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Research Article

Digital Financial Literacy and Inclusion as Determinants of Economic Sustainability Among Rural MSMEs

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Abstract: This study aims to analyze the influence of digital financial literacy and digital financial inclusion on the economic sustainability of rural micro-entrepreneurs in Deli Serdang Regency, Indonesia. The rapid development of digital financial services offers new opportunities for rural MSMEs to improve transaction efficiency and expand market access. However, the optimal utilization of these services remains limited due to uneven levels of literacy and digital access. This research employs an explanatory quantitative approach using Structural Equation Modeling-Partial Least Squares (SEM-PLS), based on survey data collected from rural business actors who have used at least one digital financial service. The findings indicate a very strong predictive accuracy of the model, with an R-Square value of 0.945 for economic sustainability. Digital financial literacy has a positive and significant effect on digital financial inclusion ($\beta = 0.273$; p = 0.001) and on economic sustainability (β = 0.235; p = 0.000). Digital financial inclusion also positively and significantly influences economic sustainability ($\beta = 0.398$; p = 0.000). These results demonstrate that improved digital literacy and wider use of services such as e-wallets, QRIS, and mobile banking enhance business resilience and expand economic opportunities for rural MSMEs. Overall, the study underscores the importance of strengthening digital capacities and expanding access to digital financial services as key strategies for advancing inclusive and sustainable rural economic development.

Keywords: Digital financial inclusion; Digital financial literacy; Economic sustainability; Rural MSMEs; SEM-PLS.

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1. Introduction

The development of digital technology has created significant opportunities for microenterprises in rural areas, including those in Deli Serdang Regency, to improve transaction efficiency and expand market reach (Ozili, 2021). Nevertheless, the utilization of digital financial services has not been evenly distributed. Many rural entrepreneurs still face challenges such as limited digital literacy, inadequate network access, and low capacity to operate technology-based financial services (Khairani, Tantono, et al., 2025). In this study, rural entrepreneurs are categorized as rural MSMEs in accordance with the definition stated in Law No. 20/2008, as the majority of respondents are micro and small businesses operating in rural areas (BPS Provinsi Sumatera Utara, 2023). These conditions indicate that strengthening literacy and optimizing the use of digital financial services are crucial issues in promoting rural economic development (Wang & Fu, 2022).

Digital financial literacy plays an important role in enhancing entrepreneurs' ability to understand the benefits, risks, and mechanisms of digital financial instruments (Barus et al., 2024). With adequate literacy, business actors are able to access information, manage transactions, and make financial decisions more effectively (Alwahidin et al., 2023). However, strong digital literacy must be accompanied by the ability to access and use digital financial services in practice, which is reflected in the level of digital financial inclusion (*OJK*, 2023).

Digital financial inclusion refers to the ability of individuals or businesses to access, use, and benefit from digital financial services effectively (Hou et al., 2025). As digital financial literacy increases, entrepreneurs have greater opportunities to utilize various digital platforms such as e-wallets, mobile banking, and QRIS in their business activities (Khairani, Tantri, et al., 2025). Enhanced digital financial inclusion can ultimately expand access to financing, improve cash flow, and increase operational efficiency for rural MSMEs (Sagala, 2025).

Economic sustainability is one of the key indicators in local economic development. MSMEs with strong economic sustainability tend to withstand market fluctuations, improve productivity, and adapt more effectively to emerging business opportunities (Prasetyani et al., 2025). Therefore, understanding how digital financial literacy and digital financial inclusion contribute to the economic sustainability of rural MSMEs is essential for strengthening digital-based economic capacity in rural areas.

In Deli Serdang Regency, most rural MSMEs still face a digital divide (Khairani et al., 2024). Data from BPS indicates that the use of digital financial services in rural areas remains lower than in urban regions, while the adoption of QRIS and e-wallets has increased but is not yet evenly distributed (Badan Pusat Statistik Kabupaten Deli Serdang, 2024)(OJK & BPS, 2024). These conditions highlight the need to strengthen digital literacy and digital financial inclusion among rural MSMEs (Harianto et al., 2025).

Theoretically, this study is grounded in the Resource-Based View (RBV), which emphasizes that internal capabilities such as digital literacy and the ability to utilize technology-based financial services are strategic resources that can enhance competitiveness and business sustainability (Kero & Bogale, 2023). In the context of rural MSMEs, mastery of digital technology and financial tools can be viewed as a core capability that strengthens business resilience and performance in the digital era (Komakech et al., 2025).

Although previous studies have discussed digital financial literacy and inclusion, most have focused on urban MSMEs or the formal business sector. Research examining their relationship with the economic sustainability of rural MSMEs particularly in Deli Serdang Regency remains limited. Moreover, earlier studies rarely tested the direct influence of digital financial literacy and digital financial inclusion on economic sustainability within an integrated model. This indicates an important research gap that needs to be addressed.

Based on these conditions, this study aims to analyze the influence of digital financial literacy and digital financial inclusion on the economic sustainability of rural MSMEs in Deli Serdang Regency using an explanatory quantitative approach. This research is expected to provide a more comprehensive understanding of how financial digitalization can strengthen the economic resilience of rural MSMEs.

2. Literature Review

Digital Financial Literacy

Digital financial literacy refers to an individual's ability to understand, access, evaluate, and use digital financial services effectively (OECD/INFE, 2024) (OECD/INFE, 2022). This literacy encompasses knowledge of digital banking features, e-wallets, digital payments, transaction security, and the ability to identify digital risks (Yadav & Banerji, 2024). From the perspective of the Resource-Based View (RBV), digital financial literacy is regarded as a strategic resource that can enhance business capabilities and competitiveness (Mishra et al., 2024).

Digital Financial Inclusion

Digital financial inclusion refers to the affordability, accessibility, and effective use of digital financial services by individuals or businesses (Purnamasari et al., 2025). It includes aspects of access, usage, quality of service, and system reliability (Zhang et al., 2022). In this study, digital financial inclusion is positioned as a mechanism that strengthens the relationship between digital financial literacy and economic sustainability (OECD/INFE, 2024).

Economic Sustainability of Business

Economic sustainability reflects the ability of business actors to maintain operational continuity, increase productivity, and take advantage of long-term growth opportunities (Nosratabadi et al., 2023). In the context of rural MSMEs, economic sustainability is associated with business resilience, financial independence, and the capacity to adapt to technological and market changes (Zhang et al., 2022)(Xiao, 2020).

The Role of Digital Financial Inclusion in This Study

Although digital financial inclusion is influenced by digital financial literacy, it is not positioned as a mediating variable in this study (Ojk, 2022). Instead, digital financial inclusion serves as an independent variable with two simultaneous functions: first, as an endogenous variable receiving the influence of digital financial literacy (X1 \rightarrow X2); and second, as a direct predictor of economic sustainability (X2 \rightarrow Y). Thus, digital financial inclusion is treated as an independent variable that directly contributes to enhancing economic sustainability, without mediating the relationship between digital financial literacy and business performance (World Bank, 2023).

Hypotheses

H1: Digital financial literacy has a positive effect on digital financial inclusion. H2: Digital financial inclusion has a positive effect on economic sustainability.

H3: Digital financial literacy has a positive effect on economic sustainability.

3. Method

This study employs an explanatory quantitative approach to examine the causal relationships among variables within the research model. This approach was selected because it allows simultaneous analysis of latent variable relationships and does not require strict data distribution assumptions. The analysis was conducted using Structural Equation Modeling with the Partial Least Squares technique (SEM-PLS). The population of this study consists of rural business actors in Deli Serdang Regency who have used at least one type of digital financial service, such as e-wallets, mobile banking, or QRIS. The sample was determined using a purposive sampling technique, with a total of 396 respondents. Primary data were collected through a Likert-scale questionnaire (1-5) covering indicators of digital financial literacy, digital financial inclusion, and economic sustainability. Data analysis was carried out using SEM-PLS through SmartPLS software. The assessment included evaluating the measurement model through convergent and discriminant validity tests, assessing construct reliability using Cronbach's Alpha and Composite Reliability, and evaluating the structural model to determine the strength of relationships among variables. Significance testing was performed using the bootstrapping procedure to obtain path coefficients, t-values, and pvalues, which serve as the basis for hypothesis testing and decision-making.

4. Results and Discussion

Respondent Characteristics and Descriptive Statistics

Descriptive analysis was conducted to provide an initial overview of the respondents' profiles and the main tendencies of the research variables. This information is essential for understanding the socio-economic context of rural business actors before proceeding to further analyses and testing the relationships among variables within the research model.

Table 1. Respondent Characteristics.

Characteristics	Category	Number	Percentage (%)
Gender	Female	349	88,13
	Male	47	11,77
Age	< 25 years	8	2,02
	25–34 years	175	44,19
	35–44 years	79	19,95
	45–54 years	127	32,07
	> 55 years	7	1,77
Education	Primary School	223	56,31
	Junior High School	119	30,05
	Senior High School		
	/ Vocational	52	13,13
	School		
	Diploma	2	0,51

The respondents' profile indicates that the majority of rural entrepreneurs in Deli Serdang Regency are women (88.13%) and fall within productive age groups, particularly those aged 25–34 years (44.19%) and 45–54 years (32.07%). Most respondents have an elementary or junior high school educational background, reflecting relatively low levels of formal education. This condition is important for understanding how rural business actors adopt technology and utilize digital financial services in their business activities.

Table 2. Descriptive Statistics.

Variable	Code	Mean	Category
Digital Financial Literacy	X1	3,57	Medium–High
Digital Financial Inclusion	X2	3,62	High
Economic Sustainability	Y	4,01	High

The average score for the Digital Financial Literacy (DFL) variable is 3.57, indicating that rural entrepreneurs possess a moderately good level of digital financial literacy, particularly in using basic services such as e-wallets, mobile banking, and QRIS. However, understanding of digital security and the ability to select appropriate financial products still needs improvement. The Digital Financial Inclusion (DFI) variable has an average score of 3.62, suggesting that access to and usage of digital financial services are relatively high. Business actors primarily use digital services for payments and transfers, although the use of more advanced services such as digital financing and digital savings remains low due to limited literacy and infrastructure constraints. Meanwhile, the economic sustainability variable has the highest average score, at 4.01, indicating that business actors perceive their economic sustainability to be in a good category. Their businesses are considered capable of remaining stable and generating consistent income, although improvements in innovation and technology-based business management are still needed to strengthen competitiveness in the digital era.

Evaluation of the Measurement Model (Outer Model)

The evaluation of the measurement model was conducted to ensure that each construct demonstrates adequate validity and reliability. The results show that all indicators have loading factor values above 0.70, thereby meeting the criteria for convergent validity. The Average Variance Extracted (AVE) values for all variables also exceed 0.50, indicating that the proportion of variance explained by the indicators is greater than the measurement error. Construct reliability testing shows that both Cronbach's Alpha and Composite Reliability values for all variables are above 0.70. This confirms that each construct possesses strong internal consistency. In addition, the results of discriminant validity testing using the Fornell–Larcker Criterion and the heterotrait–monotrait ratio (HTMT) demonstrate that each construct is clearly distinct from the others.

R-Square (Structural Model Strength)

The analysis results show that the R-Square value for the Economic Sustainability variable (Y) is 0.945, indicating that Digital Financial Literacy (X₁) and Digital Financial Inclusion (X₂) jointly explain 94.5% of the variance in business economic sustainability. This value falls into the very high category, demonstrating that the model has strong predictive power in explaining the factors influencing the economic sustainability of rural MSMEs.

Table 3. R-Square Values of Endogenous Variables.

Endogenous Variable	R- Square	Interpretation	
Economic Sustainability (Y)	0.945	Very Strong	

D. Significance Testing of the Structural Model (Inner Model)

The analysis of the inner model was conducted to examine the significance of the relationships among variables within the structural research model. This testing employed the bootstrapping procedure in PLS-SEM to obtain path coefficients, t-statistics, and p-values. These results

were then used to determine whether the relationships among variables met the acceptable levels of statistical significance.

Table 4. Path Coefficient Testing and Significance of Effects.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
Digital Financial Literacy (X ₁) -> Digital Financial Inclusion (X ₂)	0.273	0.274	0.084	3.255	0.001
Digital Financial Literacy (X ₁)-> Economic Sustainability (Y)	0.235	0.235	0.032	7.429	0.000
Digital Financial Inclusion (X ₂) -> Economic Sustainability (Y)	0.398	0.396	0.041	9.741	0.000

The bootstrapping results show that digital financial literacy has a positive and significant effect on digital financial inclusion ($\beta=0.273$; t=3.255; p=0.001). This indicates that improvements in entrepreneurs' digital understanding and skills enhance their ability to access and utilize digital financial services more effectively. Digital financial literacy is also proven to have a positive and significant effect on economic sustainability ($\beta=0.235$; t=7.429; p=0.000). This finding suggests that business actors with higher levels of digital literacy are better able to manage transactions efficiently, make more accurate financial decisions, and strengthen business stability. In addition, digital financial inclusion has a positive and significant effect on economic sustainability ($\beta=0.398$; t=9.741; p=0.000). Access to and use of digital services such as QRIS payments, e-wallets, and mobile banking facilitate transactions and expand business opportunities, thereby reinforcing the economic sustainability of rural entrepreneurs. These findings confirm that digital financial literacy and digital financial inclusion play a crucial role in enhancing the economic sustainability of rural MSMEs. Both variables contribute directly, and digital financial inclusion does not function as a mediating variable in this research model; instead, it operates as an independent variable with its own standalone influence.

The Influence of Digital Financial Literacy on Digital Financial Inclusion

The results of the study show that digital financial literacy has a positive and significant effect on digital financial inclusion. This finding indicates that the higher the entrepreneurs' understanding of the features, benefits, and risks of digital financial services, the greater their ability to access and utilize these services. In the context of rural MSMEs, stronger digital literacy helps business owners understand how e-wallets, mobile banking, and QRIS operate, enabling them to feel more confident in conducting digital transactions and adopting modern financial services. This supports the view that literacy is a fundamental element in expanding digital financial inclusion, especially in rural areas (Silalahi et al., 2024)(Pasaribu et al., 2023)(Harianto et al., 2024).

Empirically, this result aligns with previous studies showing that digital financial literacy serves as an important antecedent of financial inclusion and the utilization of digital financial services among both households and small business owners (Djohan et al., 2025). Several systematic studies also emphasize that digital financial literacy is a key prerequisite for enabling communities to participate effectively in the digital financial ecosystem rather than becoming passive users (Roy & Vasa, 2025). In the Indonesian rural MSME context, similar evidence is found in studies that examine how capacity-building programs and digital platforms strengthen both literacy and financial inclusion (García et al., 2025).

The Influence of Digital Financial Literacy on Economic Sustainability

Digital financial literacy is also proven to have a positive and significant effect on business economic sustainability. Entrepreneurs with strong digital literacy tend to manage transactions more efficiently, develop more structured financial plans, and utilize technology to support their business operations. These conditions contribute to improved income stability and business resilience in responding to market changes. This finding confirms that digital literacy not only facilitates access to financial services but also plays a direct role in strengthening the foundation of economic sustainability among rural MSMEs.

This result is consistent with previous studies showing that financial literacy including its digital dimension is closely related to business performance, financial resilience, and the long-term sustainability of small enterprises (Novela et al., 2024)(Raharjo et al., 2024)(Sitaniapessy et al., 2024). In the Indonesian MSME context, digital and financial literacy has been shown to enhance financial decision-making, expand market reach, and improve long-term business performance (Coco et al., 2024). Furthermore, several studies highlight that higher levels of digital financial literacy strengthen entrepreneurs' capacity to utilize fintech, e-wallets, and other digital platforms as adaptive strategies in navigating dynamic business environments (Muhammad Dairobi & Anisah, 2024). Thus, the findings of this study enrich the empirical evidence that strengthening digital financial literacy is one of the key pillars for achieving economic sustainability among MSMEs, particularly in rural areas that are more vulnerable to economic shocks (Pratama et al., 2024).

The Influence of Digital Financial Inclusion on Economic Sustainability

The results of the study indicate that digital financial inclusion has a positive and significant effect on business economic sustainability. Wider access to digital services such as cashless payments, fund transfers, and automated transaction recording enhances business efficiency and expands entrepreneurial opportunities. Rural business actors who actively use digital financial services tend to conduct transactions more easily, reduce operational costs, and reach a broader customer base. This directly strengthens the economic sustainability of their businesses. These findings reinforce that expanding access to digital financial services is a key strategy for promoting digital-based economic development in rural areas.

Theoretically and empirically, this result aligns with studies highlighting the role of digital financial inclusion in promoting economic growth, reducing poverty, and strengthening financial resilience, especially in developing countries (Haanurat, 2024)(Hs et al., 2024)(Khan, 2025). Various studies have found that digital financial inclusion contributes to improved access to financing, greater payment efficiency, and broader business networks for MSMEs (Aulia & Daulay, 2024). Cross-country research also demonstrates that digital financial inclusion is associated with higher-quality and more Economic sustainabality growth, including through channels of innovation and productivity enhancement (Azhima & Pinem, 2024). In the Indonesian MSME context, empirical evidence confirms that the expansion of digital financial services combined with supporting infrastructure and policy initiatives can serve as an important instrument for strengthening business sustainability, particularly in rural regions that have historically lagged in access to formal financial services (Goaied, 2023)

Relationship of Findings and Research Contribution

Overall, the three findings demonstrate that digital financial literacy and digital financial inclusion are two essential elements in promoting the economic sustainability of rural MSMEs. Digital literacy drives improvements in financial inclusion, and both variables directly contribute to business resilience and performance. This research model provides a more comprehensive understanding of how financial digitalization can strengthen the MSME sector in rural areas.

5. Conclusion

This study concludes that digital financial literacy and digital financial inclusion play an essential role in enhancing the economic sustainability of rural entrepreneurs. First, digital financial literacy has a significant effect on digital financial inclusion, indicating that improvements in digital understanding and skills encourage entrepreneurs to use digital financial services more widely. Second, digital financial literacy also has a direct effect on

economic sustainability, particularly through entrepreneurs' ability to manage transactions and make more accurate financial decisions. Third, digital financial inclusion significantly influences economic sustainability, highlighting the importance of access to digital services in improving operational efficiency and expanding business opportunities.

Overall, the findings confirm that strengthening digital literacy and expanding access to digital financial services are key strategies for enhancing the resilience and economic independence of rural MSMEs. These results provide empirical guidance for local governments, financial institutions, and industry stakeholders to promote more inclusive and sustainable digital financial initiatives.

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