

MSME Digitalization: Strengthening Fintech Adoption Through Tri-Literacy to Enhance Sustainable Entrepreneurship

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ABSTRACT

Micro, Small, and Medium Enterprises (MSMEs) are crucial to the Indonesian economy, although they encounter obstacles in leveraging digital technologies. Inadequate literacy levels, encompassing digital, financial, and entrepreneurial literacy, impede the effective adoption of financial technology (fintech), which could serve as a strategic remedy to enhance organizational performance. This study examines the impact of Tri-Literacy on fintech adoption and its consequences for MSME performance. The research employs a quantitative approach using a survey of 300 MSMEs in Pontianak City and its vicinity. The research instrument is a questionnaire with a 1–5 Likert scale, developed based on indicators of Tri-Literacy, Fintech Adoption, and MSME Performance. Data were analyzed using Structural Equation Modeling (SEM) with WarpPLS 8.0 to assess validity, reliability, coefficients of determination, and path coefficients. The findings indicate that all Tri-Literacy variables significantly and positively influence fintech adoption, which in turn significantly and positively affects MSME performance. Entrepreneurial literacy provides the largest contribution to both fintech uptake and MSME performance. The research model demonstrates validity and relevance, yielding an R² value of 0.762 for Fintech Adoption and 0.844 for MSME Performance. The performance construct used in this study captures not only short-term financial outcomes, but also aspects of resilience, adaptability, and long-term viability, thereby reflecting the broader concept of sustainable entrepreneurship.

Keywords : MSMEs; Digitalization; Fintech; Literacy; Sustainable Entrepreneurship

ABSTRAK

Penelitian ini bertujuan menganalisis peran Tri Literasi yang terdiri dari literasi digital, literasi keuangan, dan literasi kewirausahaan dalam mendorong adopsi financial technology (fintech) serta implikasinya terhadap kinerja UMKM yang berorientasi pada kewirausahaan berkelanjutan. UMKM dipandang sebagai tulang punggung perekonomian Indonesia, namun masih menghadapi berbagai hambatan dalam pemanfaatan teknologi digital secara optimal. Penelitian ini menggunakan pendekatan kuantitatif dengan metode survei terhadap 300 UMKM di Kota Pontianak dan sekitarnya. Instrumen penelitian berupa kuesioner skala Likert 1–5 yang disusun berdasarkan indikator Tri Literasi, Adopsi Fintech, dan Kinerja UMKM. Analisis data dilakukan menggunakan Structural Equation Modeling (SEM) berbasis WarpPLS untuk menguji validitas, reliabilitas, koefisien determinasi, dan pengaruh antarvariabel. Hasil penelitian menunjukkan bahwa seluruh dimensi Tri Literasi berpengaruh positif signifikan terhadap adopsi fintech, dan adopsi fintech berpengaruh positif signifikan terhadap kinerja UMKM. Literasi kewirausahaan memberikan kontribusi terbesar terhadap adopsi fintech maupun kinerja UMKM. Model penelitian memiliki daya jelas yang kuat dengan nilai R² sebesar 0,762 untuk Adopsi Fintech dan 0,844 untuk Kinerja UMKM. Kinerja UMKM dalam penelitian ini tidak hanya mencerminkan hasil finansial jangka pendek, tetapi juga mencakup aspek ketahanan, kemampuan beradaptasi, dan keberlanjutan usaha jangka panjang, sehingga merepresentasikan praktik kewirausahaan berkelanjutan dalam konteks UMKM.

Kata Kunci : UMKM; Digitalisasi; Fintech; Literasi; Kewirausahaan Berkelanjutan

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INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) constitute a significant share of national Gross Domestic Product and are pivotal in employment generation across developing economies, particularly in Indonesia (Farisi et al., 2021). Nevertheless, in the context of rapid digital transformation, MSMEs face substantial obstacles in leveraging digital technologies effectively to broaden their markets, enhance operational efficiency, and strengthen competitiveness. Although fintech solutions promise to democratize access to finance and streamline business operations, the actual utilization of fintech by MSMEs remains suboptimal. A key barrier is the multidimensional literacy gap encompassing digital, financial, and entrepreneurial literacy, which collectively constrains MSME owners' capacity to fully exploit the potential of fintech (Harahap et al., 2024; Syathiri et al., 2023; Kusuma et al., 2023).

Existing scholarly work on fintech adoption and MSME performance, while extensive, exhibits a critical fragmentation in how it conceptualizes and operationalizes literacy constructs. Most studies examine either digital literacy or financial literacy in isolation, with very few integrating entrepreneurial literacy as a distinct construct, and even fewer analysing the three literacies simultaneously (Khan et al., 2025; Hasan et al., 2024). When entrepreneurial literacy is considered, it is often conflated with financial literacy, obscuring its unique role in opportunity recognition, innovation, and strategic risk management. In addition, much of the prior research treats fintech adoption as a binary outcome or focuses on behavioural intention, without sufficiently examining how adoption quality and intensity translate into broader, sustainable performance outcomes. Studies such as Rohaeni et al. (2025) and Kurniasari and Lestari (2024) demonstrate that digital financial literacy and fintech adoption can enhance MSME performance, yet they stop short of integrating a full Tri-Literacy perspective or explicitly linking fintech adoption to sustainable entrepreneurship.

To address these gaps, this study proposes and empirically tests an integrated Tri-Literacy model grounded in Resource-Based View (RBV) and Dynamic Capabilities Theory. Tri-Literacy comprising digital literacy, financial literacy, and entrepreneurial literacy is conceptualized as a bundle of intangible strategic resources that jointly enable MSMEs to sense, seize, and reconfigure opportunities through fintech adoption. Fintech adoption is posited as a key mediating mechanism through which literacy capabilities are translated into enhanced MSME performance, conceptualized here in a way that is consistent with sustainable entrepreneurship, encompassing financial outcomes, resilience, adaptability, and long-term viability (Campanella et al., 2025; Waqar et al., 2025). The study aims to: (1) examine the direct effects of each literacy dimension on fintech adoption; (2) assess the direct and indirect effects of Tri-Literacy on MSME performance via fintech adoption; and (3) provide theoretical and practical insights for designing integrated literacy-building interventions to accelerate MSME digital transformation.

RESEARCH METHOD

This research employs a quantitative methodology via a survey technique, aimed at experimentally assessing the relationships among variables within a conceptual framework. The research population comprises MSME participants in Pontianak, encompassing several industries such as trade, services, gastronomy, and manufacturing. The research sample was established at 300 respondents to ensure a representative sample, adhering to the minimal sample size recommended for Structural Equation Modeling (SEM) analysis.

The sampling technique employed in this study was non-probability purposive sampling. MSME respondents were selected based on the following inclusion criteria: (1)

operating in Pontianak City or its surrounding areas; (2) having been in operation for at least two years; (3) classified as micro or small enterprises with 1–19 employees; and (4) having at least basic exposure to digital tools in their business activities, such as the use of smartphones, social media, or simple digital payment applications. These criteria were applied to ensure that the sample represented active MSMEs with sufficient operational history and potential relevance to fintech adoption.

The unit of analysis in this study is the owner or primary decision maker of the MSME. Accordingly, the questionnaire was addressed directly to business owners or, where applicable, to senior managers who hold final authority over financial and technological decisions, to ensure that responses on entrepreneurial literacy and fintech adoption accurately reflect the perspective of those who determine strategic choices in the enterprise.

The research tool utilized was a structured questionnaire employing a 1–5 Likert scale, spanning from strongly disagree to strongly agree. The measurement items for each construct were adapted from established scales in prior studies to ensure content validity. Digital literacy items were adapted from Nugraha et al. (2022), Mulyono (2023), and Gosal and Nainggolan (2023), capturing the ability to use digital devices, navigate online platforms, and basic awareness of digital security. Financial literacy indicators were derived from Islam and Khan (2024), Rohaeni et al. (2025), and Kurniasari and Lestari (2024), covering knowledge of basic financial concepts, budgeting, cash-flow management, and risk assessment. Entrepreneurial literacy items were adapted from Firmansyah and Susetyo (2022), Widayanto et al. (2023), and Nuraini and Darmawan (2024), reflecting opportunity recognition, innovation, risk-taking, and strategic decision-making. Fintech Adoption was measured using items based on Nugraha et al. (2022), Kolefian and Anafih (2023), and Mansyur and Ali (2022), whereas MSME Performance indicators were developed with reference to Nuraini and Darmawan (2024), Kurniasari and Lestari (2024), and Campanella et al. (2025), including both financial and non-financial aspects relevant to sustainable entrepreneurship.

Prior to distribution, the questionnaire was subjected to a pre-test to ascertain linguistic clarity, item relevance, and preliminary reliability of the instrument. The questionnaire was disseminated through a hybrid approach, employing digital forms (online) and conducting in-person visits to MSME sites, to address the digital literacy constraints of certain respondents. The gathered data was further examined utilizing Partial Least Squares (PLS)-based Structural Equation Modeling (SEM) through WarpPLS 8.0 software. The analytical phases encompassed tests for convergent and discriminant validity, reliability assessments with Cronbach's Alpha and Composite Reliability, and structural model evaluations to examine the causal linkages among variables. The research model was evaluated using the coefficient of determination (R^2), prediction relevance (Q^2), and Goodness of Fit (GoF) to determine its overall adequacy. This method facilitates thorough hypothesis testing while experimentally assessing the impact of Tri-Literacy on fintech uptake and MSME performance.

RESULTS AND DISCUSSION

A. Results

The WarpPLS analysis results indicate that the research instruments employed satisfy the standards for validity and reliability. All variables exhibit a Composite Reliability (CR) value exceeding 0.7 and a Cronbach's Alpha greater than 0.6, signifying that each construct in this study is dependable and proficient in consistently assessing the intended variables.

Table 1. Reliability Test

Variable	Composite Reliability (CR)	Cronbach's Alpha
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Digital Literacy (X1)	0,920	0,906
Financial Literacy (X2)	0,889	0,858
Entrepreneurial Literacy (X3)	0,921	0,906
Fintech Adoption (Z)	0,911	0,892
MSME Performance (Y)	0,862	0,808

Source: WarpPLS 8.0 Data Processing Results

Table 2. Coefficient of Determination (R²)

Endogenous Variable	R²
Fintech Adoption (Z)	0,762
MSME Performance (Y)	0,844

Source: WarpPLS 8.0 Data Processing Results

The coefficient of determination (R²) values for endogenous variables demonstrate that the Tri-Literacy model explains 0.762 (76.2%) of the variance in Fintech Adoption, and 0.844 (84.4%) of the variance in MSME Performance. The R² value of 0.844 for MSME Performance indicates that 84.4% of the variance in performance is explained jointly by Tri-Literacy and Fintech Adoption.

Tabel 3. Model Fit and Quality Indices

No	Index	Reference Value	Actual Value	Interpretation
1	<i>Average path coefficient (APC)</i>	P<0,05	P<0.001	Criterion met
2	<i>Average R-squared (ARS)</i>	P<0,05	P<0.001	Criterion met
3	<i>Average adjusted R-squared (AARS)</i>	P<0,05	P<0.001	Criterion met
4	<i>Average block VIF (AVIF)</i>	≤5	4.642	Criterion met
5	<i>Average full collinearity VIF (AFVIF)</i>	≤5	4.657	Criterion met
6	<i>TenenhausGoF (GoF)</i>	<i>small</i> ≥0,1 <i>medium</i> ≥0,25 <i>large</i> ≥0,36	0.626	<i>Large</i>
7	<i>Sympson's paradox ratio (SPR)</i>	ideally = 1	1	Criterion met
8	<i>R-squared contribution ratio (RSCR)</i>	acceptable if >= 0,9	1	Criterion met
9	<i>Statistical suppression ratio (SSR)</i>	≥0,7	1	Criterion met
10	<i>Nonlinear bivariate causality direction ratio (NLBCDR)</i>	≥0,7	1	Criterion met

Source: WarpPLS 8.0 Data Processing Results

The significant APC, ARS, and AARS values ($p < 0.001$) indicate that, on average, the structural paths and the explained variances in the model are statistically meaningful, thereby supporting the overall structural relationships. AVIF and AFVIF values below 5 further demonstrate that both vertical and lateral multicollinearity fall within acceptable limits, so collinearity is not a serious threat to this model. In addition, the Tenenhaus GoF value of 0.626 exceeds the 0.36 threshold for a large effect, suggesting that the model has strong combined explanatory power and satisfactory measurement quality. Finally, RSCR, SSR, and NLBCDR values that all equal 1 indicate that R² contributions are appropriate, suppression effects are absent or minimal, and the directions of causal relationships are consistent with the specified model.

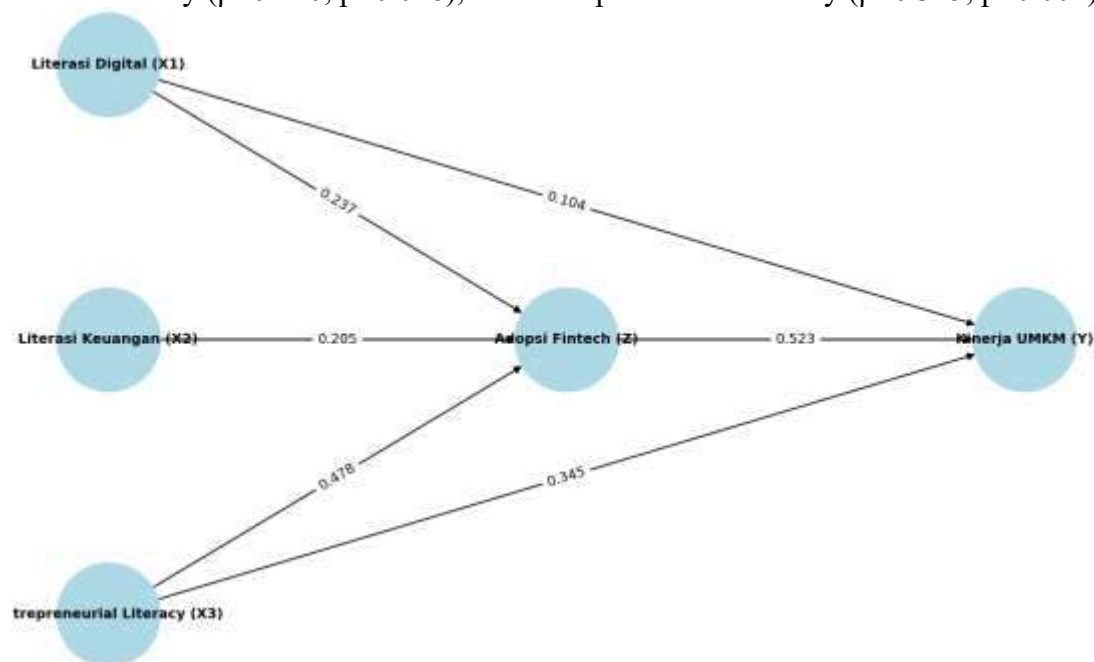
In the context of PLS-SEM, such values can be considered substantial, especially when the predictors are conceptually close to the endogenous constructs and are expected to have strong effects. To mitigate the risk of model overfitting, the study also evaluated convergent and discriminant validity, composite reliability, and model fit indices, all of which confirmed the adequacy and robustness of the specified model.

Table 4. Path Coefficients

Relationship Between Variables	Path Coefficient (β)	P-Value	Keterangan
Digital Literacy (X1) → Fintech Adoption (Z)	0,237	<0,001	Significant
Financial Literacy (X2) → Fintech Adoption (Z)	0,205	<0,001	Significant
Entrepreneurial Literacy (X3) → Fintech Adoption (Z)	0,478	<0,001	Significant
Fintech Adoption (Z) → MSME Performance (Y)	0,523	<0,001	Significant
Digital Literacy (X1) → MSME Performance (Y)	0,104	0,034	Significant
Financial Literacy (X2) → MSME Performance (Y)	0,120	0,018	Significant
Entrepreneurial Literacy (X3) → MSME Performance (Y)	0,345	<0,001	Significant

Source: WarpPLS 8.0 Data Processing Results

The results of the path coefficient test indicate that all study hypotheses are validated. Entrepreneurial Literacy exerts the most dominant influence on Fintech Adoption ($\beta=0.478$, $p<0.001$), followed by Digital Literacy ($\beta=0.237$, $p<0.001$) and Financial Literacy ($\beta=0.205$, $p<0.001$). Furthermore, Fintech Adoption markedly influences MSME Performance ($\beta=0.523$, $p<0.001$). The data suggest that the Tri-Literacies are crucial in promoting fintech adoption, which significantly enhances MSME performance. Direct effects from all three literacy dimensions to MSME Performance are also significant: Digital Literacy ($\beta=0.104$, $p=0.034$), Financial Literacy ($\beta=0.120$, $p=0.018$), and Entrepreneurial Literacy ($\beta=0.345$, $p<0.001$).

**Fig 1. SEM Diagram Test Results**

Source: WarpPLS 8.0 Data Processing Results

The SEM diagram data presentation elucidates the directional relationship between variables, indicating that Tri Literacy significantly contributes to the enhancement of Fintech adoption, which directly influences MSME performance.

B. Discussion

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The empirical findings of this study offer a compelling validation of the "Tri-Literacy" framework, demonstrating that the integration of digital, financial, and entrepreneurial literacies significantly drives fintech adoption and, subsequently, enhances the sustainable performance of MSMEs. The finding that Entrepreneurial Literacy is the strongest predictor of fintech adoption is a significant theoretical breakthrough of this research, challenging traditional technology adoption models (such as TAM or UTAUT) which typically prioritize technical ease-of-use or facilitating conditions. In the context of Pontianak's MSMEs, this suggests that the barrier to adoption is less about technical inability and more about strategic vision. Entrepreneurial literacy equips business owners with the "opportunity recognition" capability enabling them to perceive fintech not merely as a digital payment tool, but as a strategic asset for market expansion, efficiency, and competitive differentiation.

This finding robustly supports the Resource-Based View (RBV), positioning entrepreneurial literacy as a rare and valuable operant resource that creates competitive advantage. It aligns with recent research by Ismail and Rashidi (2025), who argue that dynamic entrepreneurial capabilities are prerequisites for digital innovation in small enterprises. Unlike Khan et al. (2025), who focused heavily on digital skills as the primary driver of technology adoption, this study proves that without the entrepreneurial mindset to innovate and take calculated risks, digital skills alone are insufficient to drive meaningful adoption. This confirms the assertion by Sudirman et al. (2025) that entrepreneurial competencies act as a "Sustainable Resilience Strategy" (SRS), enabling firms to navigate digital disruption effectively and implement technology in ways that enhance organizational resilience rather than merely automating existing processes.

While less dominant than entrepreneurial literacy, Digital Literacy remains a significant positive predictor of fintech adoption ($\beta=0.237$, $p<0.001$), confirming that technical competence lowers psychological barriers to entry. This positive effect corroborates findings from Febrianawati et al. (2024) and Nugraha et al. (2022), who documented that digital proficiency reduces perceived complexity and increases perceived usefulness of digital financial tools. However, the substantially lower coefficient for digital literacy compared to entrepreneurial literacy (0.237 vs. 0.478) indicates that technical skill is a foundational enabler rather than the primary driver of adoption decisions.

Financial Literacy similarly demonstrates a positive and significant influence on fintech adoption ($\beta=0.205$, $p<0.001$), indicating that MSMEs with better financial knowledge are more likely to trust and utilize fintech for budget management and investment decisions. This finding aligns with extensive research by Rohaeni et al. (2025) and Ulupui et al. (2025), who emphasize that financial literacy builds the trust and competence required for engaging with digital financial systems. However, similar to digital literacy, the lower coefficient for financial literacy relative to entrepreneurial literacy suggests that while financial knowledge is important, it provides an analytical engine for decision-making rather than the strategic driver of adoption intentions.

The strong impact of Fintech Adoption on MSME Performance ($\beta=0.523$, $p<0.001$) represents a crucial empirical validation that the adoption of financial technology translates into concrete business benefits. The mechanisms through which fintech adoption improves MSME performance include: (1) operational efficiency gains from digitized payment processing and reduced transaction times, (2) improved financial visibility and control through digital record-keeping and real-time cash flow monitoring, (3) expanded market access by enabling online sales and digital marketing capabilities, (4) reduced financial barriers through access to fintech-enabled credit and lending platforms, and (5) improved business decision-making based on more comprehensive financial data. This finding extends the work of

Campanella et al. (2025) and Waqar et al. (2025), who theorize that fintech adoption is a critical pathway to Sustainable Entrepreneurship.

The high explanatory power of the overall model ($R^2=0.844$ for MSME Performance) provides confidence in the robustness and relevance of the Tri-Literacy framework for the Indonesian MSME context. This suggests that the model captures the primary mechanisms through which MSMEs in developing economies create and sustain competitive advantage in the digital era.

CONCLUSION AND RECOMMENDATIONS

A. Conclusion

This study empirically validates the Tri-Literacy framework in the context of MSMEs in Pontianak, Indonesia. The results demonstrate that digital, financial, and entrepreneurial literacies jointly and significantly drive fintech adoption, with entrepreneurial literacy emerging as the most influential factor. Fintech adoption, in turn, significantly enhances MSME performance and serves as a key mediating mechanism through which literacy capabilities are translated into tangible performance improvements that are consistent with the notion of sustainable entrepreneurship.

Theoretically, the findings extend Resource-Based View and Dynamic Capabilities Theory by specifying how bundles of intangible literacy resources coalesce into dynamic capabilities that support digital transformation in resource-constrained MSMEs. Practically, the results highlight the need for integrated capacity-building initiatives that develop entrepreneurial, financial, and digital literacies simultaneously rather than in isolation. Future research should employ longitudinal and experimental designs, as well as comparative analyses across regions and sectors, to further validate the causal pathways identified in this study and to explore contextual factors that may strengthen or weaken the impact of Tri-Literacy on fintech adoption and MSME performance.

B. Recommendations

Recommendations for this study emphasize three main stakeholder groups. First, for MSMEs and local stakeholders in Pontianak, priority should be given to practical, on-site mentoring that helps owners integrate fintech into daily transactions, bookkeeping, and simple credit management, supported by local banks and fintech agents as “digital business companions.” Second, government and educational institutions should design integrated capacity-building programs that develop entrepreneurial, financial, and digital literacy simultaneously, using project-based learning and public-private partnerships with banks and fintech firms to ensure relevance and scalability. Third, financial institutions and fintech providers need to simplify user interfaces, offer tiered fintech solutions that allow gradual adoption, and position themselves as business partners by combining financial products with tools and training that strengthen MSMEs’ literacy and strategic decision-making.

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