

## Entrepreneurial Resilience, Digital Literacy, Business Adaptability, and MSME Performance in Semi-Rural Indonesia

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**Abstract:** Purpose - Micro, small, and medium enterprises (MSMEs) are central to employment creation, local income generation, and regional economic resilience in Indonesia. Yet semi-rural MSMEs often operate under market volatility, resource constraints, and uneven digital readiness. This study examines the effects of entrepreneurial resilience, digital literacy, and business adaptability on MSME performance in Sikur District, East Lombok Regency. Design/methodology/approach A quantitative survey design was used. The population comprised 753 MSME owners, and 100 respondents were selected using the Slovin formula and simple random sampling. Data were collected using a structured five-point Likert-scale questionnaire and analysed with validity and reliability tests, classical assumption tests, multiple linear regression, t-tests, F-test, and coefficient of determination using IBM SPSS Statistics. Findings Entrepreneurial resilience has a positive and significant effect on MSME performance ( $B = 0.168$ ; standardized beta = 0.254;  $p = 0.003$ ). Business adaptability is the strongest predictor ( $B = 0.440$ ; standardized beta = 0.619;  $p < 0.001$ ). Digital literacy has a positive but non-significant effect ( $B = 0.035$ ; standardized beta = 0.052;  $p = 0.550$ ). Simultaneously, the three predictors significantly explain MSME performance,  $F(3, 96) = 108.042$ ,  $p < 0.001$ , with  $R^2 = 0.771$ . Originality/value - The study extends MSME performance research by integrating entrepreneurial resilience, digital literacy, and business adaptability in a semi-rural Indonesian setting. The findings suggest that digital literacy alone may not immediately improve performance unless it is translated into concrete digital practices, while adaptability and resilience remain decisive capabilities for sustaining MSME competitiveness.

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## 1. Introduction

Micro, small, and medium enterprises (MSMEs) are widely recognised as an essential pillar of inclusive economic development. Globally, small and medium-sized enterprises represent around 90% of businesses and account for more than half of employment, making them central to economic diversification, productivity improvement, and poverty reduction (Nxele & Hoque, 2022). In Indonesia, MSMEs have an even more strategic role because they provide employment, support household income, and strengthen regional economic circulation. Their contribution is especially important in semi-rural areas where formal employment opportunities are limited and local entrepreneurship becomes a key mechanism for sustaining community livelihoods.

Despite their strategic role, MSMEs face persistent performance challenges. Market turbulence, fluctuating consumer demand, limited managerial capacity, constrained access to finance, digital infrastructure gaps, and competition from platform-based businesses create uncertainty for small business owners. These challenges are more visible in semi-rural contexts, where MSMEs must compete in increasingly digital markets while still relying on conventional business practices. In such contexts, performance improvement cannot be explained only by capital or market access; it also depends on internal capabilities that enable entrepreneurs to survive, learn, adapt, and transform their business practices.

The resource-based view and dynamic capability perspective provide a useful theoretical foundation for examining MSME performance. The resource-based view argues that valuable, rare, inimitable, and organisationally embedded resources can generate competitive advantage (Barney, 1991). Dynamic capability theory further explains that firms need sensing, seizing, and reconfiguring capabilities to respond to changing environments (Teece, 2007, 2018). For MSMEs, these capabilities are not always formalised in organisational systems; instead, they are often embedded in the owner-manager's resilience, digital competence, and ability to adapt business strategies to external changes.

Entrepreneurial resilience is one of the most important capabilities for MSME sustainability. It reflects the ability of entrepreneurs to withstand pressure, recover from setbacks, learn from adversity, and maintain business continuity under uncertainty. Previous studies show that entrepreneurial resilience is not merely a psychological trait, but also a strategic capability that helps entrepreneurs reinterpret constraints, mobilise resources, and redesign business practices during crisis or market disruption (Santos et al., 2023; Shore et al., 2024). Recent scholarship also positions resilience as closely connected to digital transformation and business capability development in SMEs (Sagala & Ori, 2026).

Digital literacy has become another important capability because business processes are increasingly mediated by digital technologies. Digitally literate entrepreneurs can access information, use social media marketing, communicate with customers, manage transactions, and adopt digital payment or e-commerce tools. However, recent evidence suggests that the relationship between digital capability and performance is not always linear. Digital transformation improves performance when it is supported by business model innovation, sufficient digital maturity, and strategic use of digital technologies (Escob Barragan & Becker, 2025; Merin-Rodriganez et al., 2024). Therefore, digital literacy may not directly improve MSME performance when it remains limited to basic operational use rather than being converted into market expansion, innovation, and customer value creation.

Business adaptability is also a critical determinant of MSME performance. Adaptability refers to the ability of a business to adjust products, pricing, marketing approaches, operational routines, and customer service in response to environmental changes. From a dynamic capability perspective, adaptability reflects the reconfiguration of resources and routines to maintain market relevance. Studies on business survival and failure show that adaptive leadership and collaborative capability are decisive conditions for organisational survival, whereas digital transformation capability alone may be insufficient when not accompanied by adaptive organisational practices (Gupta et al., 2024).

Although entrepreneurial resilience, digital literacy, and adaptability have received attention in the SME literature, empirical studies that integrate these three capabilities in the context of semi-rural Indonesian MSMEs remain limited. Prior studies tend to examine digitalisation, resilience, or adaptability separately, while less attention has been paid to how these capabilities jointly explain performance among MSME owners operating in local villages. This gap is important because semi-rural MSMEs often face a unique combination of constraints: they need resilience to cope with business uncertainty, digital literacy to access wider markets, and adaptability to adjust to changing consumer behaviour.

This study addresses this gap by examining the influence of entrepreneurial resilience, digital literacy, and business adaptability on MSME performance in Sikur District, East Lombok Regency. The study contributes to the literature by testing an integrated capability-based model in a semi-rural MSME context. Practically, the findings provide evidence for local governments, business development agencies, and MSME

owners regarding which internal capabilities should be prioritised to improve business performance and competitiveness.

## **2. Theoretical Background and Hypothesis Development**

### **2.1 Entrepreneurial resilience and MSME performance**

Entrepreneurial resilience enables business owners to remain functional and proactive when facing uncertainty, resource scarcity, declining sales, or competitive pressure. Resilient entrepreneurs are more likely to search for alternatives, maintain motivation, mobilise networks, and transform adversity into learning. In MSMEs, where the owner often performs strategic, financial, operational, and marketing roles simultaneously, resilience becomes a central personal and managerial resource. Studies on entrepreneurial resilience show that resilience supports opportunity recognition, strategic renewal, and continuity during disruption (Santos et al., 2023; Shore et al., 2024). Therefore, entrepreneurs with stronger resilience are expected to achieve better MSME performance.

H1: Entrepreneurial resilience has a positive and significant effect on MSME performance.

### **2.2 Digital literacy and MSME performance**

Digital literacy refers to the ability to access, evaluate, use, communicate, and create information through digital technologies for business purposes. In MSMEs, digital literacy can support social media marketing, customer communication, digital payments, inventory recording, online promotion, and market intelligence. Nevertheless, evidence from recent SME research indicates that digital orientation and digital transformation can produce delayed, non-linear, or indirect performance effects because firms need sufficient digital maturity and business model alignment before digital investment produces measurable outcomes (Escoz Barragan & Becker, 2025; Merin-Rodriganez et al., 2024). Therefore, digital literacy is expected to support performance, although the strength of its direct effect may depend on practical implementation.

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

### **2.3 Business adaptability and MSME performance**

Business adaptability reflects the capacity to modify business strategies, operational processes, products, and market approaches in response to changes in customer preferences, competition, technology, and economic conditions. In dynamic capability theory, adaptability is closely related to sensing environmental changes, seizing new opportunities, and reconfiguring resources to maintain competitiveness (Teece, 2007, 2018). Adaptive MSMEs are more capable of adjusting product offerings, responding to customer feedback, adopting new marketing channels, and reorganising resources under uncertainty. Recent evidence indicates that adaptive leadership and collaborative capability help explain business survival, while the absence of such adaptive capabilities is associated with failure (Gupta et al., 2024).

H3: Business adaptability has a positive and significant effect on MSME performance.

### **2.4 Integrated capability model**

The integration of entrepreneurial resilience, digital literacy, and business adaptability reflects a capability-based approach to MSME performance. Resilience helps entrepreneurs remain persistent, digital literacy provides access to technological opportunities, and adaptability enables strategic adjustment. Together, these capabilities should explain performance more comprehensively than any single capability. This study therefore proposes that the three variables jointly influence MSME performance.

H4: Entrepreneurial resilience, digital literacy, and business adaptability simultaneously influence MSME performance.

## **3. Research Method**

This study employed a quantitative research design using a cross-sectional survey method. The design was appropriate because the study aimed to test the relationships between entrepreneurial resilience, digital literacy, business adaptability, and MSME performance based on numerical data collected from MSME owners at one point in time.

The research was conducted in Sikur District, East Lombok Regency, Indonesia. This location was selected because MSMEs in the district contribute to local economic activity through culinary businesses, trade, services, household processing, and other small-scale business sectors. At the same time, many MSME owners operate in a semi-rural business environment characterised by limited resources, increasing competition, and gradual digital adoption.

The population consisted of 753 MSME owners registered in Sikur District. The sample size was determined using the Slovin formula with a 10% margin of error, resulting in 100 respondents. Respondents were selected using a simple random sampling technique to provide each MSME owner with an equal probability of being included in the study.

Primary data were collected using a structured questionnaire measured on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Entrepreneurial resilience was measured through indicators related to persistence, recovery from setbacks, problem solving, and confidence in facing business difficulties. Digital literacy was measured through indicators related to the use of digital devices, digital information search, digital communication, social media marketing, and digital transaction practices. Business adaptability was measured through the ability to adjust products, marketing strategies, business processes, and customer responses. MSME performance was measured through perceived sales growth, customer growth, profitability, competitiveness, and business sustainability.

Before hypothesis testing, the research instrument was evaluated through validity and reliability testing. The regression model was also tested using classical assumption procedures, including normality, multicollinearity, and heteroscedasticity tests. Data analysis was conducted using IBM SPSS Statistics. The main analytical technique was multiple linear regression with the following equation: MSME Performance =  $\alpha + \beta_1(\text{Entrepreneurial Resilience}) + \beta_2(\text{Digital Literacy}) + \beta_3(\text{Business Adaptability}) + \text{error}$ .

The hypotheses were evaluated using partial significance tests (t-tests), simultaneous significance testing (F-test), and coefficient of determination ( $R^2$ ). The t-test assessed the individual effect of each independent variable, while the F-test assessed whether all independent variables jointly explained MSME performance. The coefficient of determination was used to evaluate the explanatory power of the model.

## 4. Result and Discussion

### 4.1 Result

#### 4.1.1 Respondent profile

The study involved 100 MSME owners from Kotaraja, Loyok, and Sikur villages. The respondent profile indicates that MSME owners in the sample were mostly of productive age, had a secondary educational background, and were operating businesses that were still in the growth stage. The detailed profile is presented in Table 1.

**Table 1.** Respondent profile

| Characteristic | Category                      | Frequency | Percentage (%) |
|----------------|-------------------------------|-----------|----------------|
| Village        | Kotaraja                      | 34        | 34.0           |
|                | Loyok                         | 33        | 33.0           |
|                | Sikur                         | 33        | 33.0           |
| Age            | 20-30 years                   | 25        | 25.0           |
|                | 31-40 years                   | 38        | 38.0           |
|                | 41-50 years                   | 24        | 24.0           |
|                | > 50 years                    | 13        | 13.0           |
| Education      | Elementary school/equivalent  | 18        | 18.0           |
|                | Junior high school/equivalent | 22        | 22.0           |
|                | Senior high school/equivalent | 45        | 45.0           |
|                | Diploma/Bachelor degree       | 15        | 15.0           |
| Business age   | < 1 year                      | 12        | 12.0           |

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|                 |                          |    |      |
|-----------------|--------------------------|----|------|
| Business sector | 1-3 years                | 36 | 36.0 |
|                 | 4-6 years                | 31 | 31.0 |
|                 | > 6 years                | 21 | 21.0 |
|                 | Culinary                 | 34 | 34.0 |
|                 | Trade                    | 29 | 29.0 |
|                 | Services                 | 18 | 18.0 |
|                 | Home industry/processing | 11 | 11.0 |
|                 | Others                   | 8  | 8.0  |

#### 4.1.2 Descriptive overview and instrument testing

The instrument testing was conducted before hypothesis analysis to ensure that the questionnaire items were empirically appropriate for measuring the constructs of entrepreneurial resilience, digital literacy, business adaptability, and MSME performance. The validity test confirmed that all questionnaire items were valid, with corrected item-total correlation coefficients exceeding the critical r-table value of 0.1654. These results indicate that all measurement indicators adequately represent their respective constructs and are suitable for subsequent reliability testing and regression analysis.

**Table 2.** Instrument validity test results

| Variable                        | Item | r-value | r-table | Decision |
|---------------------------------|------|---------|---------|----------|
| Entrepreneurial Resilience (X1) | X1.1 | 0.808   | 0.1654  | Valid    |
|                                 | X1.2 | 0.871   | 0.1654  | Valid    |
|                                 | X1.3 | 0.837   | 0.1654  | Valid    |
|                                 | X1.4 | 0.867   | 0.1654  | Valid    |
|                                 | X1.5 | 0.836   | 0.1654  | Valid    |
|                                 | X1.6 | 0.877   | 0.1654  | Valid    |
|                                 | X1.7 | 0.882   | 0.1654  | Valid    |
|                                 | X1.8 | 0.819   | 0.1654  | Valid    |
| Digital Literacy (X2)           | X2.1 | 0.800   | 0.1654  | Valid    |
|                                 | X2.2 | 0.762   | 0.1654  | Valid    |
|                                 | X2.3 | 0.872   | 0.1654  | Valid    |
|                                 | X2.4 | 0.821   | 0.1654  | Valid    |
|                                 | X2.5 | 0.778   | 0.1654  | Valid    |
|                                 | X2.6 | 0.837   | 0.1654  | Valid    |
|                                 | X2.7 | 0.759   | 0.1654  | Valid    |
|                                 | X2.8 | 0.818   | 0.1654  | Valid    |
| Business Adaptability (X3)      | X3.1 | 0.740   | 0.1654  | Valid    |
|                                 | X3.2 | 0.809   | 0.1654  | Valid    |
|                                 | X3.3 | 0.786   | 0.1654  | Valid    |
|                                 | X3.4 | 0.796   | 0.1654  | Valid    |
|                                 | X3.5 | 0.860   | 0.1654  | Valid    |
|                                 | X3.6 | 0.847   | 0.1654  | Valid    |
|                                 | X3.7 | 0.873   | 0.1654  | Valid    |



|                      |      |       |        |       |
|----------------------|------|-------|--------|-------|
|                      | X3.8 | 0.817 | 0.1654 | Valid |
| MSME Performance (Y) | Y1   | 0.723 | 0.1654 | Valid |
|                      | Y2   | 0.809 | 0.1654 | Valid |
|                      | Y3   | 0.830 | 0.1654 | Valid |
|                      | Y4   | 0.772 | 0.1654 | Valid |
|                      | Y5   | 0.799 | 0.1654 | Valid |
|                      | Y6   | 0.797 | 0.1654 | Valid |

The validity test results presented in Table 2 indicate that all measurement items for Entrepreneurial Resilience (X1), Digital Literacy (X2), Business Adaptability (X3), and MSME Performance (Y) have corrected item-total correlation coefficients greater than the critical value of 0.1654. The r-values range from 0.723 to 0.882, exceeding the minimum threshold required for construct validity. Therefore, all questionnaire items are considered valid and suitable for measuring their respective constructs. These findings confirm that the research instrument has adequate validity and can be used for subsequent reliability testing and hypothesis analysis.

**Table 3.** Instrument reliability test results

| Variable                        | Cronbach's Alpha | Threshold | Decision |
|---------------------------------|------------------|-----------|----------|
| Entrepreneurial Resilience (X1) | 0.944            | 0.60      | Reliable |
| Digital Literacy (X2)           | 0.921            | 0.60      | Reliable |
| Business Adaptability (X3)      | 0.923            | 0.60      | Reliable |
| MSME Performance (Y)            | 0.877            | 0.60      | Reliable |

As shown in Table 3, the reliability analysis confirmed that all constructs exhibited satisfactory internal consistency, with Cronbach's Alpha values ranging from 0.877 to 0.944, exceeding the recommended threshold of 0.60. These results indicate that all measurement scales are reliable and suitable for further statistical analysis.

#### 4.1.3 Descriptive overview and classical assumption testing

The descriptive findings show that entrepreneurial resilience, digital literacy, business adaptability, and MSME performance generally fall within the high category. This indicates that most respondents perceived themselves as having relatively favourable internal capabilities and business outcomes. However, the range of responses from low to high suggests that not all MSME owners have the same level of readiness, especially in digital and adaptive business practices.

**Table 4.** Classical assumption test results

| Test               | Main result                     | Interpretation                          |
|--------------------|---------------------------------|-----------------------------------------|
| Normality          | Significance value > 0.10       | The residuals were normally distributed |
| Multicollinearity  | Tolerance > 0.10; VIF < 10      | No multicollinearity was detected       |
| Heteroscedasticity | No clear pattern in scatterplot | Heteroscedasticity was not indicated    |

As shown in Table 4, the regression model satisfied the required classical assumptions. The residuals were normally distributed, the independent variables did not indicate multicollinearity, and the scatterplot did not show heteroscedasticity. Therefore, the data were considered suitable for multiple linear regression analysis.

#### 4.1.4 Multiple linear regression analysis

**Table 5.** Multiple regression results

| Predictor                  | B     | SE    | Beta  | t     | p      | Decision      |
|----------------------------|-------|-------|-------|-------|--------|---------------|
| Constant                   | 2.890 | 1.050 | -     | 2.753 | 0.007  | -             |
| Entrepreneurial resilience | 0.168 | 0.056 | 0.254 | 3.001 | 0.003  | Supported     |
| Digital literacy           | 0.035 | 0.059 | 0.052 | 0.600 | 0.550  | Not supported |
| Business adaptability      | 0.440 | 0.067 | 0.619 | 6.608 | <0.001 | Supported     |

The regression equation is: MSME Performance = 2.890 + 0.168 (Entrepreneurial Resilience) + 0.035 (Digital Literacy) + 0.440 (Business Adaptability) + error. The results indicate that entrepreneurial resilience and business adaptability have positive and significant effects on MSME performance, whereas digital literacy has a positive but non-significant effect. Business adaptability has the largest standardised coefficient (beta = 0.619), indicating that it is the strongest predictor of MSME performance in this model.

**Table 6.** Model fit and explanatory power

| Indicator               | Value   |
|-------------------------|---------|
| R                       | 0.878   |
| R <sup>2</sup>          | 0.771   |
| Adjusted R <sup>2</sup> | 0.764   |
| Std. error of estimate  | 1.372   |
| F-statistic             | 108.042 |
| df                      | 3, 96   |
| p-value                 | <0.001  |

Table 6 shows that the model has strong explanatory power. The R<sup>2</sup> value of 0.771 indicates that entrepreneurial resilience, digital literacy, and business adaptability explain 77.1% of the variance in MSME performance. The remaining 22.9% is explained by other factors not included in this study, such as access to capital, market orientation, innovation capability, business networking, financial literacy, entrepreneurial experience, and institutional support. The F-test result, F(3, 96) = 108.042, p < 0.001, confirms that the three independent variables simultaneously have a significant effect on MSME performance.

**Table 7.** Hypothesis testing summary

| Hypothesis | Relationship                                                                                | Result                       | Conclusion    |
|------------|---------------------------------------------------------------------------------------------|------------------------------|---------------|
| H1         | Entrepreneurial resilience -> MSME performance                                              | Positive and significant     | Supported     |
| H2         | Digital literacy -> MSME performance                                                        | Positive but not significant | Not supported |
| H3         | Business adaptability -> MSME performance                                                   | Positive and significant     | Supported     |
| H4         | Entrepreneurial resilience, digital literacy, and business adaptability -> MSME performance | Simultaneously significant   | Supported     |

### 3.2 Discussion

The findings show that entrepreneurial resilience has a positive and significant effect on MSME performance. This result confirms that MSME owners who can cope with uncertainty, recover from setbacks, and maintain confidence in difficult situations tend to report better business performance. In semi-rural contexts, resilience is particularly important because MSME owners often face limited access to capital, unstable demand, and restricted managerial support. Resilient entrepreneurs are more likely to maintain business continuity, seek alternative strategies, and learn from market difficulties. This finding is consistent

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with recent evidence that entrepreneurial resilience functions as a dynamic capability that supports survival and strategic renewal during turbulence (Santos et al., 2023; Shore et al., 2024).

The non-significant effect of digital literacy is one of the most important findings of the study. Although the coefficient is positive, digital literacy does not significantly predict MSME performance. This does not mean that digital literacy is unimportant. Instead, it suggests that basic digital ability may not be sufficient to improve performance unless MSME owners translate digital knowledge into systematic business practices, such as digital marketing strategy, customer analytics, online sales conversion, digital payment integration, and business model innovation. This interpretation is consistent with recent SME research showing that digital orientation can produce non-linear performance effects and that digital transformation contributes to performance more strongly when combined with business model innovation and sufficient digital maturity (Escobarragan & Becker, 2025; Merin-Rodriguez et al., 2024).

The finding that digital literacy is not significant also reflects the possible gap between digital access and digital value creation. Many MSME owners may already use smartphones, social media, or messaging applications, but these tools may be used only for communication rather than strategic marketing, customer relationship management, financial recording, or data-informed decision making. In this condition, digital literacy remains at a basic operational level and does not yet generate measurable performance outcomes. Prior research similarly emphasises that digital competencies need to be supported by human capital, innovation, agility, and ecosystem support to strengthen entrepreneurial resilience and business outcomes (Shatila et al., 2025).

Business adaptability is the most dominant predictor of MSME performance. This finding indicates that MSMEs that can adjust products, services, marketing approaches, and operations to environmental change achieve better performance. Adaptability allows MSME owners to respond rapidly to customer needs, modify sales strategies, reposition products, and exploit local market opportunities. From the dynamic capability perspective, this result confirms that the ability to reconfigure resources and routines is critical for small business competitiveness (Teece, 2007, 2018). It is also consistent with evidence that adaptive leadership and collaborative capability are central conditions for business survival, while digital transformation capability alone may not be enough to prevent business failure (Gupta et al., 2024).

Taken together, the results demonstrate that MSME performance in Sikur District is shaped more strongly by adaptive and resilient capabilities than by digital literacy alone. This is an important contribution because it shows that digital capability should not be treated as an isolated technical skill. Instead, it needs to be embedded in a broader capability system that includes resilience, adaptability, innovation, collaboration, and strategic learning. This finding aligns with Fahrurrozi (2025), who emphasises the importance of digitalisation, education, and collaboration in strengthening sustainable business outcomes among Indonesian MSMEs.

Theoretically, this study contributes to the resource-based view and dynamic capability literature by showing that internal capabilities explain a substantial proportion of MSME performance in a semi-rural Indonesian setting. The findings highlight that entrepreneurial resilience and business adaptability operate as valuable intangible resources, while digital literacy requires complementary capabilities before it becomes a direct performance driver. Therefore, future MSME performance models should examine digital literacy not only as an independent variable, but also as a capability that may work through digital transformation, innovation capability, business model innovation, or market orientation.

Practically, the findings suggest that local government, cooperatives, universities, and MSME development agencies should prioritise capacity-building programs that strengthen resilience and adaptability. Entrepreneurship training should include crisis management, problem solving, business planning, customer orientation, product innovation, and market adaptation. Digital literacy programs should move beyond basic digital skills and focus on practical business implementation, including social media content strategy, online marketplace optimisation, digital payment systems, bookkeeping applications, customer data management, and performance monitoring.



## 5. Conclusion

This study examined the effects of entrepreneurial resilience, digital literacy, and business adaptability on MSME performance in Sikur District, East Lombok Regency. The results show that entrepreneurial resilience has a positive and significant effect on MSME performance. MSME owners who are more resilient are better able to withstand business uncertainty, recover from difficulties, and maintain business continuity.

Digital literacy has a positive but non-significant effect on MSME performance. This finding indicates that basic digital competence alone may not directly improve performance unless it is transformed into strategic digital business practices. Therefore, digital literacy should be strengthened through applied training that connects digital tools with marketing, customer management, financial recording, and innovation.

Business adaptability is the strongest determinant of MSME performance. MSMEs that are able to adjust strategies, respond to customer needs, modify products, and adapt to market changes tend to achieve better performance. Simultaneously, entrepreneurial resilience, digital literacy, and business adaptability significantly explain MSME performance, with an R<sup>2</sup> value of 0.771. These findings confirm that internal capability development is essential for strengthening MSME competitiveness in semi-rural Indonesia.

## Recommendation

Based on the findings, MSME development programs should prioritize business adaptability, as it was the strongest predictor of MSME performance. Training should focus on improving product adjustment, marketing strategies, customer service, and operational flexibility. Entrepreneurial resilience should also be strengthened through mentoring, peer learning, and crisis-management support. In addition, digital literacy programs should move beyond basic digital skills and emphasize practical applications such as social media marketing, digital payments, online sales, and financial recording. Collaboration among local governments, universities, cooperatives, and MSME development agencies is essential to build sustainable MSME competitiveness in semi-rural areas.

## Data availability

The data supporting the findings of this study are not publicly available due to confidentiality considerations and the privacy of MSME owners who participated in the survey. However, anonymized data may be made available by the corresponding author upon reasonable request, subject to ethical approval and institutional permission. All data used in this study were collected solely for academic and research purposes.

## Declaration of the use of artificial intelligence (AI)

The authors declare that artificial intelligence-based tools were used only to support language refinement, grammar checking, and academic editing during the preparation of this manuscript. AI tools were not used to generate research data, conduct statistical analysis, interpret findings, or formulate scientific conclusions. All intellectual content, research design, data analysis, interpretation, and final conclusions remain the full responsibility of the authors. The authors have carefully reviewed and approved the final version of the manuscript.

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