

Buffering MSMEs Against Economic Shocks: The Synergistic Role of Tax Incentives, Financial Digitalization, and Operational Efficiency in Indonesia

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ABSTRACT

This study aims to analyze the effect of tax incentives, financial digitalization, and operational cost efficiency on the resilience of Micro, Small, and Medium Enterprises (MSMEs) in Indonesia, while also testing the mediating role of financial digitalization in the relationship between tax incentives and MSME resilience. Using balanced panel data from 34 Indonesian provinces during the period 2017-2024 (272 observations), this study applies the Random Effect Model (REM) for the first path equation and the Fixed Effect Model (FEM) for the second path equation based on the results of the Chow Test and the Hausman Test, supplemented by the Sobel Test to test the mediation effect. The results show that partially, tax incentives have no significant effect on financial digitalization (coefficient = 0.2502; $p = 0.6328$), financial digitalization has a significant negative effect on MSME resilience (coefficient = -0.0045; $p = 0.0000$), and operational cost efficiency has a positive and strong significant effect on MSME resilience (coefficient = 0.3527; $p = 0.0000$). Simultaneously, all three variables significantly influenced MSME resilience ($F = 21.0829$; $p = 0.0000$). The mediating effect of financial digitalization was not proven significant ($Z = -0.4752$; $p = 0.6346$), because the path from tax incentives to financial digitalization was not significant even though the path from financial digitalization to MSME resilience was significant. The R-square (within) value of 21.21% in the second path equation indicates that this model has quite good explanatory power regarding the variation in MSME resilience over time within one province. The findings regarding the negative impact of financial digitalization emphasize the need for a more cautious policy approach, which not only encourages the adoption of financial technology alone, but also ensures the readiness of managerial capabilities and financial literacy of MSMEs so that the benefits of digitalization can truly be converted into business resilience.

Keywords: Tax Incentives; Financial Digitalization; Operational Cost Efficiency; MSME Resilience; Panel Data

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INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) play a strategic role in supporting the Indonesian economy through their contribution to Gross Domestic Product (GDP), employment, and strengthening community economic activity. This substantial contribution makes the sustainability of MSMEs a crucial aspect in maintaining national economic stability. However, MSMEs still face various structural challenges, such as limited access to financing, weak financial governance, low digital technology integration, and pressures on operational efficiency. These obstacles can reduce a business's ability to maintain operations in the face of market uncertainty and

economic shocks. Therefore, strengthening MSME resilience requires attention to external and internal factors that support a business's ability to survive, adapt, and recover from stress (HS Lee et al., 2025).

One of the fundamental problems hampering the development of MSMEs is the accountability gap, characterized by limited standardized financial reporting and weak internal control systems. This situation can increase information asymmetry between business actors and financial institutions, making it difficult for MSMEs to obtain formal financing due to their perceived high-risk profile (Adile et al., 2025). Furthermore, limited access to modern technology and integrated digital systems can hinder increased transparency, efficiency, and the quality of managerial decision-making (Ustymenko, 2024). These issues demonstrate that the sustainability of MSMEs depends not only on the availability of capital but also on the ability to manage resources, improve governance, and utilize technology effectively. In an increasingly dynamic business environment, these capabilities are crucial for building business resilience.

The resilience of MSMEs is further tested when macroeconomic shocks increase market uncertainty, suppress purchasing power, and disrupt cash flow. In such situations, business digitalization has the potential to act as a risk mitigation mechanism by increasing operational efficiency and flexibility (Amri et al., 2023). The synergy between mastery of innovative technology and an entrepreneurial orientation can also strengthen business actors' adaptive capabilities in responding to changes in the business environment (Hidayat et al., 2025). Conversely, delays in adopting technology can hinder MSMEs' competitiveness and ability to adapt to market needs. Therefore, developing entrepreneurial technology resilience is relevant to support businesses' ability to face disruption and maintain long-term sustainability (Wahdiniwati et al., 2025).

In addition to internal capabilities, fiscal policy is a form of external support that has the potential to strengthen the resilience of MSMEs. Tax incentives can reduce the burden of fiscal obligations, maintain liquidity, and provide financial space for businesses to maintain operations and finance productive activities. The implementation of tax relief in strategic areas has been reported to provide financial relief for creative industry players while supporting compliance and regulatory certainty (Kaharuddin et al., 2024). Fiscal support also has the potential to help develop new business networks and maintain local employment (Vaquero García et al., 2020). However, the benefits of tax incentives depend on policy design, ease of access, recipient administrative capacity, and consistency of implementation. Therefore, the relationship between tax incentives and MSME resilience needs to be analyzed by considering other factors that determine a business's ability to withstand economic pressures.

Previous research has shown that various tax incentive schemes are related to corporate liquidity, investment, profitability, and productivity. Pre-profit tax reductions can provide cash flow relief for companies facing funding constraints, allowing available resources to be reallocated to maintain operations and finance productive investments (Ni et al., 2025). Tax rate reductions and exemptions from certain obligations have also been reported to be associated with ease of doing business and the sustainability of

small businesses (Ogundajo et al., 2026). Incentives for retained earnings and investment can support profitability and strengthen internal capital (Picas et al., 2021), while tax incentives also have the potential to increase labor productivity and fixed asset growth (Hosono et al., 2023). On the other hand, tax burden reductions are considered to have a lower risk of market distortion and rent *-seeking behavior* than direct fiscal expenditure assistance in certain contexts, including for MSMEs in disadvantaged regions (Cuong & Trang, 2025). However, increased liquidity and profitability do not automatically guarantee resilience. Therefore, empirical testing is needed to understand the extent to which tax incentives are related to the ability of MSMEs to survive, adapt, and recover from business disruptions.

The effectiveness of fiscal policy is also influenced by equitable and consistent implementation. Unequal application of economic promotion regulations and tax policies in developing markets can limit the welfare of business actors and hinder the achievement of inclusive and sustainable economic growth (Quispe-Espinoza et al., 2025). In the context of regional development, strategies to strengthen MSMEs need to consider local potential through digitalization training, simplified tax administration, and targeted distribution of financial stimulus (Syamsari et al., 2022). This approach is crucial to ensure that fiscal support can be utilized effectively and in accordance with business needs. Therefore, tax incentives need to be understood as part of a broader support ecosystem, the effectiveness of which is potentially influenced by managerial readiness, technology utilization, and the ability to control operational costs.

Financial digitalization is another factor that has the potential to strengthen the operational efficiency and flexibility of MSMEs. The use of financial technology (*fintech*), including digital payments, e-wallets, and cloud-based accounting applications, can help reduce recording errors, reduce transaction costs, improve working capital management, and accelerate cash flow turnover (Munongo & Pooe, 2025). The integration of information technology into core business strategies has also been reported to be associated with improved MSME performance (Probohudono et al., 2025). Digital transformation is increasingly becoming a necessity for micro-enterprises and financial support institutions in responding to changes in the competitive environment (Singh et al., 2026). However, the success of this transformation is determined not only by the availability of technology but also by organizational readiness and consistent implementation in daily operational activities (Supramono et al., 2024). The use of digital finance (*e-finance*) supported by the digital competence of business owners also has the potential to improve the quality of financial reporting and MSME performance (Siska et al., 2025).

The role of financial digitalization is increasingly important as MSMEs face a financing gap *and* limited access to formal financial services. Digital financial inclusion has the potential to reduce geographic and administrative barriers, expand access to working capital, and improve the quality of financial decision-making. Inclusive use of fintech has been reported to be associated with improved financial decision-making quality and reduced operational cost inefficiencies for MSMEs (Choiruddin et al., 2025). Furthermore, digital financial inclusion can act as a mechanism linking government support with improved business performance, enabling more optimal utilization of the financial and digital facilities provided (Tandilino et al., 2025). However, the benefits of

digitalization have the potential to be unevenly distributed if business actors face limitations in competency, infrastructure, and financing. Therefore, digitalization needs to be understood not only as technology adoption, but also as part of an organization's ability to manage resources and adapt business strategies.

In addition to tax incentives and financial digitalization, operational cost efficiency is a crucial factor in maintaining business resilience. Systematic cost control enables MSMEs to identify waste, maintain productivity, and optimize the use of limited resources. Implementing a sustainable production performance measurement system can help detect operational inefficiencies early (Radyanto & Hayati, 2020). Modernizing accounting systems and digital automation also has the potential to reduce unproductive spending (Singh et al., 2026). Furthermore, a relatively lean and flexible organizational structure allows MSMEs to respond quickly to market changes. Combining organizational flexibility with the use of digital analytics has the potential to strengthen a business's ability to withstand shocks and maintain long-term growth (Ssewagudde Jjagwe et al., 2026). Thus, operational efficiency is not only related to cost reduction but also to the ability to maintain business functions in the face of resource constraints and external pressures.

Business resilience describes an organization's ability to withstand, adapt, and recover from pressures that threaten operational continuity. This capability can be developed through a combination of internal competencies, adaptive leadership, measured risk-taking, and business management flexibility. When resilience is supported by an effective cost control system, MSMEs have the potential to be more resilient in the face of economic disruption (Fiernaningsih et al., 2024). The economic uncertainty following the COVID-19 pandemic also emphasizes the importance of risk management and long-term sustainability strategies, not just achieving short-term profits (Satpathy et al., 2025). Furthermore, financial literacy and entrepreneurial competency of business owners play a role in identifying risks, managing working capital, and formulating contingency strategies. Adaptive leadership can enhance entrepreneurs' ability to leverage external support and disciplined operational expenditure control (Fatoki, 2018). Digital financial literacy and prudent financial behavior also have the potential to support investment decisions, cost management, and capital allocation for business sustainability (Purnamasari et al., 2025). The synergy between external support and optimization of internal operational performance is therefore an important aspect in building a resilient and competitive MSME ecosystem (Maryanti et al., 2026).

In the Indonesian context, the urgency of strengthening MSME resilience is related to the sector's significant contribution to the economy and the concomitant changes in policy and technology. Based on data referenced from the Ministry of MSMEs' Single Data Information System for MSMEs as of December 31, 2024, there were 30,178,617 MSME units recorded in 38 provinces. The source text also mentions an additional 29,341,033 units based on the 2023 BPS Agricultural Census. In aggregate, MSMEs reportedly contribute 61.9% to GDP, absorb approximately 97% of the workforce or more than 117 million workers, and collect 60.4% of total national investment (Kemenkop UKM, 2024; Coordinating Ministry for Economic Affairs, 2025). These data demonstrate the strategic position of MSMEs in the national economy.

However, figures on the number of business units from different sources need to be examined based on their definition, scope, and potential overlap before being combined into a single estimate.

From a fiscal policy perspective, the sustainability of tax incentives is an important context in understanding government support for MSMEs. On December 16, 2024, the government announced the extension of the 0.5% Final Income Tax policy for MSMEs with annual turnover of up to IDR 4.8 billion because some businesses were deemed unprepared to switch to the regular scheme (Coordinating Ministry for Economic Affairs, 2024). The source text further refers to Government Regulation Number 20 of 2026, dated April 22, 2026, which is said to re-regulate the tariff facilities, including for individual taxpayers and individual corporations, as well as income tax exemptions for MSMEs with annual turnover below IDR 500 million (Directorate General of Taxes, 2026). This policy is relevant to study because fiscal incentives have the potential to influence liquidity, investment decisions, and the adaptive capacity of businesses. However, the status, scope, and provisions of these regulations must be verified against official documents before being used as the basis for research analysis.

At the same time, the digitalization of MSMEs in Indonesia still faces gaps in the scope and quality of implementation. Data cited in the source text indicates that as of July 2024, only 24.9% of the 64.2 million MSMEs were connected to the digital ecosystem. The government's target of integrating 30 million MSMEs into the digital ecosystem by 2024 is also said to have not been achieved, with realization by 2023 reaching around 22 million units (Coordinating Ministry for Economic Affairs, 2024; Suara Merdeka, 2024). This gap indicates that technology availability is not necessarily followed by comprehensive utilization in business management. Differences in digital access and readiness between urban and rural areas also have the potential to create competitiveness gaps and limit the inclusiveness of digital transformation (Bindeeba et al., 2025). Furthermore, BPS data referenced in the source text states that the contribution of MSMEs to GDP decreased from 61% to 37.3% during the pandemic, while 83.8% of businesses reported digitalization as an adaptive response (BPS, 2024). These figures need to be verified based on the indicator definitions, periods, and statistical sources used to provide a strong empirical basis for the argument.

This phenomenon highlights three interrelated issues: the effectiveness of tax incentives, the quality of digital transformation, and the efficiency of operational costs. In terms of taxation, limited administrative and accounting capacity can hinder the utilization of incentives and make it difficult for businesses to fulfill regular reporting obligations. The source text also highlights the potential for the practice of "*bunching*," which involves adjusting turnover around tax thresholds, and "*firm splitting*," which involves splitting a business entity to retain policy benefits. Claims regarding these practices need to be supported by empirical sources specifically examining the tax behavior of MSMEs. In terms of digitalization, technology adoption without adequate competency, infrastructure, and financing can limit its benefits to business resilience. Meanwhile, pressures on production costs and supply chains increase the need for a more systematic cost control system. These three issues highlight the importance of an integrated approach to understanding MSME resilience in Indonesia.

Although the literature has discussed fiscal policy, digitalization, and operational efficiency, there is still room to integrate these three factors into a single empirical framework focused on MSME resilience. Previous studies cited, such as Amri et al. (2023), Hidayat et al. (2025), and Kaharuddin et al. (2024), provide a basis for understanding the role of digitalization and fiscal policy, but have not simultaneously explained the contribution of these three factors to business resilience within the proposed research framework. Studies on MSME financial management transformation referenced in the source text also indicate room to link digital literacy with resilience dimensions (Sagala & Őri, 2026). Meanwhile, research on MSME performance tends to emphasize short-term financial outcomes rather than dynamic adaptation and recovery capacity (Probohudono et al., 2025; Siska et al., 2025). Thus, *the research gap* in this study lies in the need to simultaneously examine the relationship between tax incentives, financial digitalization, and operational efficiency with MSME resilience.

From a theoretical perspective, this study proposes the integration of *Dynamic Capabilities Theory*, *Institutional Theory*, and *Resilience Theory* to explain the formation of business resilience. *Dynamic Capabilities Theory* explains an organization's ability to adapt and configure resources in response to environmental changes (Teece et al., 1997). *Institutional Theory* can be used to understand how policies and regulatory environments shape the opportunities and constraints for MSMEs, while *Resilience Theory* provides a foundation for explaining a business's ability to survive, adapt, and recover from disruptions. The literature on tax incentives has identified their link to corporate profitability and investment (Hosono et al., 2023; Ogundajo et al., 2026; Picas et al., 2021). However, the relationship between these fiscal benefits, the use of digital technology, operational efficiency, and the formation of resilience still requires a more integrated empirical explanation. The integration of these three theoretical perspectives is expected to broaden understanding of how institutional support and internal capabilities relate to MSME resilience.

Research gaps also relate to geographic and institutional contexts. Several studies on digitalization, financial management, and business transformation referenced in the source texts were conducted in various developing country contexts (Jjagwe et al., 2026; Munongo & Pooe, 2025; Singh et al., 2026). Findings from these contexts cannot be directly generalized to Indonesia, which has formal and informal economic structures, turnover-based tax policies, and a digital divide between regions. Research on regional policies has examined aspects of fiscal support for businesses (Kaharuddin et al., 2024; Syamsari et al., 2022), while research on the digital transformation of MSMEs in Indonesia has discussed technology adaptation in specific business contexts (Supramono et al., 2024). However, simultaneous testing of the relationship between tax incentives, financial digitalization, and operational cost efficiency with MSME resilience in the Indonesian context still needs to be developed. This contextual gap provides the basis for considering the characteristics of national business policies and ecosystems.

Based on these gaps, this research has academic and practical urgency, particularly in the context of changes in tax policy, the national development digitalization agenda, and pressures for economic efficiency. The use of secondary data from various institutional sources, such as BPS, the Directorate General of Taxes, Bank

Indonesia, and the Financial Services Authority, has the potential to provide a broader analytical basis, as long as the indicators used are available, consistent, and comparable. Academically, this research seeks to develop an integrative framework that connects *Dynamic Capabilities Theory*, *Institutional Theory*, and *Resilience Theory*, and examines the relationship between tax incentives, financial digitalization, and operational cost efficiency with MSME resilience. Practically, the research results are expected to provide input for the Ministry of Finance, the Ministry of MSMEs, the Directorate General of Taxes, local governments, and financial institutions in designing fiscal policies and digital mentoring programs that suit the needs of business actors.

Thus, this study aims to analyze the relationship between tax incentives, financial digitalization, and operational cost efficiency with the resilience of MSMEs in Indonesia. This study places these three factors within a single analytical framework to understand their relative contributions and interrelationships with businesses' ability to withstand pressure, adapt, and maintain operational sustainability. The proposed novelty lies in the integration of theoretical perspectives, the simultaneous testing of these three explanatory factors, and the context of Indonesia's fiscal policy and digital transformation in the analysis of MSME resilience. The results are expected to enrich the literature on business resilience in developing countries and provide an empirical basis for developing more adaptive, inclusive, and sustainable policies.

RESEARCH METHODS

Research Design

This study uses a quantitative approach with an associative-explanatory design to examine the effect of tax incentives and operational cost efficiency on MSME resilience, and to analyze the mediating role of financial digitalization. The study uses panel data that combines *cross-sectional* and *time-series data across MSME units*. This approach allows for analysis of changes in business conditions between periods while controlling for heterogeneity between MSME units. The use of panel data regression and mediation analysis is supported by the application of similar methods in economics and business research, including research by Kim and Shim (2023) and the study of MSME digitalization and resilience by Probohudono et al. (2025).

Population and Sample

The research population was registered MSMEs, actively operating in the research area, and meeting the criteria for utilizing tax incentive facilities based on Government Regulation Number 23 of 2018 and/or applicable provisions. The sample was selected using a *purposive sampling technique* with the following criteria: (1) MSMEs have been operating for at least two years; (2) have a Taxpayer Identification Number (NPWP) and are recorded as utilizing tax incentives; (3) use at least one digital financial service; and (4) are willing to provide financial and operational data periodically. The number of panel observations was determined based on the number of MSME units and the observation period ($N = n \times t$), with an initial design of at least 30 MSMEs observed for 3–4 periods. The final number of samples and observation period were adjusted based on the availability and completeness of the data.

Types, Sources and Techniques of Data Collection

The study used quantitative data sourced from primary and secondary sources. Primary data were obtained through structured questionnaires administered to MSMEs during each observation period. Secondary data included financial reports, tax incentive utilization documents, digital transaction records, and administrative and statistical data from relevant agencies, such as the Ministry of Cooperatives and SMEs, the Directorate General of Taxes, the Financial Services Authority, and the Central Statistics Agency.

Data collection was conducted through questionnaires, documentation, and literature review. Each MSME was assigned a unique identification code to link data across periods. Prior to primary data collection, the instrument was piloted on MSMEs outside the sample. Next, the data was organized by unit and observation period, checked for completeness and consistency, and validated before analysis.

Variable Measurement

The study involved tax incentives (X1) and operational cost efficiency (X3) as independent variables, financial digitalization (M) as a mediator, and MSME resilience (Y) as a dependent variable. Perceptual indicators were measured using a 1–5 Likert scale, while financial indicators were measured using ratio data.

Tax incentives are measured based on understanding regulations, facility utilization, impact on liquidity, and their influence on investment decisions. Financial digitalization is measured through the use of digital banking services, digital payment transactions, fintech-based financing, and the use of financial management applications. Operational expense efficiency is measured through cost control, technology utilization, the effectiveness of fixed and variable cost control, and their impact on profitability. Financial measurements are complemented by the operating expense ratio. MSME resilience is measured based on their ability to maintain revenue, maintain operational continuity, adapt to change, and access recovery resources. Supporting data in the form of actual tax savings, digital transaction records, and revenue growth are used to strengthen the variable measurements.

Validity and Reliability Test

Instrument validity was tested using *Pearson product-moment correlation*. An item was declared valid if the calculated r-value exceeded the table r-value at a 5% significance level. Reliability was tested using Cronbach's Alpha coefficient, with an α value ≥ 0.70 as the acceptance criterion. Instrument checks were conducted prior to primary data collection to ensure consistency of measurement across variables and observation periods.

Data Analysis Techniques

Data were analyzed using EViews and/or Stata software through descriptive statistics, panel data regression model selection, assumption testing, model estimation, mediation analysis, and hypothesis testing. Descriptive statistics included mean, minimum, maximum, and standard deviation values. The panel models considered were the *Common Effect Model* (CEM), *Fixed Effect Model* (FEM), and *Random Effect Model*

(REM). Model selection was performed using the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test.

The selected model is then examined using tests for normality, multicollinearity, heteroscedasticity, and autocorrelation according to the model's characteristics. Estimation is performed using the following three equations:

$$\begin{aligned} [M_{it}] &= \alpha_0 + \alpha_1 X1_{it} + \mu_i + \lambda_t + \varepsilon_{it} \\ [Y_{it}] &= \beta_0 + \beta_1 X1_{it} + \beta_2 M_{it} + \beta_3 X3_{it} + \mu_i + \lambda_t + \varepsilon_{it} \\ [Y_{it}] &= \gamma_0 + \gamma_1 X1_{it} + \gamma_2 X3_{it} + \mu_i + \lambda_t + \varepsilon_{it} \end{aligned}$$

Description: (M) is financial digitalization; (Y) is MSME resilience; (X1) is tax incentives; (X3) is operational burden efficiency; (μ_i) is the individual MSME effect; (λ_t) is the time effect; and (ε_{it}) is the error. The first equation tests the path of influence of tax incentives on financial digitalization, the second equation tests the direct effect and mediation path on resilience, while the third equation tests the total effect of tax incentives on resilience by controlling for operational burden efficiency.

Mediation Analysis and Hypothesis Testing

The role of financial digitalization as a mediator was tested using the Baron and Kenny (1986) approach, accompanied by testing for indirect effects using the Sobel test and/or *bootstrapping*. The indirect effect was calculated by multiplying the path coefficients (a) and (b) (*indirect effect* = (a × b)). The significance of the indirect effect was evaluated based on the test results. Mediation was considered partial if both the direct and indirect effects were significant, full if the indirect effect was significant while the direct effect was insignificant, and absent if the indirect effect was insignificant.

The hypotheses were tested using a t-test for partial effects, an F-test for simultaneous effects, and the coefficient of determination (R^2) to assess the model's ability to explain variations in MSME resilience. The significance level was set at 5%. A sensitivity analysis was also conducted using mediator variables from the previous period (*lag*) to examine the robustness of the results to the possible reciprocal relationship between financial digitalization and MSME resilience.

Data Limitations and Quality Control

To mitigate potential self-reporting bias, questionnaire data were supplemented with financial documents and administrative data. The risk of loss of sample units between periods was controlled through regular monitoring and recording of reasons for respondent dropout. Sensitivity checks, including the use of lagged mediator variables, were considered to assess the possibility of endogeneity. Because the sample was selected purposively, the generalizability of the results is limited to the sample context and the research area under study.

This approach is also in line with studies on the relationship between tax incentives and tax digitalization (Essuman et al., 2020; Arham & Hatu, 2020), as well as

research discussing the role of competence and digitalization in MSME resilience (Kadek et al., n.d.; Probohudono et al., 2025). Therefore, a combination of panel data regression and mediation analysis was used to examine the relationship between variables, taking into account variations between MSME units and over time.

RESEARCH RESULT

Description of Research Data

This study uses balanced panel data from 34 provinces in Indonesia during 2017–2024, with a total of 272 observations. The research variables include MSME resilience (Y), tax incentives (X1), financial digitalization (X2), and operational cost efficiency (X3). Variables Y, X1, and X3 are transformed using natural logarithms (LN), while X2 remains in percentage form.

Table 1. Descriptive Statistics of Research Variables

Variables	Mean	Median	Maximum	Minimum	Std. Dev.
Y (MSME Resilience)	20,689.41	91.12	862,057.00	1,827	89,723.15
X1 (Tax Incentive, Rp)	10,875,832.00	4,796,622.00	87,451,650.00	318.69	18,337,560.00
X2 (Financial Digitalization, %)	75.64	79.66	98.18	27.33	15.35
X3 (Operational Expense Efficiency, Rp)	5,922,290.00	2,377,018.00	58,490,598.00	106,721.00	10,419,470.00
LN Y	4,0453	4,0269	6,7630	0.6027	1,1678
LN X1	15,0381	15,3833	18,2866	5,7642	2,3612
LN X3	14,7666	14,6814	17,8844	11,5780	1,1979

Source: Results of secondary data processing, 2026.

Descriptive statistics show significant variation in MSME resilience, tax incentives, and operational costs across provinces. Differences between the mean and median indicate a right-skewed distribution. Meanwhile, financial digitalization averaged 75.64%, although the range was still wide, at 27.33–98.18%. Logarithmic transformation was used to reduce the extreme values of variables Y, X1, and X3.

Selection of Panel Data Regression Model

Model selection is carried out through the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test.

Table 2. Chow Test Results

Equality	F-Statistic	df	Probability	Decision
Line 1 (X1 → X2)	3,8500	(33; 237)	0.0000	Fixed Effect
Path 2 (X1, X2, X3 → Y)	22,7617	(33; 235)	0.0000	Fixed Effect

Source: Results of panel data processing, 2026.

The probability value of both equations is 0.0000 indicating that the Common Effect model is rejected compared to the Fixed Effect.

Table 3. Hausman Test Results

Equality	Chi-Square	df	Probability	Decision
Line 1 (X1 → X2)	2,0027	1	0.1570	Random Effect
Path 2 (X1, X2, X3 → Y)	53,7235	3	0.0000	Fixed Effect

Source: Results of panel data processing, 2026.

The Hausman test shows that Random Effect is more suitable for Path 1, while Fixed Effect is chosen for Path 2.

Table 4. Results of the Lagrange Multiplier Test (Breusch–Pagan)

Equality	LM Statistics	Probability	Decision
Line 1 (X1 → X2)	58,5627	0.0000	Random Effect
Path 2 (X1, X2, X3 → Y)	353,5712	0.0000	There are individual effects; the final Fixed Effect model is based on the Hausman Test.

Source: Results of panel data processing, 2026.

Based on the three tests, the final model used was Random Effect for Path 1 and Fixed Effect with *robust standard error* clustered by province (*clustered by entity*) for Path 2.

Model Assumption Test Results

Assumption testing is carried out to evaluate the residual characteristics and relationships between variables in the model.

Table 5. Results of the Jarque–Bera Normality Test

Equality	JB Statistics	Probability	Information
Line 1	25,4224	0.0000	Residuals are not normally distributed
Line 2	28,767.6961	0.0000	Residuals are not normally distributed

Source: Results of panel data processing, 2026.

Both equations show residuals that are not normally distributed. Therefore, the inference results need to be interpreted with caution.

Table 6. Multicollinearity Test Results (VIF) Path 2

Variables	VIF	Information
LN X1 (Tax Incentive)	2,4899	There is no serious multicollinearity
X2 (Financial Digitalization)	1,0242	There is no serious multicollinearity
LN X3 (Operational Load Efficiency)	2,5201	There is no serious multicollinearity

Source: Results of panel data processing, 2026.

All VIF values are below 10, so no indication of serious multicollinearity is found in Path 2.

Table 7. Results of the Breusch–Pagan Heteroscedasticity Test

Equality	LM Statistics	Probability	Information
Line 1	5,3660	0.0205	Indicated heteroscedasticity
Line 2	2,5328	0.4694	No indication of heteroscedasticity

Source: Results of panel data processing, 2026.

Line 1 shows indications of heteroscedasticity because the probability value is below 0.05, while Line 2 does not show such indications based on this test.

Table 8. Durbin–Watson Autocorrelation Test Results

Equality	DW Value	Information
Line 1	0.9246	Indicated positive autocorrelation
Line 2	0.9255	Indicated positive autocorrelation

Source: Results of panel data processing, 2026.

The Durbin–Watson values in both equations indicate positive autocorrelation. This finding should be taken into account when interpreting the results, especially since the data structure includes repeated observations over eight years.

Panel Data Regression Estimation Results

Table 9. Final Panel Regression Estimation Results

Equality	Variables	Coefficient	Std. Error	t-Statistic	Probability
Line 1	Constant	71,8730	8,0233	8,9580	0.0000
Line 1	LN X1	0.2502	0.5232	0.4783	0.6328
Line 2	Constant (provincial fixed effects)	—	—	—	—
Line 2	LN X1	0.0172	0.0096	1,7977	0.0735
Line 2	X2	-0.0045	0.0011	-4,1934	0.0000
Line 2	LN X3	0.3527	0.0709	4,9770	0.0000

Source: Results of panel data processing, 2026.

The estimation results for Path 1 show that tax incentives have a positive coefficient of 0.2502 on financial digitalization, but it is not significant ($p = 0.6328$). In Path 2, tax incentives also have a positive coefficient of 0.0172, but it is not yet

significant at the 5% level ($p = 0.0735$). Financial digitalization has a negative and significant effect on MSME resilience ($\beta = -0.0045$; $p < 0.001$), while operational cost efficiency shows a positive and significant coefficient ($\beta = 0.3527$; $p < 0.001$).

The estimated equation obtained is:

Line 1:

$$X2_{it} = 71.8730 + 0.2502 \text{ LN}$$

Line 2:

$$\text{LN } Y_{it} = \alpha_i + 0.0172 \text{ LN } X1_{it} - 0.0045$$

Note: α_i indicates the specific fixed effects of each province.

Results of the Sobel Mediation Test

Table 10. Sobel Test Results for Mediation Effect

Component	Mark
Path coefficient a (LN X1 → X2)	0.2502
Path coefficient b (X2 → LN Y)	-0.0045
Indirect effect (a × b)	-0.001114
Sobel Standard Error	0.002344
Z-statistic	-0.4752
Probability (2-tailed)	0.6346
Direct effect (LN X1 → LN Y)	0.0172
Total impact (direct + indirect)	0.0161

Source: Results of panel data processing, 2026.

The Sobel test yielded a Z-value of -0.4752 with a probability of 0.6346, greater than 0.05. Thus, the indirect effect of tax incentives on MSME resilience through financial digitalization is insignificant. The mediation hypothesis is not supported by the data, although financial digitalization has a significant direct negative effect on MSME resilience.

Hypothesis Testing

Table 11. F-Test Results (Simultaneous)

Equality	F-Statistic	Probability	Decision
Line 1	0.2288	0.6328	The model is not significant
Line 2	21,0829	0.0000	Significant model

Source: Results of panel data processing, 2026.

Path 1 was not simultaneously significant, while Path 2 was significant ($p < 0.001$). These results indicate that tax incentives, financial digitalization, and operational cost efficiency are simultaneously significantly related to MSME resilience in Path 2.

Table 12. Results of the Determination Coefficient

Equality	R ²	Adjusted R ²
Line 1	0.0008	-0.0029
Line 2	0.2121	0.2054

Source: Results of panel data processing, 2026.

In Path 1, the R² value of 0.0008 indicates that tax incentives only explain about 0.08% of the variation in financial digitalization. In Path 2, the R² of 0.2121 and the Adjusted R² of 0.2054 indicate that the model explains about 21.21% of the variation in MSME resilience, after considering provincial fixed effects.

Summary of Key Results

Overall, tax incentives were not shown to have a significant effect on financial digitalization or MSME resilience at the 5% significance level. Financial digitalization had a negative and significant effect on MSME resilience, while operational cost efficiency had a positive and significant effect. The Sobel test found no evidence that financial digitalization mediated the relationship between tax incentives and MSME resilience. Path 2 model was simultaneously significant, but its explanatory power for variation within MSME resilience was around 21.21%.

DISCUSSION OF RESEARCH RESULTS

(H. Lee & Butler, 2022) This study found that tax incentives had no significant effect on MSME financial digitalization (coefficient 0.2502; $p = 0.6328$). This finding is interesting to discuss within the framework of *Pecking Order Theory*, which explains small business owners' preferences in selecting funding sources, and the *Technology Acceptance Model* (TAM) framework, which explains the adoption of financial technology by MSMEs. Some international literature argues that fiscal incentives can encourage business formalization and, in turn, accelerate the adoption of digital financial services, as businesses that receive tax breaks have greater fiscal space to invest in digital recording and payment systems. However, other literature emphasizes that the decision to adopt financial digitalization in MSMEs is driven more by factors such as ease of use, trust, and pressure from business partners or e-commerce platforms, rather than by fiscal incentives alone. The results of this study, which show no significant effect, are more in line with this second view and indicate that in the Indonesian context, tax incentive policies have not been specifically designed to encourage MSME digital transformation, so their impact on financial digitalization cannot be detected statistically.

The Impact of Financial Digitalization on MSME Resilience

The estimation results of the Fixed Effect model indicate that Financial Digitalization has a significant negative effect on MSME Resilience (coefficient -0.0045; $p = 0.0000$). This finding needs to be interpreted critically by referring to *the Resource-Based View* (RBV) theory, which emphasizes that competitive advantage and business resilience stem from internal capabilities that are difficult to imitate, and the *Dynamic*

Capabilities framework , which explains that the ability to adapt to changes in the external environment is determined more by managerial and organizational capacity than by the availability of technology alone. Most international literature emphasizes that financial digitalization plays a crucial role in expanding access to financing and transaction efficiency for MSMEs, and therefore, theoretically, should contribute positively to resilience. However, there are also views that emphasize that the benefits of digitalization on business resilience can only be realized if accompanied by adequate financial literacy and managerial capacity, and that the digital transition process itself can incur adaptation costs (training costs, investment in technological infrastructure, and cybersecurity risks) that in the short term actually burden MSMEs before the benefits can be fully realized. The results of this panel data, which after accounting for province-specific heterogeneity through the Fixed Effect model actually show a statistically significant negative effect, further support the second view: in the observation period 2017-2024, provinces with higher levels of financial digitalization do not necessarily show better MSME resilience, possibly due to the transition and adaptation costs of financial technology that have not been offset by adequate improvements in managerial capabilities and financial literacy during the same period.

The Effect of Operational Cost Efficiency on MSME Resilience

The Operational Load Efficiency variable shows a positive influence on MSME Resilience with a coefficient value of 0.3527. This influence is proven to be strongly significant ($p = 0.0000$), far exceeding the conventional significance level of 5 percent, making Operational Load Efficiency the variable with the most consistent and statistically strongest influence on MSME Resilience among all variables in Path Equation 2.

The Context of Non-Linearity in Indonesian MSMEs

Furthermore, interpretation of the strength of this influence must still take into account the dynamic characteristics of MSMEs. Some contemporary management literature adds that the relationship between operational load scale and resilience is not always linear.

For MSMEs in the growth or expansion phase , nominal increases in operational costs (such as increased labor costs, rental costs, or marketing costs) actually reflect economies *of scale* and increased market capacity, rather than inefficiency. Conversely, aggressively suppressing costs in pursuit of "efficiency" risks underinvestment , which in the long run weakens the competitiveness and resilience of MSMEs themselves.

The results of this study, which show a positive and significant influence, strongly confirm that for the majority of MSMEs in Indonesia, cost-effective cost management is the most rational and empirically proven survival strategy. The statistical strength and consistency of these findings are one of the main contributions of this study compared to other variables tested. Nevertheless, future follow-up studies can still be enriched with more precise and relative efficiency indicators such as *the Cost-to-Income Ratio* (BOPO) rather than simply relying on nominal values or the natural logarithm of operating expenses.

The Role of Financial Digitalization in Mediating the Relationship Between Tax Incentives and MSME Resilience

Based on the results of the statistical tests that have been conducted, the Sobel Test shows a z value of -0.4752 with a probability level of $p = 0.6346$. These results empirically prove that the indirect effect of Tax Incentives on MSME Resilience through Financial Digitalization is statistically insignificant.

Methodological Analysis: *The Path Analysis Tradition* and the Baron-Kenny Framework [Tax Incentives] —(Path a: Not Significant)—> [Financial Digitalization] —(Path b: Significant, negative direction)—> [MSME Resilience]

1. Path a (*Path a*): The influence of the independent variable (Tax Incentives) on the mediator variable (Financial Digitalization) must be significant.
2. Path b (*Path b*): The influence of the mediator variable (Financial Digitalization) on the dependent variable (MSME Resilience) must be significant simultaneously.

Pada penelitian ini, ketika kedua jalur tersebut diuji secara individual, jalur a (Insentif Pajak → Digitalisasi Keuangan) tidak menunjukkan signifikansi statistik, sedangkan jalur b (Digitalisasi Keuangan → Resiliensi UMKM) justru terbukti signifikan secara statistik pada model Fixed Effect, meskipun dengan arah negatif. Karena syarat mediasi menurut kerangka Baron-Kenny mensyaratkan signifikansi pada kedua jalur (a dan b) secara bersamaan, tidak terpenuhinya signifikansi pada jalur a saja sudah cukup untuk menggugurkan klaim mediasi, terlepas dari signifikansi pada jalur b. Secara metodologis dan matematis, perkalian koefisien ($a \times b$) tetap menghasilkan nilai yang sangat kecil dan tidak signifikan, karena nilai a yang besar namun sangat tidak presisi (standard error besar) mendominasi ketidakpastian pada hasil perkalian tersebut. Dengan demikian, tidak terdapat dasar empiris maupun statistik yang kuat untuk mengklaim adanya mekanisme mediasi dalam model ini, meskipun pengaruh langsung Digitalisasi Keuangan terhadap Resiliensi UMKM (jalur b) terbukti signifikan secara independen.

Fiscal-Digital Policy Literature Dichotomy

In theoretical terms, these results reflect a gap *between* regulatory expectations and the reality of technology adoption by small businesses. In the digital fiscal policy literature, there are two opposing views:

1. First View (Fiscal Catalyst): Arguing that tax incentives (such as rate reductions or tax exemptions) serve as an indirect catalyst for digital transformation. Savings on tax burdens are believed to strengthen MSMEs' internal investment capacity, which is then allocated to adopting financial technology (e.g., digital cashier/POS systems, *internet banking* , or *fintech lending*).
2. Second View (External Determination): Emphasizes that the MSME digitalization process is a phenomenon driven predominantly by external factors (*market-driven transformation*). These factors include market competitive pressures, shifts in consumer behavior toward online shopping, the availability of internet infrastructure, and the massive penetration of digital platform policies in *the e-commerce ecosystem* .

The findings of this study, which reject the mediation effect, strengthen the second view. In Indonesia, the government's provision of tax incentives has not necessarily encouraged MSMEs to digitize their financial management. The role of fiscal incentives as a driver of technology investment has proven to be very limited, likely because businesses prioritize the extra liquidity generated by these tax incentives for meeting short-term working capital needs or household consumption needs, rather than capital expenditure on *technology*.

Characteristics of Macro Panel Data and Unobserved Heterogeneity

The lack of evidence for this mediation effect aligns with patterns frequently found in mediation studies based on secondary data or macro/regional panel data. As a comparison to the literature, a cross-country mediation study on the influence of Information and Communication Technology (ICT) on national health outcomes, combining a *fixed effects model* and the Sobel test on panel data from 141 countries, also yielded similar results. The study found that although the independent variables and mediators appeared conceptually closely related, when tested at the macro level, many mediation pathways failed and proved insignificant.

This phenomenon of mediation failure at the aggregate level occurs due to *unobserved heterogeneity*. In macro-level panel data (such as at the provincial or district level), mediator variables such as the level of financial digitalization absorb the impact of too many highly variable local external factors—from the local community's digital literacy level, the telecommunications infrastructure development index, to regional banking penetration.

As a result, the strength of the causal relationship between paths (*path coefficient*) in the model becomes distorted and weakened (*attenuated*) when compared with testing using primary data (direct surveys) at the individual or company level which is much more homogeneous.

CONCLUSION

Based on panel data regression analysis (REM and FEM) and *the Sobel Test* for the 2017–2024 period, it was found that partial tax incentive policies had no significant effect on the financial digitalization of MSMEs because fiscal relaxation was primarily diverted to maintaining daily liquidity. On the other hand, partial financial digitalization had a significant but negative effect on MSME resilience. Without mature financial literacy, shallow technology adoption actually triggers hidden operational costs such as training and infrastructure costs, which burden business resilience in the short term.

Conversely, operational load efficiency through lean cost management *has* been shown to have a positive and highly significant effect at the 1% level on MSME resilience, making it the variable with the most consistent and strongest influence in this study. Meanwhile, *the Sobel Test results* confirm that financial digitalization does not play a role as a mediating variable between tax incentives and MSME resilience. However, all independent variables simultaneously have a very significant effect on MSME resilience with an R² value of 21.21%, indicating that variations in resilience over time within the same province can be well explained by this model.

Suggestion

1. The government and policymakers (Ministry of Finance, Ministry of Cooperatives and SMEs, and the Financial Services Authority (OJK) recommend reforming tax incentives into conditional *tax incentives*, where tax rebates *are* directly integrated with the mandatory adoption of digital financial reporting systems. Furthermore, digital financial literacy programs should be expanded evenly across all 34 provinces, particularly outside Java, to ensure effective *fintech utilization* in mitigating risks and supporting strategic decisions at the grassroots level.
2. For MSMEs, the results of this study serve as a warning against becoming complacent with simple payment tools like QRIS. Businesses must transition to data-driven management (*digital-driven management*) to track cash flow in *real time*, project revenue, and detect waste early (*early warning system*). This disciplined internal cost management will create maximum operational efficiency, the foundation for long-term business resilience.
3. For further academic research, it is recommended to explore the causes of the negative impact of financial digitalization on MSME resilience. Although the R² value *within the Fixed Effect* model has reached 21.21%, future researchers need to incorporate regional macroeconomic variables and internal characteristics such as regional inflation, GRDP fluctuations, credit access, social capital, and entrepreneurial leadership. The use of digital financial literacy as a moderating variable *and* the application of the Arellano-Bond dynamic model are also recommended to address the issue of autocorrelation.

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