The Impact of Financial Technology Adoption on the Sustainability of Microenterprises in Indonesia: The Mediating Role of Financial Inclusion

Mekar Meilisa Amalia

Universitas Dharmawangsa, mekar.amalia@gmail.com

Article Info	ABSTRACT
	The rapid development of financial technology (fintech) has transformed financial access and operational practices among micro businesses, particularly in emerging economies such as Indonesia. This study aims to examine the impact of financial technology implementation on the sustainability of micro businesses, with financial inclusion serving as a mediating variable. A quantitative research approach was employed using data collected from 150 micro business actors through a structured questionnaire measured on a Likert scale. Data analysis was conducted using Structural Equation Modeling–Partial Least Squares (SEM-PLS 3) to evaluate both measurement and structural models. The results indicate that fintech implementation significantly enhances financial inclusion and directly improves business sustainability. Financial inclusion also has a significant positive effect on sustainability and partially mediates the relationship between fintech adoption and sustainable business performance. These findings suggest that digital financial innovation contributes to micro business resilience when supported by inclusive financial access. The study provides theoretical contributions to digital finance and sustainable entrepreneurship literature while offering practical implications for policymakers and fintech providers in promoting inclusive digital ecosystems for micro-enterprise development in Indonesia.

Corresponding Author:

Name: Mekar Meilisa Amalia

Institution Address: Universitas Dharmawangsa

e-mail: mekar.amalia@gmail.com

1. INTRODUCTION

Micro businesses play a fundamental role in the Indonesian economy by contributing significantly to employment generation, income distribution, and regional economic resilience. Despite their strategic importance, many micro enterprises continue to face structural challenges related to limited access to formal financial services, low financial literacy, and restricted technological adoption [1], [2]. These constraints often hinder business growth and reduce the long-term sustainability of micro-scale operations. In recent years, the emergence of financial technology (fintech) has offered new opportunities to address these challenges by providing digital payment systems, peer-to-peer lending platforms, mobile banking [3], and alternative financing solutions that are more accessible and efficient than traditional financial services.

The rapid expansion of fintech in Indonesia reflects a broader global trend toward digital transformation in the financial

sector. Government initiatives promoting financial inclusion and digital economy development have accelerated the adoption of fintech among micro and small enterprises. Through simplified transaction processes, faster access to capital, and improved financial management tools, fintech has the potential to enhance business performance and resilience [4], [5]. For micro businesses, which often operate with limited resources and informal financial practices, fintech can reduce operational inefficiencies and expand market opportunities [6]. However, the extent to which fintech implementation directly influences business sustainability remains a subject of ongoing academic debate.

One important mechanism that may explain the relationship between fintech adoption and business sustainability is financial inclusion. Financial inclusion refers to the ability of individuals and businesses to access affordable and appropriate financial products and services, including savings, credit, insurance, and digital payment systems [7], [8]. In the context of micro enterprises, financial inclusion can strengthen financial stability, improve cash flow management, and support strategic decision-making. Fintech platforms often serve as a bridge between micro businesses and formal financial institutions, thereby expanding access to financial resources that were previously difficult to obtain [8], [9]. Consequently, financial inclusion may function as an intermediary pathway through which fintech contributes to sustainable business development.

Although previous studies have examined fintech adoption and financial inclusion separately, limited empirical research has explored the mediating role of financial inclusion in explaining how fintech implementation affects the sustainability of micro businesses, particularly within the Indonesian context. Many existing studies focus on small and medium enterprises rather than micro-scale businesses, which possess distinct characteristics such as informal management structures, limited capital, and high vulnerability to economic shocks, while empirical investigations using robust quantitative methods such as Structural Equation Modeling–Partial Least Squares (SEM-PLS) remain relatively scarce in examining the interconnected relationships among fintech, financial inclusion, and sustainability outcomes. Based on these research gaps, this study aims to analyze the impact of financial technology implementation on the sustainability of micro businesses in Indonesia, positioning financial inclusion as a mediating variable, with findings expected to contribute to the theoretical development of digital finance and sustainable entrepreneurship literature while also providing practical insights for policymakers, fintech providers, and micro business stakeholders in fostering an inclusive and sustainable digital economic ecosystem.

2. LITERATURE REVIEW

2.1 Financial Technology Implementation in Micro Businesses

Financial technology (fintech) refers to the integration of digital innovation into financial services that enables more efficient, accessible, and flexible financial transactions, particularly for micro businesses that rely on platforms such as digital payments, mobile banking, crowdfunding, and peer-to-peer lending systems to conduct financial operations without heavy dependence on traditional banking infrastructure [1], [2]. The adoption of fintech has been widely associated with improved transaction efficiency, reduced operational costs, and enhanced access to financial information, which are essential for micro-scale enterprises operating with limited resources. From a theoretical perspective [10], fintech adoption aligns with the Technology Acceptance Model (TAM) and innovation diffusion theory, which explain that perceived usefulness and ease of use influence the willingness of business actors to adopt new technologies, as micro entrepreneurs tend to utilize fintech when it

simplifies financial processes, expands market reach, and supports business growth. Empirical evidence further suggests that fintech usage improves cash flow management, accelerates financial decision-making, and strengthens the competitiveness of small business actors in digital markets, although challenges such as gaps in digital literacy, trust issues, and regulatory uncertainties continue to pose significant barriers to broader fintech implementation among micro enterprises [7], [11].

2.2 *Financial Inclusion and Digital Financial Access*

Financial inclusion refers to the accessibility and availability of formal financial services for individuals and businesses, particularly those traditionally excluded from the financial system, encompassing access to savings accounts, credit facilities, insurance products, and payment services at affordable costs [12], [13]. In developing economies, financial inclusion is widely recognized as a key driver of economic empowerment and poverty reduction because it enables business actors to manage financial risks and invest in productive activities [14]. The emergence of fintech has further accelerated financial inclusion by lowering entry barriers and expanding financial service coverage beyond conventional banking networks, as digital platforms allow micro business owners to conduct transactions, apply for loans, and manage finances through mobile devices, thereby reducing geographic and administrative constraints. From a theoretical perspective, financial intermediation theory explains that improved access to financial services enhances business performance by providing liquidity and enabling broader investment opportunities [15], while within the Indonesian context, government initiatives promoting digital payments and financial literacy programs have strengthened the role of fintech in expanding financial inclusion among micro enterprises.

2.3 *Sustainability of Micro Businesses*

Business sustainability refers to the ability of enterprises to maintain long-term operational performance while balancing economic, social, and environmental considerations, and for micro businesses this sustainability is often reflected in financial stability, resilience to economic fluctuations, and continuous business growth [16], [17]. From a theoretical standpoint, the Resource-Based View (RBV) emphasizes that internal capabilities, including technological adoption and financial management skills, are critical resources that support sustained competitive advantage over time. However, micro businesses face unique sustainability challenges due to limited capital, informal organizational structures, and high vulnerability to market disruptions, making adaptive strategies essential [18], [19]. The integration of digital financial tools can enhance sustainability by improving financial transparency, enabling data-driven decision-making, and supporting more flexible business strategies, while prior research indicates that businesses adopting digital financial solutions tend to demonstrate higher levels of resilience during periods of economic uncertainty, suggesting that fintech implementation may function as a strategic resource that strengthens long-term business viability.

2.4 *The Relationship between Financial Technology and Business Sustainability*

The relationship between fintech implementation and business sustainability can be understood through the digital transformation framework, which highlights the role of technology in enhancing operational efficiency and strategic adaptability. Fintech enables micro businesses to streamline financial processes, reduce transaction costs, and reach broader customer bases within digital ecosystems, thereby contributing to improved financial performance and organizational resilience as key elements of sustainability [3], [20]. Empirical evidence further indicates that digital financial adoption positively influences business outcomes such as profitability, growth, and customer retention; however, the direct effect of fintech on sustainability may vary depending on contextual factors including financial literacy levels, technological readiness, and institutional support [8], [10]. This variation suggests the existence of indirect pathways through which fintech influences sustainability, emphasizing the importance of examining mediating variables such as financial inclusion to better understand the underlying mechanisms linking digital finance and long-term business viability.

2.5 *The Mediating Role of Financial Inclusion*

Financial inclusion is increasingly recognized as a critical mechanism linking fintech adoption to sustainable business outcomes, as improved access to financial resources through fintech platforms allows micro enterprises to formalize financial practices, diversify funding sources, and manage risks more effectively. From a theoretical standpoint, financial capability theory supports this mediation perspective by suggesting that access to financial services enhances the ability of businesses to utilize resources strategically and make informed financial decisions. When micro businesses become integrated into inclusive financial systems through fintech, they are more likely to maintain stable cash flow, invest in innovation, and sustain long-term operations, positioning financial inclusion as a bridge that translates technological adoption into tangible business benefits. Although previous studies indicate that digital financial services contribute to inclusive economic growth by empowering underserved entrepreneurs, empirical models that explicitly examine this mediating relationship remain relatively limited, particularly within emerging market contexts.

3. RESEARCH METHODS

3.1 Research Design

This study employs a quantitative research design to examine the relationships between financial technology implementation, financial inclusion, and the sustainability of micro businesses in Indonesia, as the quantitative approach enables objective measurement of constructs and statistical testing of the proposed hypotheses. The research adopts an explanatory design to identify causal relationships among variables and to test the mediating role of financial inclusion using Structural Equation Modeling–Partial Least Squares (SEM-PLS 3). Data were collected through a cross-sectional survey method, in which information was gathered at a single point in time from micro business actors, a design considered suitable for capturing their perceptions and experiences regarding fintech usage and business sustainability within the evolving digital economic environment.

3.2 Population and Sample

The population of this research consists of micro business owners in Indonesia who have utilized financial technology services such as digital payments, mobile banking, or online lending platforms, where micro businesses are defined according to national criteria emphasizing small-scale operations, limited capital, and independent ownership. This study applies purposive sampling to ensure that selected respondents meet criteria relevant to the research objectives, namely actively managing a micro business, having experience using fintech services in business transactions, and operating the business for at least one year to ensure adequate business experience. A total of 150 respondents were successfully collected, which fulfills the minimum sample size requirement for Structural Equation Modeling–Partial Least Squares (SEM-PLS) analysis, considering the complexity of the structural model employed in this study.

3.3 Data Collection Techniques

Primary data were collected through a structured questionnaire distributed both online and offline to micro business actors, using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to capture respondents' perceptions of fintech implementation, financial inclusion, and business sustainability. The measurement items were adapted from prior empirical studies and adjusted to reflect the Indonesian micro business context, and prior to full-scale distribution, the instrument underwent a pilot test to ensure clarity, validity, and reliability. Ethical considerations were upheld throughout the data collection process by maintaining respondent anonymity and ensuring voluntary participation.

3.4 Research Variables and Measurement

This study examines three main variables, namely financial technology implementation as the independent variable, financial inclusion as the mediating variable, and micro business sustainability as the dependent variable. Financial technology implementation refers to the extent to which micro businesses utilize digital financial services in their operations, measured through indicators such as perceived usefulness, transaction efficiency, accessibility, and digital financial management practices. Financial inclusion represents the degree to which micro business actors can access and use formal financial services, assessed through access to credit, digital payment usage, savings facilities, and financial service affordability, while micro business sustainability reflects the ability of enterprises to maintain long-term performance and resilience, captured through indicators such as financial stability, business growth, adaptability, and operational continuity. All constructs in this study were modeled as reflective variables and measured using multiple indicators to represent the multidimensional characteristics of each concept.

3.5 Data Analysis Technique

Data analysis in this study was conducted using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with the assistance of SmartPLS 3 software, as this method is appropriate for exploratory and predictive research models involving relatively small sample sizes and complex mediation relationships. The analytical procedure consisted of two main stages, namely evaluation of the measurement model (outer model) and the structural model (inner model), where the outer model assessment included tests of convergent validity, discriminant validity, and construct reliability using criteria such as factor loadings, Average Variance Extracted (AVE), Composite Reliability, and Cronbach's Alpha. The inner model evaluation examined path coefficients, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and hypothesis testing through bootstrapping procedures, while the mediating role of financial inclusion was analyzed by assessing both direct and indirect effects between fintech implementation and business sustainability. Statistical significance was determined using a t-statistic threshold greater than 1.96 and a

p-value less than 0.05, indicating empirical support for the proposed relationships, and this analytical approach is expected to provide robust insights into how fintech adoption and financial inclusion contribute to the sustainability of micro businesses in Indonesia.

4. RESULTS AND DISCUSSION

4.1 Respondent Profile

This study involved 150 micro business actors in Indonesia who had experience using financial technology in their business operations. The respondent profile provides an overview of demographic characteristics and business conditions, which are important to understand the context of fintech adoption and sustainability among micro enterprises.

Table 1. Respondent Demographic Characteristics

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	66	44.0
	Female	84	56.0
Age	< 25 years	18	12.0
	26–30 years	42	28.0
	31–40 years	54	36.0
	> 40 years	36	24.0
Education Level	Junior High School	21	14.0
	Senior High School	78	52.0
	Diploma/Bachelor	51	34.0
Business Age	< 2 years	27	18.0
	2–5 years	72	48.0
	> 5 years	51	34.0
Business Sector	Culinary	63	42.0
	Retail Trade	39	26.0
	Services	33	22.0
	Others	15	10.0
Fintech Usage Type	Digital Payments/E-Wallet	102	68.0
	Mobile Banking	84	56.0
	Online Lending/P2P	45	30.0

The demographic profile of respondents indicates that the sample is dominated by female micro-entrepreneurs (56%), suggesting a significant participation of women in fintech-based micro business activities, particularly within Indonesia's digital economic landscape. Most respondents are in the productive age range of 31–40 years (36%), followed by 26–30 years (28%), reflecting a relatively mature group of business actors who are likely to possess sufficient entrepreneurial experience while remaining adaptable to technological innovation. In terms of education, the majority hold a senior high school background (52%), which highlights the importance of accessible fintech platforms that accommodate varying levels of financial literacy. Business age is largely concentrated within the 2–5 year category (48%), indicating that many enterprises are in a growth phase where digital financial tools may play a critical role in scaling operations and maintaining stability. The culinary sector dominates the sample (42%), consistent with the strong presence of micro culinary enterprises in Indonesia's informal economy, while digital payments or e-wallets emerge as the most widely used fintech service (68%), followed by mobile banking (56%) and online lending (30%).

4.2 Measurement Model Evaluation (Outer Model)

The evaluation of the measurement model (outer model) was conducted to ensure that all constructs in this study meet the requirements of validity and reliability before

proceeding to the structural model analysis. The assessment included tests of convergent validity, discriminant validity, and construct reliability using SmartPLS 3. The constructs

analyzed consisted of Financial Technology Implementation (FT), Financial Inclusion (FI), and Business Sustainability (BS), each measured using reflective indicators.

Table 2. Outer Model

Construct	Item	Loading	Cronbach's Alpha	Composite Reliability	AVE
Financial Technology Implementation (FT)	FT1	0.821	0.876	0.903	0.612
	FT2	0.864			
	FT3	0.792			
	FT4	0.721			
	FT5	0.756			
Financial Inclusion (FI)	FI1	0.889	0.894	0.917	0.645
	FI2	0.845			
	FI3	0.812			
	FI4	0.734			
Business Sustainability (BS)	BS1	0.852	0.861	0.895	0.598
	BS2	0.808			
	BS3	0.764			
	BS4	0.708			
	BS5	0.733			

The outer loading results demonstrate that all indicators meet the recommended threshold above 0.70, indicating strong convergent validity across the three constructs. Financial Technology Implementation shows loading values ranging from 0.721 to 0.864, supported by high reliability levels with Cronbach's Alpha of 0.876 and Composite Reliability of 0.903, while the AVE value of 0.612 confirms that the construct explains more than half of the variance of its indicators. Similarly, Financial Inclusion exhibits very strong indicator contributions, with loadings between 0.734 and 0.889, alongside excellent reliability (Cronbach's Alpha = 0.894; Composite

Reliability = 0.917) and an AVE of 0.645, suggesting robust measurement consistency. Business Sustainability also demonstrates acceptable convergent validity, with loadings from 0.708 to 0.852, Composite Reliability of 0.895, and AVE of 0.598, indicating that the indicators adequately capture the sustainability construct.

Discriminant validity was assessed using the Fornell–Larcker criterion, where the square root of AVE for each construct must be higher than its correlations with other constructs. The results indicate that each construct is empirically distinct from the others.

Table 3. Fornell–Larcker Criterion

Construct	FT	FI	BS
Financial Technology Implementation (FT)	0.782		
Financial Inclusion (FI)	0.680	0.803	
Business Sustainability (BS)	0.619	0.701	0.773

The Fornell–Larcker criterion results indicate that the measurement model has achieved satisfactory discriminant validity, as the square root of the Average Variance Extracted (AVE) for each construct is higher than its correlations with other constructs.

Financial Technology Implementation shows a diagonal value of 0.782, which exceeds its correlations with Financial Inclusion (0.680) and Business Sustainability (0.619), while Financial Inclusion demonstrates a strong diagonal value of 0.803 that is greater than its

correlation with Business Sustainability (0.701). Similarly, Business Sustainability presents a diagonal value of 0.773, confirming that the construct shares more variance with its own indicators than with other latent variables. These findings suggest that each construct is empirically distinct and measures different conceptual dimensions, thereby supporting the validity of the structural model and ensuring that subsequent hypothesis testing is not affected by multicollinearity or construct overlap.

4.3 Structural Model Evaluation (Inner Model)

After confirming the validity and reliability of the measurement model, the next stage involved evaluating the structural model (inner model) using SEM-PLS 3 by examining the coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and overall model fit indicators. The R^2 value for Financial Inclusion (FI) was 0.462, indicating that Financial Technology Implementation (FT) explains 46.2% of the variance in financial inclusion and reflecting a moderate level of explanatory power, while the R^2 value for Business Sustainability (BS) reached 0.538, suggesting that fintech implementation and financial inclusion together account for 53.8% of sustainability outcomes, which falls within the moderate to strong category and demonstrates the robustness of the proposed model. Furthermore, predictive relevance assessed through the blindfolding procedure produced Q^2 values of 0.291 for FI and 0.347 for BS, both exceeding zero, confirming that the model possesses adequate predictive capability and can effectively explain observed data patterns, thereby supporting the structural relationships tested in this study.

Table 4. Effect Size (f^2) Results

Relationship	f^2 Value	Effect Size Interpretation
FT → FI	0.861	Large
FT → BS	0.158	Small–Moderate
FI → BS	0.329	Moderate

The effect size (f^2) results provide further insight into the relative contribution of each structural relationship within the model. The relationship between Financial Technology Implementation and Financial Inclusion (FT → FI) shows a very large effect size (f^2 = 0.861), indicating that fintech adoption plays a substantial role in shaping the level of financial inclusion among micro businesses. In contrast, the direct effect of Financial Technology Implementation on Business Sustainability (FT → BS) demonstrates a small to moderate effect (f^2 = 0.158), suggesting that while fintech contributes to sustainability, its influence may be partially transmitted through other mechanisms. Meanwhile, Financial Inclusion exhibits a moderate effect on Business Sustainability (FI → BS) with an f^2 value of 0.329, highlighting its significant role as a strategic pathway through which improved access to financial services enhances long-term business performance.

Hypothesis testing was conducted using the bootstrapping procedure with 5,000 resamples to determine the significance of path relationships among variables. A hypothesis is considered supported when the t-statistic exceeds 1.96 and the p-value is less than 0.05.

Table 5. Hypothesis Testing

Hypothesis	Relationship	Path Coefficient (β)	t-Statistic	p-Value	Result
H1	FT → FI	0.680	11.432	0.000	Supported
H2	FT → BS	0.312	3.245	0.001	Supported
H3	FI → BS	0.451	5.987	0.000	Supported

The hypothesis testing results indicate that all proposed relationships in the structural model are statistically significant and supported by empirical evidence. Financial Technology Implementation has a strong positive effect on Financial Inclusion (β = 0.680, t = 11.432, p < 0.001), confirming that greater utilization of digital financial services substantially enhances access to formal financial systems among micro business actors. Furthermore, fintech implementation also shows a significant direct influence on Business Sustainability (β = 0.312, t = 3.245, p = 0.001), suggesting that digital financial adoption contributes to improved long-term business performance and resilience. Financial Inclusion demonstrates a stronger positive effect on Business Sustainability (β = 0.451, t = 5.987, p < 0.001), indicating that access to inclusive financial services plays a crucial role in strengthening sustainability outcomes.

To examine the mediating role of Financial Inclusion, indirect effects were analyzed through bootstrapping. The results show that the indirect relationship between Financial Technology Implementation and Business Sustainability through Financial Inclusion is statistically significant.

Table 6. Indirect Effect (Mediation Analysis)

Relationship	Indirect Effect (β)	t-Statistic	p-Value	Mediation Type
FT → FI → BS	0.307	4.874	0.000	Partial Mediation

The indirect effect value (β = 0.307) indicates that Financial Inclusion partially mediates the relationship between fintech implementation and business sustainability. Since both the direct and indirect effects are significant, the mediation can be classified as partial mediation, meaning that fintech influences sustainability both directly and indirectly through increased financial inclusion.

4.4 Discussion

The findings of this study provide strong empirical evidence that financial technology implementation significantly contributes to the sustainability of micro businesses in Indonesia, both directly and indirectly through financial inclusion. The strong relationship between fintech implementation and financial inclusion demonstrates that digital financial platforms play a crucial role in expanding access to formal financial services among micro entrepreneurs by reducing structural barriers such as geographic limitations, administrative complexity, and high transaction costs. The high path coefficient (β = 0.680) indicates that micro business actors who actively utilize fintech services are more likely to experience improved financial accessibility, including digital payments, savings mechanisms, and alternative financing opportunities, thereby supporting the broader digital transformation perspective [3], [20].

The direct effect of fintech implementation on business sustainability (β = 0.312) highlights the operational advantages gained from adopting digital financial tools, such as faster transaction processing, improved financial monitoring, and expanded market reach through digital ecosystems. These benefits contribute to enhanced business performance and resilience, especially within dynamic and uncertain economic environments. However, the moderate magnitude of the direct relationship suggests that fintech adoption alone is not sufficient to guarantee long-term sustainability, indicating that technological innovation must be supported by broader institutional and financial structures to generate sustainable outcomes for micro enterprises.

Financial inclusion emerged as a key determinant of business sustainability (β = 0.451), reinforcing the argument that access to financial resources functions as a strategic driver of long-term business viability. Micro businesses that are financially included tend to demonstrate stronger cash flow management, greater investment capacity, and higher financial stability, which align

with the resource-based view that emphasizes financial capital as a critical organizational resource [21], [22]. The mediation analysis further reveals that financial inclusion partially mediates the relationship between fintech implementation and sustainability (β = 0.307), indicating that fintech's impact becomes more meaningful when it enhances inclusive access to financial services and strengthens entrepreneurs' capacity to manage risks and adapt to market changes.

From a practical perspective, these findings highlight the importance of developing inclusive digital financial ecosystems that integrate technological infrastructure with financial literacy initiatives and equitable service access. Policymakers and fintech providers are encouraged to design programs that enhance digital skills, financial management capabilities, and regulatory support to ensure that micro business actors can fully leverage fintech adoption. Overall, this study contributes to the literature on digital finance and sustainable entrepreneurship by demonstrating that fintech serves as a catalyst for sustainable micro business development when supported by inclusive financial systems, offering valuable insights into how technological innovation can foster resilient economic growth within Indonesia's micro business sector.

5. CONCLUSION

This study concludes that financial technology implementation plays a significant role in enhancing the sustainability of micro businesses in Indonesia. The empirical results demonstrate that fintech adoption not only improves operational efficiency and financial management but also strengthens business resilience through increased financial inclusion. Financial inclusion was found to partially mediate the relationship between fintech implementation and sustainability, indicating that access to formal financial services is a crucial pathway through which digital innovation generates long-term business benefits. These findings highlight the importance of integrating technological advancement with inclusive financial policies to support sustainable micro-enterprise growth. Future initiatives should focus on improving digital literacy, expanding access to financial services, and strengthening collaborative frameworks between government institutions, fintech providers, and micro business actors to foster a more inclusive and sustainable digital economy

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