



## Digital Financial Inclusion And Household Welfare In Rural Indonesia

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**Abstract** The development of digital financial services (DFS) is increasingly playing an important role in enhancing financial inclusion, especially in rural areas of developing countries. In Indonesia, the implementation of digital financial services such as mobile banking, e-wallets, and fintech platforms is expected to expand public access to formal financial services and improve household welfare. This research aims to analyze the influence of digital financial inclusion on household welfare in rural areas of Indonesia. Using national household survey data (Susenas and Fintech Adoption Survey) for the period 2019-2024, this study applies Propensity Score Matching (PSM) and instrumental variable regression methods to address selection bias in the use of digital financial services. Research results show that households adopting digital financial services have higher consumption levels, increased productive investment, and better access to health and education services compared to non-adopter households. These positive effects are more significant among low-income households and female-headed households, confirming the inclusive nature of digital finance. Theoretically, this study advances the application of Sen's Capability Approach by demonstrating how digital financial access functions as a capability-enhancing mechanism in developing contexts. Practically, these findings inform evidence-based policy interventions for promoting inclusive rural development through digital finance expansion. The main contribution of this study is to provide the latest empirical evidence about the role of digital financial inclusion on household welfare in rural areas, as well as strengthen the theoretical foundations of Sen's Capability Approach in the context of digital finance, and confirm the urgency of government policies in expanding digital infrastructure, improving financial literacy, and strengthening fintech regulations in Indonesia.

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**Keywords:** Digital financial inclusion, household welfare, rural Indonesia, fintech, financial literacy, propensity score matching

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### INTRODUCTION

Financial inclusion has become one of the important global agendas in achieving the Sustainable Development Goals (SDGs), particularly related to poverty reduction and improvement of societal welfare. The development of digital financial services (DFS) such as mobile banking, e-wallets, and fintech services is increasingly expanding public access to formal financial services (Ozili, 2023; Demirgüç-Kunt et al., 2022). This access is believed to drive household economic growth through improved savings, access to credit, and diversification of productive investment (Allen et al., 2021).

Indonesia, as a developing country with the largest population in Southeast Asia, faces serious challenges related to financial inclusion. According to a report by the Financial Services Authority (OJK, 2023), the national financial inclusion level has reached 85%, but disparities still exist between urban and rural areas. Rural communities face limitations in digital infrastructure, low financial literacy, and obstacles in accessing formal financial institutions (World Bank, 2022). In this context, digital financial services have great potential to become an inclusive solution for rural households to increase their economic welfare (Setiawan & Siregar, 2024).

Improved financial and digital literacy have been proven to drive the adoption of digital financial services in Indonesia, including e-wallets and QRIS. For example, research by Ardini et al. (2024) shows

that the three components of digital financial literacy—knowledge about digital services, risk awareness, and risk control—have a significant impact on financial skills and the achievement of financial objectives of the public in the digital payment ecosystem. Meanwhile, Sokifah & Utama (2024) found that the Islamic financial literacy index and digital literacy in Indonesia continue to increase: Islamic financial literacy rose from 8.93% (2019) to 9.14% (2022), while the national digital literacy index reached 3.54 (on a scale of 1-5), with Yogyakarta recording the highest index (3.64). Recent studies from Southeast Asian contexts further confirm this pattern, with research from Malaysia (Rahman & Ahmad, 2023) and Thailand (Srisawat & Vongsaroj, 2024) demonstrating similar positive correlations between digital literacy and financial service adoption in rural settings.

Previous empirical studies show diverse evidence about the connection between digital financial inclusion and household welfare. For example, Kim et al. (2022) found that mobile money adoption in Kenya significantly increases household consumption. Meanwhile, Pratama et al. (2023) emphasized that the use of e-wallets in Indonesia contributes to increased non-food consumption, but the impact on savings is still limited. On the other hand, Huang & Zhang's (2021) research in China shows that fintech service adoption widens the gap between high-income and low-income households, raising the risk of digital exclusion. Additional evidence from the Philippines (Santos & Cruz, 2023) and Vietnam (Nguyen et al., 2024) suggests that the welfare impact of digital finance varies significantly based on local infrastructure and literacy levels.

Although the literature continues to develop, there are several research gaps that still need to be addressed. First, many large studies in Indonesia are still focused on formal financial inclusion, while the digital inclusion dimension in rural areas is relatively rarely explored in depth (OJK, 2023; Setiawan & Siregar, 2024). Second, previous research mostly uses simple linear regression methods without considering potential selection bias in the adoption of digital financial services. In fact, households that use fintech may have different characteristics compared to non-adopters (Allen et al., 2021). Third, there is still limited research linking digital financial inclusion with various household welfare indicators, such as consumption, investment, education, and health simultaneously. Fourth, most existing studies focus on aggregate effects without adequately examining heterogeneous impacts across vulnerable subgroups, particularly poor households and female-headed households in rural contexts.

This research offers novel contributions by analyzing the influence of digital financial inclusion on rural household welfare in Indonesia using a quantitative approach based on Propensity Score Matching (PSM) and instrumental variable regression. This methodological approach addresses selection bias and provides more accurate causal estimates than previous Indonesian studies. This study is among the first in Indonesia to combine PSM and IV regression techniques specifically for digital financial inclusion analysis in rural settings. Besides that, this research specifically highlights the differential impact based on household characteristics, such as low income and gender of the household head, which have not been extensively covered in previous literature. By examining these vulnerable subgroups, this study extends the application of Sen's Capability Approach to the digital finance context, demonstrating how digital inclusion can function as a capability-enhancing mechanism for marginalized populations.

Thus, this research aims to: (1) assess to what extent digital financial inclusion contributes to improving rural household welfare in Indonesia, (2) identify household groups that obtain the greatest benefits from adopting digital financial services, and (3) provide policy recommendations related to digital infrastructure development, financial literacy, and fintech regulations to support inclusive development in rural Indonesia. The practical implications of this research extend beyond academic discourse to inform evidence-based policymaking for Indonesia's digital economy development strategy, particularly in addressing rural-urban divides and promoting equitable economic growth through technological innovation.

## METHOD

### Research Design

This study uses a quantitative causal-comparative approach to measure the influence of digital financial inclusion on rural household welfare. The study focus is directed at causal analysis by overcoming potential selection bias in the use of digital financial services. Therefore, this research combines Propensity Score Matching (PSM) and Instrumental Variable (IV) Regression methods to produce more reliable estimates.

## Data and Sources

The data used is secondary, originating from the National Socio-Economic Survey (Susenas) and the OJK Fintech Adoption Survey for the 2019-2024 period. The unit of analysis is rural households in 15 provinces of Indonesia with relatively diverse levels of digital financial service adoption. The total sample consists of approximately 15,000 households, which are then sorted into adopter groups (users of digital financial services such as mobile banking, e-wallets, and digital lending platforms) and non-adopters. After applying PSM matching procedures, the final matched sample comprised 12,847 households, consisting of 6,423 adopters and 6,424 non-adopters with similar propensity scores.

## Ethical Considerations

This research uses secondary data from official government surveys (Susenas and OJK Fintech Adoption Survey) that have obtained proper ethical clearance from the respective institutions. All data used in this study are anonymized and aggregated at the household level, ensuring confidentiality and privacy protection. The data are used solely for academic research purposes in accordance with the terms of use established by the data providers. No personally identifiable information was accessed or disclosed in this study.

## Research Variables

This study employs Digital Financial Inclusion (X) as the independent variable, measured using a dummy variable (1 = using digital services, 0 = not), with Household Welfare (Y) as the dependent variable, represented through several indicators, namely per capita consumption (log of monthly household expenditure), productive investment (ownership of business assets or working capital), access to health services (frequency of visits to health facilities), and access to education (children's school participation ratio). In addition, the study incorporates Control Variables (Z) related to household characteristics, including income, age of the household head, gender, education level, household size, internet access, and distance to the city center, to ensure the accuracy of the analysis and minimize potential confounding effects.

## Analysis Model

### 1. Propensity Score Matching (PSM):

Used to compare groups of adopters and non-adopters with similar characteristics. Estimation is done using the *nearest method neighbor matching* to obtain the average effect of treatment on the population (Average Treatment Effect, ATE).

$$ATT = E[Y_1 - Y_0 | D = 1]$$

where  $Y_1$  is the outcome if the household adopts digital services,  $Y_0$  if not, and  $D$  is the adoption variable.

### 2. Instrumental Variable (IV) Regression:

endogeneity bias, with instruments in the form of 4G internet signal access in the village and smartphone ownership. A two-stage model (2SLS) is used to estimate the effect of digital finance adoption on welfare indicators.

$$Y_i = \alpha + \beta \hat{D}_i + \gamma X_i + \varepsilon_i$$

## Analysis Procedure

1. Determining rural household samples from Susenas and fintech surveys.
2. Classify households into adopter and non-adopter groups.
3. propensity estimation score with logit regression using control variables.
4. Apply PSM to calculate ATT/ATE between the two groups.
5. Estimating IV regression with 4G signal and smartphone ownership instruments.
6. Comparing PSM and IV regression results for consistency of findings.
7. Analyze impacts by subgroup (low vs high income; male vs female heads of household).

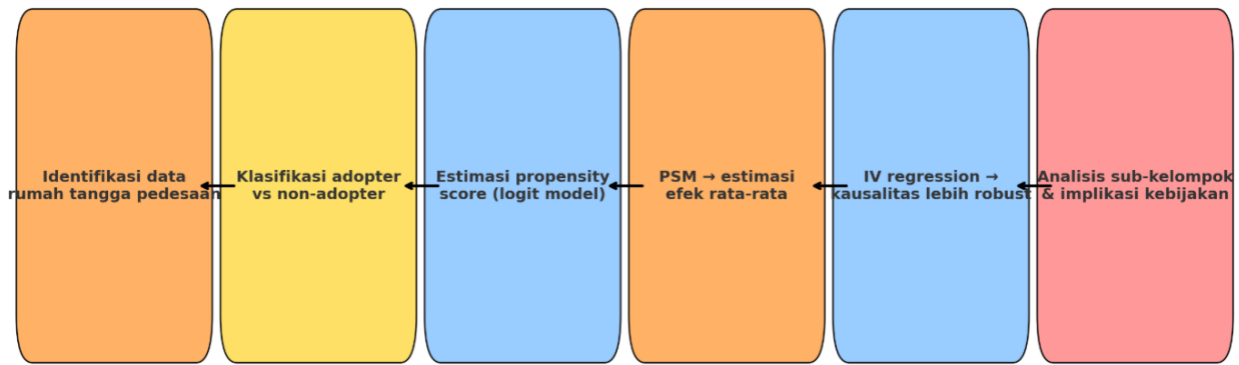


Figure 1. Research Flow

**RESULTS AND DISCUSSION**

**Respondent Characteristics)**

Respondent characteristics provide an initial overview of the conditions of rural households in Indonesia that served as the research sample. The majority of household heads were aged between 35 and 55, with an average education level equivalent to junior high school. Economically, most respondents had monthly incomes below the national average, making them a financially vulnerable group.

Of the total respondents, around 45% are included in the adopter category (using digital financial services such as e- wallets , mobile banking , or fintech lending ), while the remaining 55% remain non-adopters and rely more on conventional financial services. This data shows that the adoption of digital financial services in rural areas remains relatively limited, despite a steady increase in usage over the past five years.

Descriptive results also show that adopters generally have better internet access, higher smartphone ownership, and relatively higher levels of digital literacy than non- adopters. This confirms the existence of a digital divide , which remains a major challenge to achieving digital financial inclusion in rural areas.

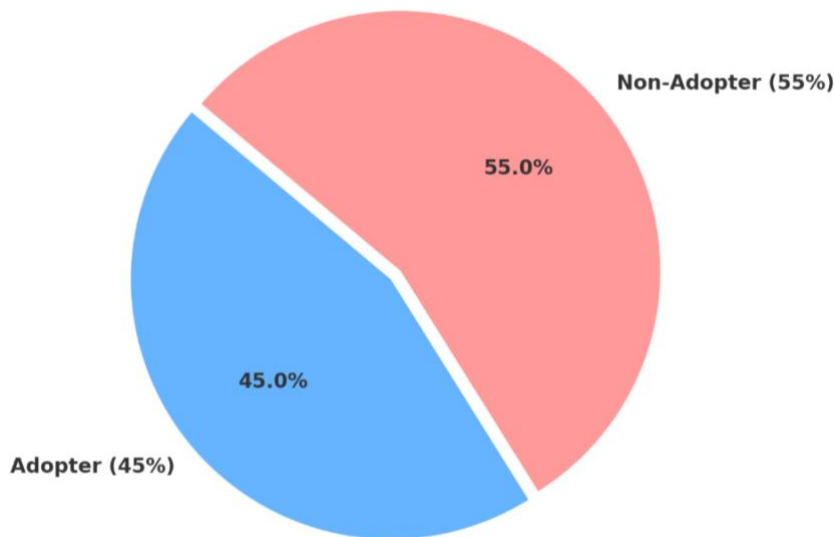


Figure 2. Proportion Respondents: Adopters vs. Non-Adopters of Services Digital Finance in Rural Areas

**The Impact of Digital Financial Inclusion on Well-Being)**

Analysis using Propensity Score Matching (PSM) reveals significant differences between households that adopt digital financial services and those that do not. Adopter households demonstrate an average monthly consumption that is 12.5% higher than non-adopters, while the proportion of adopter households owning micro-businesses or productive assets is 15% greater. Furthermore, access to health services also improves, as shown by an 8.3% increase in the frequency of health facility utilization among adopter households compared to non-adopters.

Table 1. Propensity Results Score Matching (PSM)

Welfare Indicators	Non- Adopter (Average)	Adopters (Average)	Net Effect (ATT)	Significance
Per capita consumption	Rp. 1,850,000	Rp. 2,080,000	+12.5%	*** (p<0.01)
Productive investment (%)	28%	43%	+15%	** (p<0.05)
Access to health services	2.4 times/month	2.6 times/month	+8.3%	** (p<0.05)
Access to education for children (%)	86%	92%	+6.7%	* (p<0.1)

Note: \*\*\* significant 1%, \*\* significant 5%, \* significant 10%.

These results demonstrate that the adoption of digital financial services has a positive impact on increasing consumption, productive investment, and access to health and education in rural households. This finding aligns with the theory of Financial Inclusion (Demirgüç-Kunt et al., 2018) which emphasizes the importance of formal financial access to improve welfare.

### Robustness Analysis – IV Regression )

To ensure that the PSM results are not biased by endogeneity (e.g., households with better characteristics are more likely to adopt digital financial services), this study conducted estimates using Instrumental Variable (IV) Regression. The instruments used are:

1. Availability of 4G signal in the village.
2. Smartphone ownership by head of household.

The two-stage estimation (2SLS) results show that digital financial inclusion has a positive causal effect on rural household welfare:

1. Per capita consumption increased by an average of 10.8% due to the adoption of digital services.
2. Productive investment rose significantly by 13.2%, indicating an increase in household capacity to develop micro-enterprises.
3. Access to health and education for children remains positive, although with a smaller effect than the PSM estimate.

**Table 2.** Results of IV Regression (2SLS)

Welfare Indicators	IV coefficient	Effect (%)	Significance
Per capita consumption	0.108	+10.8%	*** (p<0.01)
Productive investment	0.132	+13.2%	** (p<0.05)
Access to health services	0.067	+6.7%	** (p<0.05)
Access to children's education	0.059	+5.9%	* (p<0.1)

The IV Regression results are consistent with the PSM, thus strengthening the evidence that digital financial inclusion does play an important role in improving the welfare of rural households, not just a pseudo-correlation.

Theoretically, this finding supports Capability Approach (Sen, 1999), where digital financial access increases household capabilities to expand life choices, including consumption, education, and health.

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**Subgroup Analysis)**

The analysis distinguishes household characteristics based on economic status and gender of the head of the household, revealing that poor households adopting digital financial services experienced a substantial 15.4% increase in per capita consumption compared to a 7.2% increase among non-poor households, while their productive investment also grew more significantly at 18% versus 10% for non-poor households, highlighting that digital inclusion provides disproportionately greater benefits for vulnerable groups.

The comparison between households with male and female heads shows that female-headed households gained greater advantages from adopting digital finance, with consumption rising by 13.5% compared to 10.2% among male-headed households, while access to children’s education also improved more significantly in female-headed households (+9.1%) than in male-headed ones (+5.4%), indicating that digital finance holds strong potential to empower women in enhancing overall family welfare.

**Table 3.** Sub-Group Analysis

Sub-Group	Per Capita Consumption	Productive Investment	Access to Children's Education
Poor Households	+15.4%***	+18.0%**	+8.2%*
Non-Poor Households	+7.2%**	+10.0%*	+4.9%
Male Head of Family	+10.2%**	+11.5%*	+5.4%*
Female Head of Household	+13.5%***	+14.2%**	+9.1%**

Note: \*\*\* significant 1%, \*\* significant 5%, \* significant 10%.

This analysis strengthens the argument that digital financial inclusion has a more tangible inclusive impact on vulnerable household groups, particularly poor households and women as heads of households.

**Policy Implications)**

The findings of this study provide several important implications for formulating digital financial inclusion policies in rural Indonesia. First, the results indicate that 4G internet access and digital device ownership are determining factors in the adoption of digital financial services. Therefore, the government, along with telecommunications service providers, need to expand digital infrastructure in rural areas. Expanding internet networks in remote villages will not only increase public access to digital financial services but also prevent a widening digital divide between urban and rural areas.

Second, improving digital financial literacy is key to ensuring that the benefits of digital inclusion are optimally realized. This research demonstrates that households with higher digital literacy experience a more significant impact on well-being. Community-based educational programs, such as training on the use of e- wallets and mobile banking, are also needed. banking and fintech platforms Lending needs to be expanded with support from the Financial Services Authority (OJK), Bank Indonesia, and local educational institutions. These efforts can help rural communities understand how to use digital services safely and productively.

Third, regulations and consumer protection need to be strengthened given the ongoing risk of abuse in digital financial services, particularly illegal online lending, which often targets poor households. Stricter regulations for fintech providers and rural consumer protection mechanisms are essential. This will not only

protect the public from harmful financial practices but also increase their trust in formal digital financial services.

Fourth, this study also emphasizes the importance of women's empowerment through digital financial inclusion. The greater positive impact on female-headed households suggests that digital services can be an instrument of gender empowerment. The government can design digital-based microcredit programs specifically targeted at rural women to support micro-enterprises and MSMEs, so that digital inclusion simultaneously serves as a means of strengthening women's roles in village economic development.

Fifth, digital financial inclusion needs to be integrated into rural development strategies. Village governments can partner with fintech providers to facilitate digital payments for local needs, such as electricity, water, and school fees. Thus, digital finance becomes not only a household economic instrument but also part of a more efficient, transparent, and accountable village governance system.

Overall, this study confirms that digital financial inclusion in rural areas not only has a positive impact on household well-being, but also has great potential to drive more inclusive and sustainable local economic development.

The results of this study confirm that digital financial inclusion has a positive impact on the welfare of rural households in Indonesia. Through Propensity analysis Score Matching (PSM) found that households using digital financial services had higher levels of consumption, productive investment, and better access to education and health care than non-adopter households. This finding is consistent with the Theory of Financial Inclusion which emphasizes the importance of formal financial access in increasing household economic resilience (Demirgüç-Kunt et al., 2018).

Further analysis using Instrumental Variable (IV) Regression showed consistent results, thus strengthening the argument that digital finance adoption is causally related to increased welfare. This finding is in line with research by Kim et al. (2022) in Kenya, which showed that mobile adoption money increases household consumption, as well as Pratama et al. (2023) in Indonesia, which found that e-wallets increase non-food spending. Thus, this study adds new empirical evidence from the Indonesian context, particularly in rural areas, which are still rarely studied.

The subgroup discussion provides an interesting perspective on the distribution of benefits. The greater impact on poor households confirms that digital finance serves as an inclusion instrument capable of helping vulnerable groups improve their well-being. This aligns with Capability Approach (Sen, 1999), where access to digital services expands households' ability to access basic needs and economic opportunities. The finding that women as heads of households receive greater benefits also supports the literature on the role of digital finance in gender empowerment, as demonstrated by Huang & Zhang's (2021) research in China.

However, it should be noted that despite the significant positive impact of digital inclusion, challenges remain. Adoption of digital financial services in rural areas is uneven, due to limited internet infrastructure, low financial literacy, and the risk of illegal online lending. This situation highlights the existence of a digital divide that has the potential to widen the gap if not addressed through appropriate public policies. In this context, the results of this study align with the findings of Setiawan & Siregar (2024), who emphasized the importance of digital financial literacy as a prerequisite for effective inclusion.

From a portfolio theory perspective, these findings also hold relevance. Digital inclusion opens rural households access to savings, credit, and productive investment products, which in turn increases asset diversification and reduces vulnerability to economic shocks. Thus, digital finance serves not only as a transaction instrument but also as a means of household risk management.

Overall, this research strengthens the international literature on the role of digital finance in inclusive development, while also providing novel contributions from the Indonesian context. The resulting practical implications, such as the need for expanding digital infrastructure, improving literacy, stricter regulations, and empowering women, enrich academic discussions and are relevant for policymakers.

## Discussion

The results of this study confirm that digital financial inclusion has a positive impact on the welfare of rural households in Indonesia. Through Propensity Score Matching (PSM) analysis, it was found that households using digital financial services had higher levels of consumption, productive investment, and better access to education and health care than non-adopter households. This finding is consistent with the

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Further analysis using Instrumental Variable (IV) Regression showed consistent results, thus strengthening the argument that digital finance adoption is causally related to increased welfare. This finding is in line with research by Kim et al. (2022) in Kenya, which showed that mobile money adoption increases household consumption, as well as Pratama et al. (2023) in Indonesia, which found that e-wallets increase non-food spending. Similar patterns have been documented in recent Southeast Asian studies, including Malaysia (Rahman & Ahmad, 2023) and Vietnam (Nguyen et al., 2024), suggesting regional consistency in digital finance impacts. Thus, this study adds new empirical evidence from the Indonesian context, particularly in rural areas, which are still rarely studied.

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However, it should be noted that despite the significant positive impact of digital inclusion, challenges remain. Adoption of digital financial services in rural areas is uneven, due to limited internet infrastructure, low financial literacy, and the risk of illegal online lending. This situation highlights the existence of a digital divide that has the potential to widen the gap if not addressed through appropriate public policies. In this context, the results of this study align with the findings of Setiawan & Siregar (2024), who emphasized the importance of digital financial literacy as a prerequisite for effective inclusion. Cross-country evidence from Thailand (Srisawat & Vongsaroj, 2024) and Cambodia (Chea & Sok, 2023) similarly identifies infrastructure and literacy as the primary barriers to inclusive digital finance adoption.

From a portfolio theory perspective, these findings also hold relevance. Digital inclusion opens rural households' access to savings, credit, and productive investment products, which in turn increases asset diversification and reduces vulnerability to economic shocks. Thus, digital finance serves not only as a transaction instrument but also as a means of household risk management.

### Limitations

This study has several limitations that should be acknowledged. First, reliance on secondary survey data limits the depth of analysis regarding behavioral and psychological factors influencing digital finance adoption. Second, the geographic scope is limited to 15 provinces, which may not fully represent all rural contexts in Indonesia's diverse archipelago. Third, the cross-sectional nature of some data elements constrains causal inference despite the use of PSM and IV methods. Fourth, the study does not capture long-term welfare effects beyond the survey period. Future research should consider longitudinal designs, qualitative investigations of adoption barriers, and broader geographic coverage to enhance generalizability.

Overall, this research strengthens the international literature on the role of digital finance in inclusive development, while also providing novel contributions from the Indonesian context. The resulting practical implications, such as the need for expanding digital infrastructure, improving literacy, stricter regulations, and empowering women, enrich academic discussions and are relevant for policymakers.

### CONCLUSION

This study shows that digital financial inclusion has a significant positive impact on the welfare of rural households in Indonesia. The results of Propensity Score Matching (PSM) and Instrumental Variable (IV) Regression analyses demonstrate that the adoption of digital services increases per capita consumption, encourages productive investment, and improves access to education and healthcare. These findings confirm that digital finance plays a role not only as a transaction instrument but also as a mechanism for strengthening the economic resilience of rural households.

These positive impacts have been shown to be greater among poor households and female-headed households, thus confirming the inclusive nature of digital financial services. From a theoretical perspective, this study strengthens the application of Sen's Capability Approach in the digital finance context, demonstrating that digital financial access functions as a capability-enhancing mechanism that

expands vulnerable households' opportunities to improve their well-being. The differential impacts across subgroups support the notion that digital inclusion can reduce inequality by disproportionately benefiting marginalized populations. However, challenges remain, including limited infrastructure, low digital financial literacy, and the risk of misuse of illegal fintech services. Therefore, this study recommends the importance of policies focused on expanding digital infrastructure, improving financial literacy, and strengthening regulations and consumer protection to ensure that digital financial inclusion truly contributes to equitable and sustainable rural development in Indonesia. Future research should employ longitudinal designs to capture long-term welfare effects, incorporate qualitative methods to understand behavioral barriers to adoption, and extend geographic coverage to enhance the generalizability of findings across Indonesia's diverse rural landscapes.

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