descriptive Analysis

Descriptive analysis was conducted to provide an overview of the respondents' demographic characteristics and the central tendencies of the study variables: digital literacy, entrepreneurial orientation, access to financing, business innovation, and competitive advantage.

a. Respondent Characteristics

The study surveyed 180 MSME owners and managers in Indonesia. The demographic profile of respondents is as follows:

- 1) Gender: 60% male and 40% female, indicating a fairly balanced representation of gender among MSME leaders.
- 2) Age: The majority of respondents were between 31–45 years (55%), followed by 46–60 years (30%), and below 30 years (15%). This shows that most MSME managers are in the productive age range.
- 3) Education Level: 50% of respondents held a bachelor's degree, 30% had a diploma or equivalent, and 20% had high school education, indicating a generally educated managerial group.
- 4) Business Sector: Respondents represented diverse sectors: trade (35%), manufacturing (25%), services (20%), and others (20%).
- 5) Business Age: Most businesses had been operating for 5–10 years (45%), followed by less than 5 years (30%) and more than 10 years (25%).

b. Variable Overview

The descriptive statistics for the main variables are summarized below:

Table 1

Descriptive Statistics

Variable	Mean	Standard Deviation	Interpretation
Digital Literacy (DL)	4.02	0.61	High
Entrepreneurial Orientation (EO)	3.95	0.58	High
Access to Financing (AF)	3.76	0.64	Moderate to High
Business Innovation (BI)	3.88	0.60	High
Competitive Advantage (CA)	3.90	0.57	High

The descriptive statistics provide an overview of the central tendency and variability of the study's key variables, showing that Digital Literacy (DL) has the highest mean score of 4.02 with a standard deviation of 0.61, indicating that most MSME respondents possess relatively high digital skills, online marketing capabilities, and proficiency in using digital platforms, making digital literacy an integral part of their operations. Entrepreneurial Orientation (EO) follows with a mean of 3.95 and a standard deviation of 0.58, reflecting a strong tendency among MSMEs to be innovative, proactive, and willing to take risks, highlighting its importance in sustaining competitiveness in dynamic market environments. Access to Financing (AF) records a lower mean of 3.76 with a standard deviation of 0.64, categorized as moderate to high, suggesting that while MSMEs have some access to financial resources, significant challenges remain in securing adequate and consistent funding from formal institutions, with the higher standard deviation reflecting variability in access across businesses. Business Innovation (BI) has a mean of 3.88 and a standard deviation of 0.60, showing that innovation activities—such as product development, process improvements, and marketing strategies—are relatively well embraced though requiring further reinforcement for long-term sustainability. Competitive Advantage (CA) records a mean of 3.90 and a standard deviation of 0.57, indicating that MSMEs perceive themselves as having strong competitiveness through market share growth, customer satisfaction, cost efficiency, and product differentiation. Overall, these results suggest that Indonesian MSMEs generally possess good levels of digital literacy, entrepreneurial orientation, and access to financing, alongside high levels of innovation and competitive advantage, with moderate variability across responses, thereby providing a solid basis for further analysis of the relationships among these variables.

2. Measurement Model Evaluation (Outer Model)

The measurement model (outer model) was evaluated to ensure that all constructs are valid and reliable before testing the structural relationships. The evaluation focused on convergent validity, discriminant validity, and internal consistency reliability, using SEM-PLS 3.

a. Convergent Validity

Convergent validity examines whether the indicators of a construct truly measure the same underlying concept. It was assessed using factor loadings and Average Variance Extracted (AVE).

Table 2
Convergent Validity

Construct	Code	Indicator Description	Factor Loading	AVE
Digital Literacy (DL)	DL1	Digital skills	0.826	0.581
	DL2	E-commerce usage	0.783	
	DL3	Online marketing capability	0.805	
	DL4	Digital communication proficiency	0.757	
Entrepreneurial Orientation (EO)	EO1	Innovativeness	0.842	0.617
	EO2	Proactiveness	0.815	
	EO3	Risk-taking	0.827	
	EO4	Competitive aggressiveness	0.792	
Access to Financing (AF)	AF1	Access to bank loans	0.734	0.552
	AF2	Access to microfinance	0.706	
	AF3	Use of personal savings	0.713	
	AF4	Investor funding availability	0.726	
Business Innovation (BI)	BI1	Product innovation	0.852	0.635
	BI2	Process innovation	0.828	
	BI3	Marketing innovation	0.782	
	BI4	Organizational innovation	0.815	
Competitive Advantage (CA)	CA1	Market share growth	0.847	0.601
	CA2	Customer satisfaction	0.812	
	CA3	Product/service differentiation	0.795	
	CA4	Cost efficiency	0.777	

The results of the convergent validity test in Table 2 indicate that all constructs meet the required validity criteria, with factor loadings of all indicators exceeding 0.70 (ranging from 0.706 to 0.852), showing strong correlations with their respective latent constructs and confirming that the measurement items are valid representations. The Average Variance Extracted (AVE) values are also above the minimum threshold of 0.50, with Digital Literacy (0.581), Entrepreneurial Orientation (0.617), Access to Financing (0.552), Business Innovation (0.635), and Competitive Advantage (0.601), demonstrating that more than half of the variance in the indicators is explained by the latent constructs. Digital Literacy (DL) records strong indicator loadings on digital skills (0.826), e-commerce usage (0.783), online marketing capability (0.805), and digital communication proficiency (0.757), confirming its multidimensional role in MSME operations. Entrepreneurial Orientation (EO) shows high reliability with strong loadings on innovativeness (0.842) and risk-taking (0.827), emphasizing its strategic importance. Access to Financing (AF) presents relatively lower but acceptable loadings, particularly on access to microfinance (0.706), reflecting varied financial accessibility among MSMEs. Business Innovation (BI) displays the strongest indicator loadings, especially product innovation (0.852), underscoring the central role of innovation in business growth. Lastly, Competitive Advantage (CA) demonstrates solid contributions through market share growth (0.847) and customer satisfaction (0.812), highlighting them as key dimensions of competitive strength.

b. Internal Consistency Reliability

Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability (CR). Both metrics exceeded the minimum recommended threshold of 0.7, confirming that the constructs are reliable.

Table 3
Reliability

Construct	Cronbach's Alpha	Composite Reliability
Digital Literacy (DL)	0.816	0.878
Entrepreneurial Orientation (EO)	0.833	0.883
Access to Financing (AF)	0.798	0.841
Business Innovation (BI)	0.855	0.894
Competitive Advantage (CA)	0.842	0.882

The reliability test results in Table 3 show that all constructs demonstrate strong internal consistency, as indicated by Cronbach's Alpha and Composite Reliability values exceeding the recommended threshold of 0.70. Digital Literacy (DL) achieves a Cronbach's Alpha of 0.816 and a Composite Reliability of 0.878, confirming that the indicators consistently measure the construct of digital competence. Entrepreneurial Orientation (EO) records slightly higher values, with a Cronbach's Alpha of 0.833 and Composite Reliability of 0.883, reflecting the stable measurement of innovativeness, proactiveness, and risk-taking within MSMEs. Access to Financing (AF), while having the lowest values among the constructs (Cronbach's Alpha 0.798 and Composite Reliability 0.841), still exceeds the minimum threshold, indicating acceptable reliability though with relatively more variability compared to other constructs. Business Innovation (BI) shows the highest reliability levels, with a Cronbach's Alpha of 0.855 and Composite Reliability of 0.894, underscoring the robustness of indicators measuring product, process, marketing, and organizational innovation. Similarly, Competitive Advantage (CA) demonstrates strong reliability with a Cronbach's Alpha of 0.842 and Composite Reliability of 0.882, signifying that the indicators consistently capture MSMEs' market share growth, customer satisfaction, cost efficiency, and product/service differentiation. Overall, the results confirm that the constructs used in this study are both valid and reliable, providing a solid foundation for further structural model analysis.

c. Discriminant Validity

Discriminant validity was assessed using the Fornell-Larcker criterion, requiring the square root of AVE for each construct to exceed correlations with other constructs. The results indicate that all constructs meet this criterion, confirming that they are distinct.

Table 4
Discriminant Validity

Construct	DL	EO	AF	BI	CA
DL	0.765				
EO	0.526	0.788			
AF	0.487	0.506	0.742		

BI	0.612	0.653	0.555	0.797	
CA	0.585	0.607	0.528	0.663	0.772

The results of the discriminant validity test in Table 4, assessed using the Fornell-Larcker criterion, confirm that each construct in the model is distinct and measures unique aspects of MSME performance, as indicated by diagonal values representing the square root of AVE that are higher than the correlations between constructs. Digital Literacy (DL) has a square root of AVE of 0.765, greater than its correlations with EO (0.526), AF (0.487), BI (0.612), and CA (0.585), showing its empirical distinctiveness despite moderate-to-strong correlations, particularly with business innovation. Entrepreneurial Orientation (EO) also meets the criterion with a square root of AVE of 0.788, exceeding its correlations with DL (0.526), AF (0.506), BI (0.653), and CA (0.607), underscoring its unique role in shaping MSME strategies. Access to Financing (AF) has a square root of AVE of 0.742, higher than its correlations with DL (0.487), EO (0.506), BI (0.555), and CA (0.528), confirming that financing stands as an independent construct even though it relates closely to innovation and competitiveness. Business Innovation (BI) shows the strongest correlations with EO (0.653) and CA (0.663), yet maintains distinctiveness with a square root of AVE of 0.797, emphasizing its mediating role while remaining statistically independent. Finally, Competitive Advantage (CA) achieves a square root of AVE of 0.772, higher than its correlations with DL (0.585), EO (0.607), AF (0.528), and BI (0.663), indicating that it captures unique aspects of market performance, customer satisfaction, and differentiation not fully explained by other constructs. Overall, these findings confirm that all constructs fulfill the discriminant validity requirement, ensuring that digital literacy, entrepreneurial orientation, access to financing, business innovation, and competitive advantage are conceptually and empirically distinct while maintaining meaningful interrelationships in the MSME context.

3. Structural Model Evaluation (Inner Model)

The structural model, or inner model, was evaluated to examine the hypothesized relationships between the study variables: digital literacy, entrepreneurial orientation, access to financing, business innovation, and competitive advantage. The evaluation involved assessing path coefficients, t-values, R-squared values, and mediation effects using bootstrapping with 5,000 resamples in SEM-PLS 3.

a. Path Coefficients and Hypothesis Testing

The path coefficients indicate the strength and direction of the relationships between constructs. The t-values and p-values were used to determine statistical significance, with a significance level of 0.05 ($t > 1.96$).

Table 5
Hypothesis Testing

Hypothesis	Path	Path Coefficient (β)	t-value	p-value	Result
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H1	Digital Literacy → Business Innovation	0.325	4.211	<0.001	Supported
H2	Entrepreneurial Orientation → Business Innovation	0.387	5.105	<0.001	Supported
H3	Access to Financing → Business Innovation	0.272	3.857	<0.001	Supported
H4	Business Innovation → Competitive Advantage	0.453	6.257	<0.001	Supported

The hypothesis testing results in Table 5 provide strong evidence supporting the proposed relationships among digital literacy, entrepreneurial orientation, access to financing, business innovation, and competitive advantage. H1, which examines the effect of Digital Literacy on Business Innovation, shows a positive and significant path coefficient ($\beta = 0.325$, $t = 4.211$, $p < 0.001$), indicating that MSMEs with higher digital literacy are more capable of leveraging technology to enhance product, process, and marketing innovations. H2, testing the influence of Entrepreneurial Orientation on Business Innovation, yields the strongest direct effect among the three antecedents ($\beta = 0.387$, $t = 5.105$, $p < 0.001$), suggesting that innovativeness, proactiveness, and risk-taking behaviors significantly drive MSMEs' innovation capacity and adaptability to market changes. H3, which explores the impact of Access to Financing on Business Innovation, also demonstrates a significant positive relationship ($\beta = 0.272$, $t = 3.857$, $p < 0.001$), highlighting that sufficient financial resources enable MSMEs to invest in new products, adopt advanced technologies, and pursue innovative strategies. Finally, H4 confirms the mediating role of Business Innovation in enhancing firm performance, as Business Innovation strongly and significantly affects Competitive Advantage ($\beta = 0.453$, $t = 6.257$, $p < 0.001$), showing that innovation serves as a key mechanism through which MSMEs achieve market differentiation, customer satisfaction, and superior performance.

b. R-Squared Values

The R-squared (R^2) results show that Business Innovation (BI) has a value of 0.616, indicating strong explanatory power, while Competitive Advantage (CA) records a value of 0.583, reflecting moderate to strong explanatory power, meaning that the model is able to explain a substantial proportion of the variance in both constructs. These findings demonstrate that digital literacy, entrepreneurial orientation, and access to financing collectively account for a significant portion of MSMEs' business innovation, which in turn strongly contributes to enhancing their competitive advantage, thereby confirming the robustness of the model in explaining MSME performance within the Indonesian context.

c. Effect Size (f^2)

Effect size (f^2) was calculated to evaluate the impact of each exogenous construct on endogenous constructs:

Table 6
Effect Size

Predictor	Endogenous	f^2	Interpretation
Digital Literacy	BI	0.115	Small to medium
Entrepreneurial Orientation	BI	0.151	Medium
Access to Financing	BI	0.094	Small to medium
Business Innovation	CA	0.216	Medium to large

The effect size results in Table 6 provide further insights into the relative contribution of each predictor to the endogenous constructs. Digital Literacy (DL) has an effect size of 0.115 on Business Innovation (BI), categorized as small to medium, which indicates that while digital literacy significantly enhances innovation, its impact is more complementary than dominant, suggesting that MSMEs still require additional factors to fully realize innovation outcomes. Entrepreneurial Orientation (EO) shows the largest effect on BI with a value of 0.151, interpreted as medium, confirming that innovativeness, proactiveness, and risk-taking behaviors play a central role in shaping MSMEs' ability to develop new products, processes, and business models. Access to Financing (AF) records an effect size of 0.094 on BI, categorized as small to medium, implying that financial resources are indeed important for enabling innovation, but their influence is somewhat constrained, likely due to uneven access or dependency on external conditions. Finally, Business Innovation (BI) has the strongest effect size of 0.216 on Competitive Advantage (CA), which falls within the medium to large category, demonstrating that innovation serves as a key driver of market differentiation, customer satisfaction, and overall competitiveness.

d. Mediation Analysis

Mediation analysis was performed to test whether business innovation mediates the relationships between digital literacy, entrepreneurial orientation, access to financing, and competitive advantage. The results of the bootstrapping procedure show:

Table 7
Indirect Effect

Mediation Path	Indirect Effect (β)	t-value	Result
Digital Literacy \rightarrow BI \rightarrow CA	0.143	3.926	Significant
Entrepreneurial Orientation \rightarrow BI \rightarrow CA	0.176	4.354	Significant
Access to Financing \rightarrow BI \rightarrow CA	0.129	3.452	Significant

The results of the indirect effect analysis in Table 7 demonstrate the mediating role of Business Innovation (BI) in linking digital literacy, entrepreneurial orientation, and access to financing with competitive advantage (CA). The path from Digital Literacy to Competitive Advantage through Business Innovation shows a significant indirect effect ($\beta = 0.143$, $t = 3.926$), indicating that digital skills and technology adoption contribute to competitive

advantage primarily by enabling MSMEs to innovate in products, processes, and marketing strategies. Similarly, Entrepreneurial Orientation to Competitive Advantage through Business Innovation has the strongest indirect effect ($\beta = 0.176$, $t = 4.354$), suggesting that innovativeness, proactiveness, and risk-taking behaviors enhance MSMEs' competitive positioning when they are channeled into business innovation activities. Finally, the path from Access to Financing to Competitive Advantage through Business Innovation also yields a significant indirect effect ($\beta = 0.129$, $t = 3.452$), highlighting that financial resources influence competitiveness mainly by enabling MSMEs to invest in innovation initiatives.

Discussion

The findings of this study provide meaningful insights into how digital literacy, entrepreneurial orientation, and access to financing influence business innovation and competitive advantage among Indonesian MSMEs.

1. The Role of Digital Literacy

Digital literacy was found to have a significant positive effect on business innovation, as MSMEs with higher digital competence are better equipped to leverage online platforms, digital tools, and e-commerce solutions for marketing, customer engagement, and operational efficiency, thereby supporting prior findings that digital literacy enhances the capacity to adopt innovative business practices. It enables MSME owners to formulate clear digital transformation goals and adapt to market changes, improving operational efficiency, expanding market reach, and fostering competitive advantage through digital entrepreneurship (PANJIATAN et al., 2023). However, challenges remain, including limited resources, inadequate technical skills, cybersecurity risks, financial constraints, and resistance to technological change, all of which hinder effective digital adoption (Purnomo, 2024; Sudirman et al., 2024). To address these barriers, government policies, financial incentives, and digital training programs are vital, alongside collaborations with technology providers that can support MSMEs in utilizing digital solutions more effectively (Purnomo, 2024; Sudirman et al., 2024). Case studies show that successful MSMEs have integrated e-commerce platforms, automation tools, and platform-based business models, which enhance adaptability, customer engagement, and long-term competitiveness, particularly in the e-commerce sector (Sudirman et al., 2024). In the Indonesian context, where many MSMEs are transitioning to digital markets, strengthening digital skills is thus essential for maintaining competitiveness, driving innovation, and ensuring sustainability.

2. The Impact of Entrepreneurial Orientation

Entrepreneurial orientation (EO) demonstrated a strong positive influence on business innovation, as firms that exhibit innovativeness, proactiveness, and risk-taking are more likely to experiment with new products, services, and processes, aligning with theoretical perspectives that position EO as a key driver of innovation and firm performance. Innovativeness encourages the creation of new products and services, which is essential for sustaining competitiveness in dynamic markets, with studies showing that firms high in innovativeness achieve better business performance and innovation outcomes (Maldonado-Guzman et al., 2019; Rihayana et al., 2024), while in the context of business model innovation, innovativeness significantly enhances adaptability and performance (Arabeche et al., 2022).

Proactiveness enables firms to anticipate and act on future market demands, thereby seizing opportunities before competitors, which is associated with higher sales growth, profitability, and market share (Rassool et al., 2023), and also strengthens business model innovation as a mediator between EO and performance (Arabeche et al., 2022). Risk-taking, on the other hand, involves exploring new markets and investing in emerging technologies, which can drive profitability and growth (Rassool et al., 2023), though prior research highlights that the effect may be non-linear, with excessive risk-taking not always producing favorable outcomes (Kreiser et al., 2013). For MSMEs, fostering an entrepreneurial mindset through innovativeness, proactiveness, and calculated risk-taking can help build distinctive capabilities that enable them to respond effectively to opportunities and challenges in competitive markets.

3. Access to Financing and Innovation

Access to financing was also positively associated with business innovation, as financial resources provide the means for investing in technology, product development, and innovative business processes, while limited funding often constrains the ability of MSMEs to innovate, underscoring the importance of improving financial accessibility through bank loans, microfinance, or investor support, consistent with prior studies highlighting financing as a key enabler of innovation and competitive advantage. Financial accessibility is a major driver of MSME growth and innovation, with evidence from Indonesia showing that access to financing, alongside product innovation and financial literacy, significantly influences growth, with product innovation exerting the strongest effect (Sulistyo et al., 2022), while in Colombia, financing is essential for MSMEs to sustain productivity and competitiveness, particularly during economic distress when liquidity becomes critical (De Colombia, 1991). Banking and financial services also play a central role, as seen in Jambi City where innovative financial services support MSME transformation (Utama et al., 2024), and in Vietnam where bank loans are crucial for process innovation while informal loans from family and friends facilitate product innovation (Hanh & Xu, 2021). Beyond traditional banking, non-mainstream financial schemes such as informal credit and state ownership in sub-Saharan Africa significantly support SME innovation, especially in resource-limited contexts where formal financial channels are scarce (Tajeddin et al., 2025). Collectively, these findings reinforce that diverse financing mechanisms, both formal and informal, are critical for enabling MSMEs to innovate, adapt, and enhance their competitiveness.

4. Business Innovation and Competitive Advantage

Business innovation was found to significantly enhance competitive advantage, indicating that MSMEs that implement innovative practices can differentiate themselves, improve operational efficiency, and satisfy customer needs more effectively. The partial mediation effect of business innovation suggests that digital literacy, entrepreneurial orientation, and access to financing indirectly improve competitive advantage through the development of innovative capabilities. This emphasizes that innovation is the mechanism through which resources and competencies translate into superior market performance.

5. Theoretical and Practical Implications

The study confirms the applicability of the Resource-Based View (RBV) and Dynamic Capability Theory in the context of Indonesian MSMEs, showing that digital literacy, entrepreneurial orientation, and access to financing function as critical resources and capabilities that foster innovation, which in turn drives competitive advantage. Practically, this implies that MSME support programs should prioritize strengthening technological skills through digital literacy training, cultivating an entrepreneurial mindset via mentorship and capacity-building initiatives, and enhancing access to financial resources through formal credit and microfinance schemes to facilitate innovation. Collectively, these strategies can empower MSMEs to stay competitive, adapt to dynamic market conditions, and sustain long-term business growth.

CONCLUSION

This study provides empirical evidence that digital literacy, entrepreneurial orientation, and access to financing are key determinants of business innovation and competitive advantage in Indonesian MSMEs. Digital literacy enhances the ability to utilize digital tools and platforms for innovative business practices, while entrepreneurial orientation drives the firm's proactive and risk-taking behavior in pursuing new opportunities. Access to financing ensures the availability of resources needed to implement innovative strategies. Business innovation serves as a crucial mediator, linking these capabilities and resources to competitive advantage.

The practical implications suggest that MSMEs should invest in improving digital competencies, cultivate an entrepreneurial mindset, and seek diverse financial resources to foster innovation and achieve sustainable competitive advantage. Policymakers and business support institutions can facilitate these efforts through targeted training programs, mentorship, and improved access to formal and informal financing. Ultimately, the integration of digital skills, entrepreneurial orientation, and financial accessibility can strengthen MSMEs' resilience, innovation capacity, and market competitiveness in Indonesia.

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