

Digital Commerce Utilization and Rural MSME Performance: The Mediating Roles of Digital Literacy and Market Orientation

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ABSTRACT

Digital transformation has become an important strategy for strengthening the competitiveness of rural Micro, Small, and Medium Enterprises (MSMEs). However, many rural MSMEs still experience challenges in utilizing digital technologies due to limited digital literacy and weak market-oriented capabilities. This study examines the relationship between digital commerce utilization and perceived MSME performance by investigating the mediating roles of digital literacy and market orientation among MSMEs in Babussalam Village, Rokan Hulu Regency, Riau Province. A quantitative cross-sectional survey design was employed involving 150 MSME owners and managers. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the structural relationships among digital commerce utilization, digital literacy, market orientation, and perceived MSME performance. The results indicate that digital commerce utilization is positively associated with perceived MSME performance. Furthermore, digital literacy and market orientation partially mediate the relationship between digital commerce utilization and perceived performance, indicating that digital technologies generate greater business value when supported by entrepreneurial capabilities and strategic market understanding. These findings suggest that rural digital transformation requires not only access to digital platforms but also continuous development of digital competencies and market-oriented capabilities. The study provides empirical insights for designing sustainable digital empowerment strategies to enhance rural MSME competitiveness.

Keywords: Digital literacy, E-commerce adoption, Market orientation, Rural MSMEs, Small business performance.

1. INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) have become a fundamental component of rural economic development because they contribute significantly to employment creation, household income generation, poverty reduction, and local economic resilience. In developing economies, MSMEs also function as important drivers of inclusive economic growth because they facilitate entrepreneurship development, local resource utilization, and employment opportunities within communities (Hayes, 2014; Pedraza, 2021). However, despite their strategic contribution, rural MSMEs continue to experience various challenges, including limited market access, weak business networks, low technological capability, and dependence on conventional marketing mechanisms. These challenges are intensified by limited organizational resources, lack of digital competence, and difficulties in integrating digital technologies into existing business processes (Eller et al., 2020).

Digital transformation has fundamentally changed the business environment by enabling enterprises to overcome geographical limitations through technology-based business models. Digital transformation represents a broader organizational change process involving the integration of digital technologies, strategic renewal, and capability development rather than merely adopting digital tools (Vial, 2019). Among various digital technologies, electronic commerce (*e-commerce*) has emerged as an important strategic instrument for MSMEs because it provides opportunities to expand market coverage, improve customer interaction, reduce transaction costs, and increase business efficiency. Previous studies indicate that e-commerce

adoption enables SMEs to develop new market channels, strengthen customer relationships, and improve competitive advantage through digital-based business processes (Chatterjee & Kar, 2020). E-commerce adoption allows small businesses to connect directly with consumers beyond their local boundaries and create new sources of competitive advantage. Recent empirical evidence indicates that digital adoption has a positive relationship with MSME performance because digital technologies support marketing expansion, operational improvement, and business sustainability (Affandi et al., 2024). A large-scale study involving 5,035 ultra-micro, micro, and small enterprises in Indonesia demonstrated that digital adoption significantly influences business performance, although the level of adoption varies depending on entrepreneur characteristics, organizational factors, infrastructure, and business environment conditions.

Nevertheless, the benefits of e-commerce adoption among rural MSMEs are not generated automatically through technology availability alone. Engagement with digital commerce platforms may create opportunities for entrepreneurial learning by exposing business owners to digital transactions, online customer interactions, market information, and new forms of business management. Through repeated interaction with digital platforms, entrepreneurs may gradually develop stronger digital literacy and market-oriented capabilities. Therefore, this study conceptualizes digital literacy and market orientation as capabilities strengthened through e-commerce adoption that subsequently contribute to perceived MSME performance.

Many rural entrepreneurs face difficulties in utilizing digital platforms effectively due to limited digital literacy, insufficient knowledge regarding online marketing strategies, and lack of confidence in managing digital transactions. Digital literacy represents an important capability that enables entrepreneurs to understand, evaluate, and utilize digital technologies to achieve business objectives. However, in rural MSME contexts, digital literacy may also emerge through continuous engagement with digital platforms. Entrepreneurs who actively use e-commerce systems are exposed to online transaction processes, digital communication mechanisms, customer data, and platform-based marketing practices, which can gradually enhance their digital competencies. Previous studies suggest that digital literacy strengthens MSME capability by improving technology acceptance, digital marketing competence, and the ability to transform digital resources into economic value (Affandi et al., 2024; Suryani et al., 2021). Furthermore, research on Indonesian MSMEs indicates that digital capability and technology adoption play important roles in translating digital transformation into improved business outcomes.

Besides digital literacy, market orientation represents another important factor influencing MSME performance in the digital era. In this study, market orientation is not positioned merely as a prerequisite for digital adoption but also as a capability that can be strengthened through digital commerce engagement. E-commerce platforms provide entrepreneurs with direct access to customer feedback, purchasing patterns, competitor information, and market trends. Such information availability may encourage MSMEs to become more responsive to customer needs and competitive dynamics. Market orientation refers to the organizational capability to understand customer needs, monitor competitors, and respond effectively to market changes. In a highly competitive digital marketplace, MSMEs must not only adopt technology but also possess the ability to utilize market information for strategic decision-making. Firms with stronger market orientation tend to be more responsive to consumer preferences and more capable of developing products that meet market demands. Empirical studies have demonstrated that market orientation contributes positively to innovation capability, competitive advantage, and business performance among small enterprises (Alqahtani et al., 2024).

The relationship between e-commerce adoption, digital literacy, market orientation, and MSME performance becomes particularly relevant in rural areas where economic activities are strongly connected with local resources and community-based entrepreneurship. The present study focuses on MSMEs in Babussalam Village, Rambah District, Rokan Hulu Regency, Riau

Province. This rural setting provides an important context for examining digital transformation because local economic activities have substantial potential but require strengthening in terms of technology utilization and market access.

Previous research and community development activities in Babussalam Village demonstrate that the area has potential for developing community-based economic activities through innovation and technology utilization. A research program on renewable energy development based on biomass waste identified BUMDes Babussalam as a strategic partner in implementing technology-based community empowerment. The program involved technology assistance, production training, and strengthening community understanding regarding the economic value of local resources. The research also highlighted that appropriate technology can be developed and adopted by communities and MSMEs to improve productivity and create new economic opportunities (Kristiyanti et al., 2024; Piawi et al., 2025; Rahayu et al., 2025).

The economic environment of Rokan Hulu Regency reflects the characteristics of many rural regions in Indonesia, where agriculture, plantation activities, and local resource-based industries represent important economic sectors. At the provincial level, Riau has significant economic potential derived from plantations, agriculture, processing industries, fisheries, tourism, and other resource-based sectors. However, economic development challenges remain, particularly regarding innovation capacity, digital transformation, and strengthening the competitiveness of local economic actors. Previous regional analysis has emphasized the importance of technology integration, innovation development, and strengthening partnerships among government, industry, educational institutions, and communities to support sustainable economic growth. These conditions reflect broader challenges faced by rural economies, where digital capability, innovation ecosystems, and collaborative governance are increasingly important factors in improving competitiveness and achieving sustainable development (Arman et al., 2017; Putra et al., 2024; Syahza & Asmit, 2019).

Despite the increasing attention toward digital transformation among MSMEs, several research gaps remain. Previous studies have frequently focused on technology adoption outcomes but have paid less attention to the internal capabilities that enable SMEs to transform digital technologies into sustainable performance advantages (Grego et al., 2025). However, limited studies have examined whether technology adoption itself can contribute to the development of these internal capabilities, particularly among rural MSMEs with limited prior digital exposure. First, previous studies have predominantly examined MSMEs located in urban areas or businesses that have already adopted digital platforms. Limited empirical evidence explains how rural MSMEs with different levels of digital readiness utilize e-commerce to improve performance. Second, many studies analyze digital adoption as a direct determinant of performance without sufficiently explaining the internal capabilities that enable entrepreneurs to convert digital technology into business value. Third, although digital literacy and market orientation have been recognized as important factors, their integrated role in explaining the effectiveness of e-commerce adoption among rural MSMEs remains underexplored.

Recent studies provide evidence that e-commerce adoption generates stronger performance outcomes when accompanied by digital capability and strategic orientation. Suryani et al., (2021) found that digital literacy and market orientation positively influence e-commerce adoption and MSME performance, suggesting that technological adoption should be supported by entrepreneurial capabilities and market understanding. Similarly, recent studies emphasize that digital transformation among MSMEs requires more than platform adoption; it requires digital competence, strategic adaptation, and organizational readiness to achieve sustainable performance improvements.

Based on these conditions, this study investigates how e-commerce adoption is associated with rural MSME performance by examining digital literacy and market orientation as capability-building mechanisms developed through digital commerce engagement. The study is designed to

provide empirical evidence regarding the mechanisms through which rural entrepreneurs transform digital opportunities into improved business outcomes. Specifically, this research addresses three main questions: (1) How does e-commerce adoption influence the performance of MSMEs in Babussalam Village, Rokan Hulu Regency? (2) How does digital literacy mediate the relationship between e-commerce adoption and MSME performance? and (3) How does market orientation mediate the relationship between e-commerce adoption and MSME performance?

The objective of this research is to develop an empirical understanding of digital transformation among rural MSMEs by analyzing the interaction between technological adoption, entrepreneurial capability, and market strategy. The findings are expected to contribute theoretically by expanding knowledge regarding digital transformation in rural MSME contexts and practically by providing insights for policymakers, village institutions, and business development programs in designing effective digital empowerment strategies.

2. METHOD

This study employed a quantitative research approach using a cross-sectional survey design to examine the relationship between e-commerce adoption and rural MSME performance, with digital literacy and market orientation as explanatory factors. The research was conducted among MSMEs located in Babussalam Village, Rambah District, Rokan Hulu Regency, Riau Province. This location was selected because rural MSMEs in the area represent community-based economic activities with significant potential for digital transformation. Previous community empowerment activities in Babussalam Village have demonstrated the existence of local economic initiatives supported through technology utilization and capacity-building programs, including assistance involving BUMDes Babussalam as a community partner.

The eligible population included active MSMEs operating in Babussalam Village that met the predetermined criteria. Questionnaires were distributed to eligible business owners and managers, resulting in 150 valid responses used for the final analysis. The sample size was considered adequate for PLS-SEM analysis because the model contains a limited number of structural relationships and latent constructs. A statistical power assessment was conducted to ensure sufficient capability for detecting the expected effects. With 150 observations, the sample size exceeded the minimum requirement for testing the proposed structural model with acceptable statistical power. The unit of analysis in this study was the MSME firm. Each MSME was represented by one key informant, namely the owner or manager who was directly involved in business decision-making and digital technology utilization. To avoid duplication, only one respondent was allowed to represent each business unit. Data were collected through structured questionnaires distributed directly to MSME actors. The questionnaire items were measured using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

The research model consisted of four main constructs: e-commerce adoption as the independent variable, digital literacy and market orientation as supporting variables, and MSME performance as the dependent variable. E-commerce adoption was measured through indicators related to the utilization of online marketplaces, digital payment systems, online promotion, and digital customer interaction. Digital literacy was assessed based on entrepreneurs' ability to access, understand, evaluate, and utilize digital technologies for business purposes. Market orientation was measured through customer orientation, competitor awareness, and responsiveness to market changes. Meanwhile, MSME performance was measured as perceived organizational performance reported by owners/managers based on financial and non-financial indicators, including perceived sales growth, customer expansion, operational improvement, and competitiveness.

Because the study collected data from a single respondent for each MSME, potential common method bias was considered. Procedural remedies were applied by ensuring respondent anonymity, emphasizing that there were no right or wrong answers, and separating measurement

items for different constructs. Furthermore, Harman's single-factor test was conducted to assess whether a single factor accounted for the majority of covariance among variables.

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM). This analytical technique was selected because it is appropriate for examining complex relationships among latent variables and testing predictive models in exploratory research contexts (Hair et al., 2021). The analysis involved two stages: evaluation of the measurement model (*outer model*) and evaluation of the structural model (*inner model*). The measurement model was assessed through validity and reliability testing, including factor loading, Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha. The structural model was evaluated through path coefficient analysis, coefficient of determination (R^2), predictive relevance (Q^2), and hypothesis testing using bootstrapping procedures.

Ethical research principles were applied throughout the research process by ensuring voluntary participation, confidentiality of respondents' information, and the use of collected data solely for academic purposes. Through this methodological approach, the study aims to provide empirical evidence regarding how e-commerce adoption, supported by digital literacy and market orientation, contributes to improving rural MSME performance in the context of digital economic transformation.

3. RESULTS AND DISCUSSION

3.1 Respondent Characteristics

This study involved 150 MSME owners and managers in Babussalam Village, Rambah District, Rokan Hulu Regency, Riau Province. The respondents represented various rural business sectors, including food processing, agricultural products, household industries, handicrafts, and small-scale trading activities. The characteristics of respondents provide an overview of the current condition of rural entrepreneurs regarding business experience, digital technology utilization, and entrepreneurial capacity.

The demographic analysis showed that most MSME owners had operated their businesses for more than five years, indicating that the majority of respondents possessed sufficient entrepreneurial experience. However, despite having relatively established businesses, the level of digital technology utilization remained varied. Most respondents reported using smartphones and social media platforms for business promotion, while only a smaller proportion had adopted integrated e-commerce platforms such as online marketplaces and digital payment systems.

Table 1. Characteristics of Respondents

Characteristics	Category	Frequency	Percentage
Business sector	Food and beverage	52	34.7%
	Agricultural-based products	36	24.0%
	Trading and retail	38	25.3%
	Handicraft and others	24	16.0%
Business age	<5 years	41	27.3%
	5–10 years	67	44.7%
	>10 years	42	28.0%
Digital platform usage	Social media only	71	47.3%
	Marketplace and social media	56	37.3%
	Integrated e-commerce system	23	15.4%

The characteristics of respondents indicate that most MSMEs in Babussalam Village have established business experience, but their digital adoption level remains relatively diverse. The finding that a large proportion of MSMEs still rely on social media platforms rather than integrated e-commerce systems reflects a common pattern among rural small businesses in developing economies. Previous studies have shown that MSMEs often begin digital transformation through basic digital activities, such as online promotion and social media marketing, before progressing toward more advanced digital business models involving online transactions, customer relationship management, and data-driven decision-making (Agustino & Susilo, 2023; Suliswanto & Rofik, 2019).

The dominance of MSMEs using social media rather than marketplace-based e-commerce suggests that technology availability alone does not guarantee effective digital transformation. Digital capability, managerial readiness, and entrepreneurial competence are important determinants that influence whether MSMEs can transform digital tools into business value. Warner & Wäger, (2019) emphasized that successful digital transformation requires dynamic capabilities, including the ability to identify digital opportunities, utilize technological resources, and continuously adapt business processes. Similarly, (Vial, 2019) explained that digital transformation represents a broader organizational change process involving technology integration, value creation, and strategic renewal rather than merely adopting digital applications.

This finding is consistent with previous empirical studies indicating that digital technology adoption contributes to MSME performance by expanding market access, improving operational efficiency, and enhancing customer engagement. This indicates that rural MSMEs require not only access to digital platforms but also continuous support in developing digital competencies. Furthermore, the relatively high proportion of MSMEs operating for more than five years indicates that respondents possess valuable entrepreneurial experience and knowledge of local markets. However, traditional business experience must be complemented with digital competencies to remain competitive in changing market environments. Budiarto et al., (2023) found that digital literacy plays an important role in strengthening the relationship between e-commerce adoption and MSME performance because entrepreneurs with higher digital literacy are better able to utilize online platforms, manage digital marketing activities, and respond to customer needs.

From a strategic perspective, the findings also highlight the importance of market orientation in rural MSME digital transformation. Digital platforms provide access to broader market information, but entrepreneurs must possess the ability to interpret customer preferences, competitor activities, and market trends. According to (Affandi et al., 2024), market orientation strengthens business performance by improving firms' responsiveness to market changes and supporting innovation capability. Therefore, the digital development of MSMEs in Babussalam Village should be directed not only toward increasing the number of businesses adopting digital platforms but also toward improving their ability to strategically utilize digital information for sustainable business growth.

3.2 Measurement Model Assessment

The measurement model was evaluated to assess indicator reliability, construct validity, and construct reliability. The evaluation included outer loading, Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha.

The results showed that all indicators achieved acceptable loading values above 0.70, indicating that each measurement item adequately represented its respective construct. Furthermore, all constructs demonstrated AVE values exceeding the recommended threshold of 0.50, confirming convergent validity.

Table 2. Construct Reliability and Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
E-commerce Adoption	0.874	0.913	0.725
Digital Literacy	0.889	0.922	0.748
Market Orientation	0.861	0.903	0.700
MSME Performance	0.902	0.934	0.779

The results of the measurement model assessment indicate that all constructs used in this study demonstrate satisfactory reliability and convergent validity. The high values of Composite Reliability across e-commerce adoption (0.913), digital literacy (0.922), market orientation (0.903), and MSME performance (0.934) indicate that the indicators consistently measure their respective constructs. Furthermore, all Average Variance Extracted (AVE) values exceed the recommended threshold of 0.50, confirming that each construct explains more than half of the variance of its measurement indicators.

These findings are consistent with the methodological recommendations of (Hair et al., 2021), who stated that measurement models in PLS-SEM should demonstrate adequate internal consistency reliability through Composite Reliability values above 0.70 and convergent validity through AVE values above 0.50. Therefore, the constructs developed in this study are statistically appropriate for examining the structural relationships between e-commerce adoption, digital literacy, market orientation, and MSME performance.

The strong reliability of the e-commerce adoption construct indicates that the selected indicators, including online marketplace utilization, digital payment adoption, online promotion activities, and digital customer interaction, effectively represent the digital transformation practices of rural MSMEs. This finding supports previous research indicating that digital adoption among small businesses should be measured not only through technology ownership but also through the extent to which digital tools are integrated into business activities (Khairuddin et al., 2021; Riswandi & Permadi, 2022).

Similarly, the reliability of the digital literacy construct demonstrates that entrepreneurs' abilities to access, understand, evaluate, and utilize digital technologies represent important dimensions of digital capability. Digital literacy has increasingly been recognized as a critical resource that enables MSMEs to transform technological opportunities into improved business performance. (Affandi et al., 2024) emphasized that digital capability influences how Indonesian MSMEs utilize digital technologies to improve operational efficiency, market access, and business sustainability.

The market orientation construct also demonstrates strong reliability, confirming that customer orientation, competitor awareness, and responsiveness to market changes are appropriate dimensions for assessing strategic capability among rural MSMEs. This finding aligns with the market orientation perspective, which suggests that firms with stronger abilities to acquire and utilize market information are more capable of developing competitive strategies and improving performance (Puspaningrum, 2020; Shafei & Zohdi, 2014).

Meanwhile, the high reliability value of the MSME performance construct indicates that the combination of financial and non-financial performance indicators, including sales growth, customer expansion, operational improvement, and competitiveness, provides a comprehensive measurement of rural business performance. Previous studies have highlighted that MSME performance in the digital era should not be evaluated solely through financial outcomes but also through market expansion, innovation capability, and operational effectiveness (Desmiyawati et al., 2023; Gusti, 2022).

Overall, the measurement model results confirm that the research instruments have adequate psychometric quality. The validity and reliability of the constructs provide a strong

foundation for further analysis of the structural model, particularly in examining how e-commerce adoption influences MSME performance through digital literacy and market orientation.

3.3 Discriminant Validity Assessment

Discriminant validity was assessed using the Fornell–Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT). The results indicated that the square root values of AVE for each construct were higher than the correlations with other constructs. Additionally, all HTMT values were below 0.90, indicating that each construct represented a distinct theoretical concept.

Table 3. HTMT Ratio

Relationship	HTMT Value
EA-DL	0.742
EA-MO	0.681
EA-MP	0.795
DL-MO	0.724
DL-MP	0.812
MO-MP	0.786

The discriminant validity assessment confirms that each construct in this study represents a distinct theoretical concept. The HTMT values among constructs range from 0.681 to 0.812, which are below the recommended threshold of 0.90, indicating that there is no critical overlap among e-commerce adoption, digital literacy, market orientation, and MSME performance. This finding demonstrates that although these constructs are theoretically interconnected, each variable captures a different dimension of rural MSME digital transformation. According to Henseler et al., (2015), HTMT is considered a more sensitive approach for assessing discriminant validity in PLS-SEM because it evaluates the ratio of between-construct correlations compared with within-construct correlations. Therefore, the results confirm that the measurement model has sufficient discriminant validity and can be used for further structural model evaluation. The distinction among constructs is particularly important in this study because digital literacy represents the internal capability of entrepreneurs, market orientation reflects strategic responsiveness toward customers and competitors, while e-commerce adoption represents the technological mechanism used to improve MSME performance. This result is consistent with previous studies emphasizing that digital transformation among SMEs involves interconnected but separate dimensions of technology utilization, organizational capability, and strategic adaptation (Vial, 2019; Warner & Wäger, 2019).

3.4 Structural Model Assessment

After confirming the validity and reliability of the measurement model, the structural model was evaluated. The coefficient of determination (R^2) was analyzed to determine the explanatory power of the proposed research model.

Table 4. Coefficient of Determination (R^2)

Endogenous Construct	R^2	Interpretation
Digital Literacy	0.286	Moderate
Market Orientation	0.177	Moderate
MSME Performance	0.617	Substantial

The coefficient of determination (R^2) analysis indicates that the structural model provides meaningful explanatory power for understanding rural MSME digital transformation. The results show that e-commerce adoption explains 28.6% of the variance in digital literacy and 17.7% of the variance in market orientation. These findings indicate that digital commerce utilization contributes to the development of entrepreneurial capabilities, although additional factors may also influence digital literacy and market-oriented behavior. This finding suggests that although digital commerce adoption contributes to strengthening market-oriented capabilities, market orientation is also influenced by other organizational factors such as entrepreneurial experience, customer knowledge, competitive awareness, and business strategy. These findings suggest that the adoption of digital commerce platforms contributes to the development of entrepreneurs' digital capabilities and encourages greater attention toward market information. However, digital literacy and market orientation are also influenced by other factors beyond e-commerce adoption, such as previous technology experience, education level, business characteristics, digital infrastructure, and organizational readiness (Eller et al., 2020; Warner & Wäger, 2019).

More importantly, the model demonstrates a substantial explanatory capability for MSME performance, with an R^2 value of 0.617. This indicates that e-commerce adoption, digital literacy, and market orientation collectively explain 61.7% of the variation in rural MSME performance. The result confirms that digital transformation factors represent important determinants of business outcomes among rural entrepreneurs. This finding supports previous studies emphasizing that digital technologies create greater business value when combined with internal capabilities, including digital competence, innovation capability, and strategic market orientation (Wielgos et al., 2021). Thus, the performance improvement of rural MSMEs is not solely determined by the presence of digital platforms but also by the ability of entrepreneurs to effectively utilize these resources.

The substantial R^2 value for MSME performance also strengthens the theoretical argument that technology adoption should be viewed through a capability-based perspective. From the Resource-Based View (RBV), digital literacy and market orientation can be considered strategic intangible resources that enable MSMEs to transform digital technologies into sustainable competitive advantages (Sitaniapessy et al., 2024). In the context of Babussalam Village, these findings indicate that strengthening digital capabilities and market-oriented strategies should become important components of rural MSME development programs, because digital adoption without adequate entrepreneurial capability may produce limited performance improvement.

3.5 Hypothesis Testing

The hypothesis testing was conducted using the bootstrapping procedure with 5,000 resamples. The significance of relationships was determined based on t-values greater than 1.96 and p-values below 0.05.

Table 5. Structural Model Results

Hypothesis	Relationship	Path Coefficient (β)	t-value	p-value	Result
H1	E-commerce Adoption → MSME Performance	0.312	4.526	<0.001	Supported
H2	E-commerce Adoption → Digital Literacy	0.534	8.214	<0.001	Supported
H3	Digital Literacy → MSME Performance	0.286	3.871	<0.001	Supported
H4	E-commerce Adoption → Market Orientation	0.421	6.347	<0.001	Supported
H5	Market Orientation → MSME Performance	0.351	5.214	<0.001	Supported

The structural model results demonstrate that all proposed hypotheses are statistically supported, confirming that e-commerce adoption, digital literacy, and market orientation play

significant roles in improving rural MSME performance. The positive relationship between e-commerce adoption and MSME performance indicates that digital commerce utilization provides strategic benefits for rural businesses, including broader market access, improved customer interaction, and increased business competitiveness. This finding is consistent with previous studies showing that digital technology adoption enables SMEs to overcome geographical limitations and improve business outcomes through enhanced marketing capabilities and operational efficiency (Affandi et al., 2024). Furthermore, the significant relationship between e-commerce adoption and digital literacy suggests that engagement with digital platforms encourages entrepreneurs to develop technological competencies necessary for effective digital business management. This finding supports the argument that digital transformation requires not only technology availability but also the development of human capabilities that enable businesses to maximize digital opportunities (Vial, 2019; Warner & Wäger, 2019).

The significant influence of digital literacy and market orientation on MSME performance highlights the importance of internal capabilities in achieving successful digital transformation. Digital literacy enables entrepreneurs to manage digital platforms, utilize online marketing tools, and make technology-based business decisions, while market orientation allows MSMEs to interpret customer needs, monitor competitors, and respond to changing market conditions. These findings support the Resource-Based View (RBV), which emphasizes that valuable and difficult-to-imitate resources, including knowledge and strategic capabilities, can generate sustainable competitive advantages (Sitaniapessy et al., 2024). Similarly, the positive effect of market orientation on MSME performance aligns with previous empirical evidence that market-oriented firms tend to achieve better performance because they are more responsive to market dynamics and innovation opportunities (Affandi et al., 2024). Therefore, the findings confirm that e-commerce adoption produces stronger performance outcomes when supported by adequate digital capabilities and strategic market orientation.

3.6 Mediation Analysis

The mediation analysis examined whether digital literacy and market orientation function as mechanisms connecting e-commerce adoption with MSME performance.

Table 6. Indirect Effect Analysis

Relationship	Indirect Effect	t-value	p-value	Decision
EA → DL → MP	0.153	3.412	<0.001	Mediated
EA → MO → MP	0.148	3.215	<0.001	Mediated

The mediation analysis indicates that digital literacy and market orientation partially explain the statistical association between digital commerce utilization and perceived MSME performance. These findings indicate that digital commerce utilization is associated with improved perceived performance both directly and indirectly through capability development mechanisms. Therefore, the mediation results should be interpreted as partial statistical mediation rather than definitive causal mediation because the study uses a cross-sectional design. The significant indirect effects indicate that digital technology adoption does not automatically generate improved business outcomes; rather, performance improvements occur when entrepreneurs possess the capability to utilize digital technologies effectively and the strategic ability to respond to market changes. The mediating role of digital literacy demonstrates that entrepreneurs with stronger digital competencies are more capable of transforming e-commerce platforms into valuable business resources through effective online marketing, digital transactions, and customer engagement. This finding supports previous research indicating that digital capability serves as a critical bridge between technology adoption and business

performance because it enables SMEs to convert technological resources into operational and strategic advantages (Affandi et al., 2024; Warner & Wäger, 2019).

Furthermore, the mediating role of market orientation highlights that digital platforms provide greater benefits when entrepreneurs actively use digital information to understand customers, monitor competitors, and adapt business strategies. E-commerce adoption enables MSMEs to access broader market information, but the ability to interpret and respond to such information determines the extent to which digitalization contributes to performance improvement. This finding reinforces the argument that digital transformation requires integration between technological capability and strategic orientation (Vial, 2019). Therefore, the results extend previous studies by demonstrating that rural MSME digital transformation is not merely a process of adopting digital platforms but involves the development of internal capabilities that strengthen the conversion of digital opportunities into sustainable business performance.

DISCUSSION

The findings of this study provide empirical evidence that e-commerce adoption contributes significantly to improving rural MSME performance in Babussalam Village, Rokan Hulu Regency. However, the results also demonstrate that technology adoption alone is insufficient to generate optimal business outcomes. The effectiveness of e-commerce depends on complementary capabilities, particularly digital literacy and market orientation. These findings reinforce the argument that digital transformation in MSMEs is not merely a process of technology implementation but involves the development of entrepreneurial capabilities and strategic adaptation.

E-Commerce Adoption as a Driver of Rural MSME Performance

The findings of this study demonstrate that e-commerce adoption has a significant positive effect on rural MSME performance, indicating that digital commerce platforms have become an important mechanism for strengthening the competitiveness of small businesses in rural areas. The adoption of e-commerce enables MSMEs to overcome geographical limitations by expanding market reach, increasing customer accessibility, improving promotional activities, and creating more efficient transaction processes. In the context of Babussalam Village, where many businesses are based on local resources and community economic activities, digital platforms provide opportunities to connect local products with broader consumer markets beyond traditional trading boundaries.

This finding supports the perspective of digital transformation, which emphasizes that technology adoption creates value when it contributes to changes in business processes, customer relationships, and organizational capabilities (Vial, 2019). E-commerce should therefore not be interpreted merely as the use of online platforms but as a strategic transformation process that changes how MSMEs create, deliver, and capture business value. Previous studies have demonstrated that digitalization enables SMEs to improve market access, operational efficiency, and customer engagement, particularly when digital technologies are integrated into core business activities (Dhahri et al., 2021; Eller et al., 2020).

The significant relationship between e-commerce adoption and MSME performance also aligns with the Technology–Organization–Environment (TOE) framework, which explains that technology adoption outcomes depend on technological availability, organizational readiness, and environmental support (Baker, 2012). Although rural MSMEs may have access to digital platforms, the actual benefits of e-commerce depend on entrepreneurs' ability to integrate technology into their business strategies. Therefore, the findings indicate that digital transformation programs should move beyond providing digital infrastructure and focus on strengthening entrepreneurial capabilities, training, and continuous assistance.

Furthermore, this result is consistent with empirical evidence from Indonesian MSMEs. Affandi et al., (2024) found that digital adoption contributes positively to business performance among micro and small enterprises in Indonesia, although the magnitude of its impact depends on supporting capabilities such as financial literacy, technological readiness, and business management skills. Similarly, Priyono et al., (2020) emphasized that digital transformation among SMEs requires changes in business models and organizational practices rather than simply adopting digital tools.

From a practical perspective, the findings suggest that rural MSME development initiatives should encourage entrepreneurs to utilize e-commerce platforms not only for product promotion but also for market analysis, customer relationship management, digital payment integration, and business decision-making. Strengthening e-commerce adoption in rural areas requires collaboration among village institutions, government agencies, educational institutions, and business development organizations to create an ecosystem that supports sustainable digital transformation.

The Role of Digital Literacy in Strengthening Digital Transformation

The findings of this study demonstrate that digital literacy plays an important role in strengthening the relationship between e-commerce adoption and rural MSME performance. The results indicate that e-commerce adoption significantly influences digital literacy, while digital literacy also has a significant positive effect on MSME performance. These findings suggest that the value generated from digital technology adoption depends largely on entrepreneurs' ability to understand, utilize, and strategically apply digital resources in business activities. Therefore, digital literacy functions not merely as a technical skill but as a strategic capability that enables MSMEs to transform digital opportunities into sustainable business outcomes.

In the context of rural MSMEs in Babussalam Village, digital literacy becomes particularly important because entrepreneurs operate within an environment where traditional business practices remain dominant. Although many MSME owners have access to smartphones and digital platforms, effective utilization requires competencies beyond basic technology use. Entrepreneurs need the ability to manage online marketing, communicate with customers through digital channels, utilize electronic payment systems, and interpret digital information for business decision-making. This finding supports the argument that digital transformation requires human capability development because technology adoption without adequate user competence may result in limited business benefits (Vial, 2019).

The significant role of digital literacy in improving MSME performance is consistent with the Resource-Based View (RBV), which explains that organizational competitiveness is derived from valuable internal resources that are difficult to imitate (Barney, 1991). In this perspective, digital literacy represents an intangible resource because it reflects entrepreneurs' knowledge, skills, and ability to leverage technology for business purposes. MSMEs with higher levels of digital literacy are more capable of identifying digital opportunities, adapting marketing strategies, and improving operational processes compared with businesses that only adopt technology at a superficial level.

This finding also supports previous empirical research regarding digital capabilities among SMEs. Affandi et al., (2024) demonstrated that digital adoption among Indonesian micro and small enterprises contributes to improved business performance, but the impact varies depending on supporting capabilities and entrepreneurial readiness. Similarly, Suryani et al., (2021) found that digital literacy strengthens the effectiveness of e-commerce adoption because entrepreneurs with better digital competencies are more capable of utilizing online platforms to improve market access and business performance.

Furthermore, the findings indicate that digital literacy represents a critical factor in reducing the digital divide experienced by rural MSMEs. Digital inequality is not only associated

with infrastructure availability but also with differences in knowledge, skills, and confidence in using digital technologies. Therefore, rural digital empowerment programs should emphasize capacity-building approaches, including digital marketing training, online business management, financial technology utilization, and data-based decision-making. Such programs can help MSMEs move from basic digital participation toward meaningful digital transformation.

From a practical perspective, strengthening digital literacy among MSMEs in Babussalam Village requires continuous collaboration between village institutions, government agencies, universities, and business development organizations. Training programs should be designed according to entrepreneurs' actual needs and business characteristics rather than focusing solely on technical platform usage. By improving digital literacy, rural MSMEs can maximize the benefits of e-commerce adoption and develop stronger competitiveness in increasingly digital markets.

Market Orientation as a Strategic Capability for Rural MSMEs

The findings of this study indicate that market orientation plays an important role in strengthening the performance of rural MSMEs in the context of digital transformation. The results demonstrate that e-commerce adoption significantly influences market orientation, while market orientation has a significant positive effect on MSME performance. These findings suggest that digital platforms provide not only transactional benefits but also strategic opportunities for entrepreneurs to obtain market information, understand consumer preferences, monitor competitors, and respond more effectively to changing market conditions.

In rural MSMEs, market orientation is particularly important because many businesses traditionally rely on local customer networks and conventional marketing approaches. The adoption of e-commerce expands the ability of entrepreneurs to interact with customers beyond geographical boundaries and provides access to broader market intelligence. Through digital platforms, MSMEs can analyze customer responses, observe purchasing trends, evaluate competitor strategies, and adjust their products and services according to market demands. Therefore, e-commerce adoption can strengthen market orientation by increasing entrepreneurs' access to relevant and timely market information.

The positive relationship between market orientation and MSME performance supports the theoretical perspective that firms with stronger market-oriented capabilities are more likely to achieve competitive advantages. According to Puspaningrum, (2020), market orientation consists of three main dimensions: customer orientation, competitor orientation, and interfunctional coordination. These dimensions enable firms to create superior value by understanding customer needs and responding effectively to environmental changes. In the context of rural MSMEs, market orientation becomes a strategic capability that allows small businesses to compete in increasingly dynamic markets despite limitations in resources and scale.

The findings are consistent with recent empirical studies showing that market orientation contributes significantly to innovation capability, competitive advantage, and firm performance. (Affandi et al., 2024) found that market orientation strengthens business performance by improving firms' ability to identify market opportunities and develop appropriate responses to competitive pressures. Similarly, (Rokkan, 2023) demonstrated that digital engagement and market-oriented strategies contribute to improved firm performance by enhancing customer relationships and value creation.

From the perspective of the Resource-Based View (RBV), market orientation can be considered an intangible organizational capability that enables MSMEs to utilize external information as a strategic resource Barney, (1991). Unlike physical resources, market knowledge and customer understanding are difficult to imitate because they are developed through continuous learning processes and interactions with the business environment. Therefore, MSMEs with stronger market orientation are more capable of transforming digital information obtained from e-commerce platforms into strategic business decisions.

The findings also have important implications for rural MSME development programs. Digitalization initiatives should not only encourage entrepreneurs to create online business accounts or use marketplace platforms but should also strengthen their ability to manage market information strategically. Training programs should include customer analysis, digital marketing strategy, product positioning, online consumer behavior analysis, and competitor monitoring. Through the integration of e-commerce adoption and market-oriented capability development, rural MSMEs can achieve more sustainable improvements in competitiveness and business performance.

In the context of Babussalam Village, strengthening market orientation can support local businesses in maximizing the economic potential of community-based products. Rural MSMEs often possess unique local resources and products; however, their competitiveness depends on their ability to understand market opportunities and communicate product value effectively. Therefore, market orientation becomes an essential bridge that connects local economic potential with broader digital market opportunities.

The Mediating Role of Digital Literacy and Market Orientation

The mediation analysis provides deeper insight into the mechanism through which e-commerce adoption influences rural MSME performance. The findings demonstrate that digital literacy and market orientation significantly mediate the relationship between e-commerce adoption and MSME performance, indicating that digital transformation outcomes are not generated solely through technology adoption but through the development of complementary organizational capabilities. These findings suggest that e-commerce functions as an enabling resource, while digital literacy and market orientation represent the internal mechanisms that determine whether technology adoption can be transformed into sustainable business value.

The mediating role of digital literacy indicates that entrepreneurs' ability to understand and utilize digital technologies is a critical pathway connecting e-commerce adoption with improved business performance. Although e-commerce platforms provide opportunities for market expansion and operational efficiency, their effectiveness depends on entrepreneurs' capability to manage digital processes, create online marketing strategies, communicate with customers, and utilize digital information for decision-making. This finding reinforces the perspective of digital transformation that emphasizes capability development as an essential component of technology-driven organizational change (Vial, 2019). Digital technologies create value when organizations possess the knowledge and skills required to integrate them into business activities.

Furthermore, the mediating role of market orientation demonstrates that digital adoption improves MSME performance when entrepreneurs actively utilize digital platforms to understand and respond to market dynamics. E-commerce platforms generate valuable market information, including customer preferences, purchasing behavior, and competitive trends. However, this information only becomes strategically valuable when entrepreneurs possess the capability to interpret and apply it in business decisions. Therefore, market orientation acts as a strategic mechanism that transforms digital information into customer value and competitive advantage.

These findings extend previous research by demonstrating that the relationship between digital technology adoption and business performance is not simply a direct relationship. Instead, the impact of digital transformation depends on organizational capabilities that enable firms to exploit technological resources effectively. This argument is consistent with the Resource-Based View (RBV), which suggests that competitive advantage emerges from valuable internal resources and capabilities that allow organizations to utilize external opportunities more effectively (Barney, 1991). In the context of rural MSMEs, digital literacy and market orientation represent strategic intangible resources because they determine how entrepreneurs utilize e-commerce platforms to improve business outcomes.

The findings also support previous empirical evidence regarding SME digital transformation. Affandi et al., (2024) demonstrated that digital adoption among Indonesian micro and small enterprises contributes to improved business performance, but the magnitude of the impact depends on supporting capabilities, including financial literacy and technological readiness. Similarly, Suryani et al., (2021) found that digital literacy and market orientation strengthen the effectiveness of e-commerce adoption in improving MSME performance. These studies confirm that technology adoption should be accompanied by capability development to achieve meaningful economic outcomes.

From a practical perspective, the mediation results provide important implications for rural MSME development strategies. Digital empowerment programs should not focus only on increasing the number of MSMEs adopting e-commerce platforms but should also strengthen entrepreneurs' digital competencies and market-oriented thinking. Training programs should integrate digital marketing skills, online customer management, market analysis, and strategic utilization of digital information. Such an integrated approach can help rural MSMEs move from basic digital participation toward sustainable digital transformation.

In the context of Babussalam Village, the findings indicate that strengthening digital literacy and market orientation can maximize the benefits of existing local economic potential. Rural MSMEs often possess unique products based on local resources, but their ability to compete depends on their capacity to connect these products with broader markets through digital channels. Therefore, the development of rural digital ecosystems requires collaboration among village institutions, government agencies, educational institutions, and business support organizations to ensure that technology adoption is accompanied by continuous capability improvement.

Implications for Rural MSME Development

The findings of this study provide important implications for the development of rural MSMEs, particularly regarding how digital transformation strategies should be designed and implemented. The results demonstrate that improving MSME performance requires an integrated approach that combines technology adoption, digital capability development, and market-oriented strategies. Although e-commerce adoption has a significant contribution to improving business performance, the findings indicate that technology alone is insufficient to generate sustainable competitive advantages. Rural MSMEs require continuous support to develop the capabilities necessary to utilize digital technologies effectively and strategically.

From a policy perspective, rural digital transformation programs should move beyond infrastructure-oriented approaches and focus on strengthening human capabilities. Providing access to digital platforms, internet connectivity, or digital devices represents only the initial stage of transformation. Entrepreneurs also require practical knowledge regarding digital marketing, online customer management, digital payment systems, data utilization, and business analytics. This approach is consistent with the dynamic capability perspective, which emphasizes that organizations must develop the ability to identify digital opportunities, utilize technological resources, and continuously adapt their business processes in response to environmental changes (Warner & Wäger, 2019).

The findings also highlight the strategic role of local institutions, particularly village-based organizations such as BUMDes, in facilitating rural digital transformation. BUMDes can function as an intermediary institution that connects MSMEs with digital resources, training programs, market networks, and innovation ecosystems. Previous community empowerment activities in Babussalam Village demonstrate that local institutions can support technology-based economic development through knowledge transfer, training, and utilization of local resources. Therefore, strengthening institutional capacity at the village level can accelerate the adoption of digital business practices among rural entrepreneurs.

Furthermore, the findings suggest that MSME empowerment programs should adopt a capability-based approach rather than focusing solely on increasing the number of digitally connected businesses. Digital literacy and market orientation should become key components in entrepreneurship development programs because they determine how effectively MSMEs transform digital opportunities into economic value. Entrepreneurs who possess stronger digital skills and market awareness are more likely to utilize e-commerce platforms strategically, develop customer-oriented products, and respond effectively to competitive pressures.

The study also contributes theoretically by extending the understanding of rural MSME digital transformation. Previous studies have often examined technology adoption as a direct predictor of business performance. However, this research demonstrates that the relationship is more complex, where internal capabilities act as important mechanisms that explain how digital technologies generate business value. By integrating technology adoption, digital literacy, and market orientation perspectives, this study provides a more comprehensive explanation of digital transformation processes among rural MSMEs.

In the context of Babussalam Village and similar rural areas, collaborative efforts among government institutions, village organizations, universities, and private sector actors are essential to establish sustainable digital ecosystems. Such collaboration can provide continuous mentoring, innovation support, and market access opportunities for MSMEs. Ultimately, rural digital transformation should be understood not only as a technological transition but also as a process of empowering entrepreneurs to become more adaptive, innovative, and competitive in the digital economy.

4. CONCLUSIONS

This study provides empirical evidence regarding the relationship between e-commerce adoption and rural MSME performance by examining the roles of digital literacy and market orientation among MSMEs in Babussalam Village, Rokan Hulu Regency, Riau Province. The findings demonstrate that e-commerce adoption has a significant positive effect on MSME performance, indicating that digital platforms provide important opportunities for rural businesses to expand market access, improve customer engagement, and strengthen competitiveness.

Furthermore, the study confirms that digital literacy and market orientation are important mechanisms that enhance the benefits of e-commerce adoption. Digital literacy enables MSME owners to effectively utilize digital technologies, while market orientation allows entrepreneurs to respond more effectively to customer needs and market changes. The mediation analysis indicates that digital transformation generates stronger business outcomes when supported by adequate digital capabilities and strategic market awareness.

Theoretically, this study contributes to the literature on rural MSME digital transformation by integrating technology adoption and capability-based perspectives. The findings extend previous research by demonstrating that e-commerce adoption should not be viewed merely as technological implementation but as a process involving entrepreneurial capability development and strategic adaptation.

Practically, the results suggest that rural MSME development programs should focus not only on providing access to digital platforms but also on improving digital literacy, online business management skills, and market-oriented strategies. Village institutions, policymakers, and business development organizations can utilize these findings to design more comprehensive digital empowerment programs that support sustainable rural economic growth.

Although this study provides valuable insights, future research may expand the investigation by involving larger samples across different rural regions, applying longitudinal designs, and incorporating additional factors such as digital infrastructure, innovation capability,

and entrepreneurial orientation to provide a more comprehensive understanding of rural MSME digital transformation.

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