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Bridging FinTech Adoption to Sustainable Financial Behavior: The Mediating Roles of Financial Literacy and Inclusion in Indonesia

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ABSTRACT

This study investigates the indirect relationship between FinTech adoption and sustainable financial behavior through the mediating roles of financial literacy and financial inclusion in the Indonesian context. While the proliferation of FinTech services is often seen as a catalyst for financial transformation, evidence remains limited regarding its behavioral impact, particularly in emerging markets. Using a quantitative explanatory design and data from 315 active FinTech users across diverse regions in Indonesia, this study applies partial least squares structural equation modeling (PLS-SEM) to examine both direct and mediated effects. The results show that FinTech adoption significantly influences financial literacy and financial inclusion, but does not directly affect sustainable financial behavior. Instead, its influence is fully mediated by the users' financial knowledge and access to financial services. These findings underscore the critical importance of capability and access in realizing the behavioral benefits of digital financial tools. The study offers theoretical contributions by extending the technology acceptance model (TAM) and the theory of planned behavior (TPB) within a FinTech context and provides practical implications for inclusive financial policy and literacy-driven innovation strategies.

Keywords: FinTech Adoption, Financial Literacy, Financial Inclusion, Sustainable Financial Behavior, Indonesia
JEL Classifications: M31, C83, 033

1. INTRODUCTION

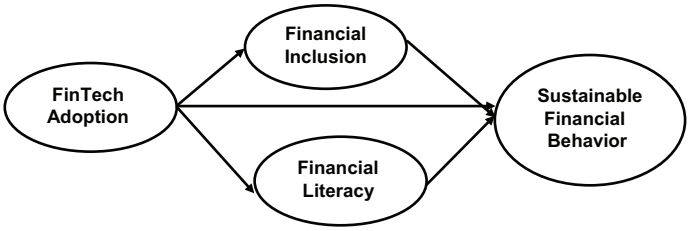
Digital transformation has fundamentally reshaped the landscape of global financial services. One of the most significant outcomes of this transformation is the rapid expansion of financial technology (FinTech) services, which offer faster, more accessible, and cost-efficient financial solutions. In developing countries such as Indonesia, FinTech is increasingly viewed as a strategic tool to address financial access disparities and promote broader financial inclusion. According to Statista (2023), the number of FinTech companies operating in Indonesia surged from 51 in 2011 to 336 in 2023. This growth is accompanied by a significant increase in digital financial transactions.

Data from Bank Indonesia (2024) indicate that digital banking transactions exceeded IDR 5,300 trillion in January 2024, reflecting a 17.2% increase from the previous year. Additionally, QRIS-based payment systems experienced a remarkable 150% increase in transaction volume, involving over 50 million users and transactions valued at IDR 42 trillion. These figures underscore the accelerating adoption of FinTech in Indonesia and its growing influence on consumer financial behavior. Nevertheless, the widespread adoption of FinTech does not automatically translate into improved financial decision-making. The World Bank (2021) reported that Indonesia ranks fourth globally in terms of the unbanked population, with approximately 97.7 million adults lacking access to formal financial institutions. Furthermore, according to the 2022 National Survey on Financial Literacy and Inclusion (OJK, 2022), while Indonesia's financial inclusion index reached 85.10%, the financial literacy index stood at only 49.68%. This gap between access and understanding raises concerns about the potential for ineffective or even harmful financial behaviors, particularly among inexperienced digital finance users.

In the context of sustainable development, promoting sustainable financial behavior has become a global priority. Responsible and informed financial behavior not only enhances individual financial well-being but also contributes to the overall stability of the financial system. The Indonesian government has taken steps to align with green finance objectives through initiatives such as the establishment of IDX Carbon and the development of a national green taxonomy. The country is also exploring international carbon credit markets to support energy transition financing. From a theoretical standpoint, this study draws upon multiple conceptual frameworks. The technology acceptance model (TAM) explains that individuals' acceptance of FinTech is driven by perceived ease of use and perceived usefulness (Davis, 1989; Ryu, 2018). The Theory of Planned Behavior (TPB) posits that financial behavior is shaped by intention, attitudes, and perceived behavioral control (Ajzen, 1991). The OECD's Financial Capability Framework emphasizes the interaction between financial access (inclusion), knowledge (literacy), and personal competencies as key factors in shaping sound financial behavior. Finally, sustainable finance theory highlights the importance of aligning financial behavior with long-term environmental and social goals (UNEP FI, 2019).

Although prior studies have examined the effects of FinTech on either financial inclusion or financial literacy in isolation (Ozili, 2021; Gomber et al., 2017), an integrative model that links FinTech adoption with both financial literacy and inclusion as mediators of sustainable financial behavior remains limited, particularly in the Indonesian context. Therefore, this study seeks to fill that gap by examining the direct and indirect effects of FinTech adoption on sustainable financial behavior, with financial literacy and financial inclusion as parallel mediating variables.

Figure 1: Research framework



2. LITERATURE REVIEW

2.1. FinTech Adoption

FinTech adoption refers to the extent to which individuals accept and actively use financial technologies such as digital banking, e-wallets, P2P lending platforms, and investment apps. The technology acceptance model (TAM) posits that adoption is driven by perceived ease of use and perceived usefulness (Davis, 1989). In developing countries, FinTech adoption has been accelerated by limited physical access to banking infrastructure (Ryu, 2018). Empirical studies (Gomber et al., 2017; Suryono et al., 2021) confirm that FinTech offers a viable means to improve access to financial services for underserved populations. In Indonesia, the increasing penetration of mobile technology has facilitated FinTech growth, yet its influence on long-term financial behavior remains under-researched.

2.2. Financial Inclusion

Financial inclusion refers to the ability of individuals to access and use affordable financial products and services that meet their needs (World Bank, 2021). FinTech can improve inclusion by reducing transaction costs, increasing reach, and offering alternatives to traditional banking (Ozili, 2021). However, inclusion without supporting literacy and behavior change can be superficial. Demirgüç-Kunt et al. (2018) suggest that sustainable financial inclusion requires both access and the ability to use financial tools effectively.

Figure 2: Respondent characters distribution

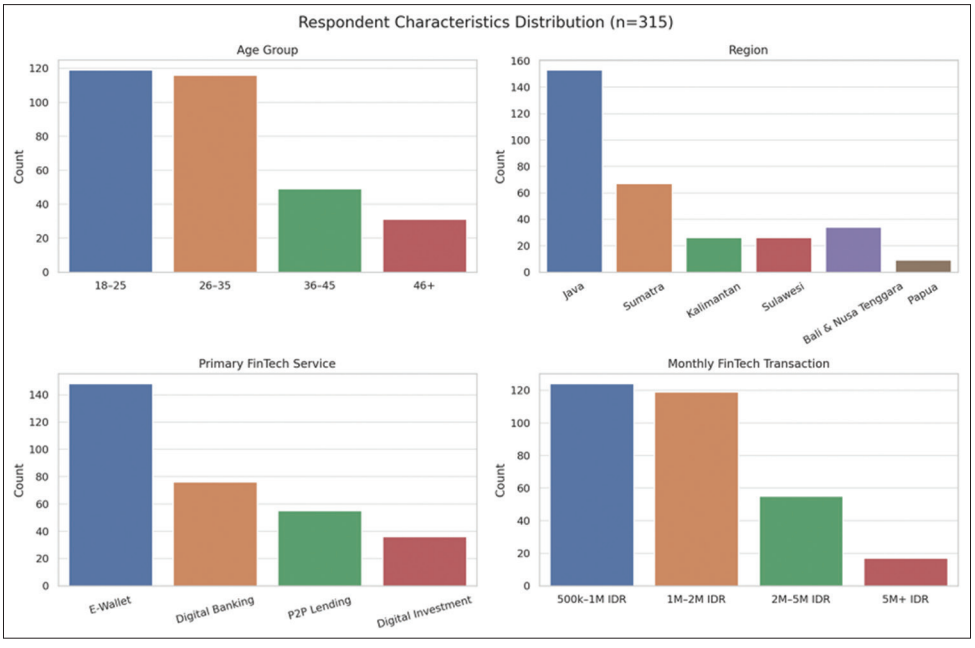


Table 1: Measurement indicators of variables

Variable	Indicator statement	Code	Source
FinTech adoption	I find FinTech usage makes my financial transactions easier	FA1	Ryu (2018)
	I feel comfortable using FinTech applications	FA2	Ryu (2018)
	I believe FinTech services are secure to use	FA3	Ryu (2018)
	I intend to continue using FinTech for financial activities	FA4	Ryu (2018)
Financial inclusion	I have access to formal financial services through FinTech	FI1	Demirgüç-Kunt et al. (2018)
	I use FinTech services for saving, payments, or borrowing	FI2	Demirgüç-Kunt et al. (2018)
	I do not encounter major difficulties in using FinTech services	FI3	Demirgüç-Kunt et al. (2018)
Financial literacy	I understand basic financial concepts such as interest, inflation, and risk	FL1	OECD and INFE (2016)
	I carefully consider my options before making financial decisions	FL2	OECD and INFE (2016)
	I feel confident in managing my personal finances	FL3	OECD and INFE (2016)
	I have a positive attitude toward prudent financial management	FL4	OECD and INFE (2016)
Sustainable financial behavior	I regularly prepare a monthly budget for my expenses	SB1	Lusardi and Mitchell (2014); Xiao and O'Neill (2016)
	I set aside income for savings and future needs	SB2	Lusardi and Mitchell (2014)
	I avoid taking on debt beyond my repayment ability	SB3	Xiao and O'Neill (2016)
	I consider sustainability aspects (e.g., social/environmental impact) in my spending or investment decisions	SB4	Lusardi and Mitchell (2014)

Table 2: Outer loading test

Indicators	FinTech adoption	Financial inclusion	Financial literacy	Sustainable financial behavior
F12		0.907		
FA2	0.598			
FA3	0.840			
FA4	0.869			
FI1		0.838		
FI3		0.908		
FL1			0.886	
FL2			0.846	
FL3			0.879	
FL4			0.923	
SB1				0.888
SB2				0.887
SB3				0.901
SB4				0.742
FA1	0.873			

Source: Output processed using SmartPLS 4.0

2.3. Financial Literacy

Financial literacy encompasses knowledge, skills, attitudes, and behaviors necessary to make informed financial decisions (OECD and INFE, 2016). It is a crucial determinant of financial well-being and long-term sustainability. Research by Lusardi and Mitchell (2014) shows that individuals with higher financial literacy are more likely to plan, save, and avoid over-indebtedness. In a digital finance context, literacy also includes understanding digital risks and optimizing digital tools (Hung et al., 2021). Despite high inclusion rates, Indonesia still struggles with moderate literacy levels (OJK, 2022), pointing to a need for empirical exploration of its mediating role.

2.4. Sustainable Financial Behavior

Sustainable financial behavior is defined as responsible financial decision-making that promotes long-term individual and societal well-being. This includes budgeting, saving, investing ethically, and avoiding unsustainable debt. According to the Theory of Planned Behavior (Ajzen, 1991), behavior is influenced by intention, shaped by attitudes, subjective norms, and perceived behavioral control. Financial literacy and inclusion are hypothesized to strengthen such intentions by increasing confidence and reducing information asymmetry (Atkinson and Messy, 2012; Xiao and O'Neill, 2016).

However, limited research integrates FinTech adoption, financial inclusion, and literacy simultaneously to predict sustainable financial behavior—especially in the Indonesian context. This research aims to fill this gap by proposing a parallel mediation model that captures these interdependencies. This illustrated in the research framework show in picture 1.

Based on the conceptual framework and the supporting theoretical and empirical literature, the following hypotheses are proposed to examine the relationships among FinTech adoption, financial inclusion, financial literacy, and sustainable financial behavior:

H_1: FinTech adoption has a positive effect on financial inclusion.
H_2: FinTech adoption has a positive effect on financial literacy.
H_3: Financial inclusion has a positive effect on sustainable financial behavior.
H_4: Financial literacy has a positive effect on sustainable financial behavior.
H_5: FinTech adoption has a positive effect on sustainable financial behavior.
H_6: Financial inclusion mediates the relationship between FinTech adoption and sustainable financial behavior.
H_7: Financial literacy mediates the relationship between FinTech adoption and sustainable financial behavior.

3. METODOLOGY

This study employs a quantitative explanatory approach to investigate the direct and indirect effects among FinTech adoption, financial inclusion, financial literacy, and sustainable financial behavior. The sample consists of 315 active FinTech users across multiple regions in Indonesia, selected through purposive sampling with proportional representation to ensure demographic and geographic diversity. Respondents were required to have minimum monthly transactions of IDR 500,000 through FinTech platforms, ensuring relevance to the study context. The data were analyzed using structural equation modeling based on partial least squares

(SEM-PLS) with SmartPLS 4.0. This method was chosen due to its suitability for predictive modeling, its robustness in handling complex models with multiple mediators, and its ability to work effectively with relatively moderate sample sizes and non-normal data distributions (Hair et al., 2019). SEM-PLS is also appropriate when the research objective is theory development rather than theory confirmation, which aligns with the exploratory nature of this study in a developing market context. The model evaluation includes tests for convergent and discriminant validity (via AVE, CR, and HTMT), as well as bootstrapping to assess the significance of direct and indirect paths.

The research model comprises four latent constructs: FinTech adoption, financial inclusion, financial literacy, and sustainable financial behavior, all measured using reflective indicators on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

4. RESEARCH RESULTS

4.1. Descriptive Statistic

To provide an overview of the research respondents and contextualize the empirical findings, this section presents the descriptive statistics of the sample. A total of 315 valid responses were obtained from active FinTech users across various regions of Indonesia. The descriptive analysis includes demographic profiles such as age and gender, regional distribution, types of FinTech services used, and the average monthly transaction volume through FinTech platforms.

The descriptive results reveal that the majority of FinTech users in this study are in the 26-35 age group, indicating that digital financial services are predominantly adopted by young working-age adults. In terms of regional distribution, most respondents are concentrated in Java, reflecting both the population density and digital infrastructure advantages in the region. The most commonly used FinTech service is e-wallets, suggesting a preference for fast and practical payment solutions among Indonesian users. Regarding financial activity, most users report average monthly transactions between IDR 500,000 and IDR 2 million, which aligns with daily spending and digital payment behaviors for consumption and routine financial activities. The description of respondents in the study can be seen in Figure 2 which is presented.

4.2. Measurement Model

Before testing the structural relationships among constructs, it is essential to evaluate the measurement model to ensure the reliability and validity of the latent variables. This stage involves assessing indicator loadings, internal consistency reliability, convergent validity, and discriminant validity. The evaluation was conducted using the partial least squares approach through SmartPLS 4.0. Clearly presented in table 2.

The outer loading results show that all indicators meet the minimum threshold of 0.50, with most exceeding 0.70. Indicators such as FA3, FA4, FA1, and all items under financial literacy and sustainable financial behavior demonstrate strong reliability. Although FA2 has a loading of 0.598, it is retained due to its theoretical relevance and does not impair the overall construct validity. Therefore, all measurement items are considered acceptable for further analysis. Following the evaluation of outer loadings, further assessment was conducted to examine the internal consistency and convergent validity of each construct through Cronbach's alpha, composite reliability, and average variance extracted (AVE). The results are presented in Table 3.

The results show that all constructs meet the required thresholds for internal consistency and convergent validity. Cronbach's Alpha and Composite Reliability (both ρa and ρc) values exceed 0.70, indicating high internal consistency. Additionally, all average variance extracted (AVE) values are above 0.50, confirming that each construct explains more than half of the variance in its indicators. These results validate the reliability and convergent validity of the measurement model. To further evaluate the measurement model, discriminant validity was assessed using the Fornell-Larcker criterion, which compares the square root of the AVE of each construct with its correlations to other constructs. The results are presented in Table 4.

The Fornell-Larcker criterion results confirm adequate discriminant validity across all constructs. For each latent variable, the square root of AVE (shown on the diagonal) is greater than the correlations with other constructs (off-diagonal values). This indicates that each construct shares more variance with its own indicators than with other constructs, thus satisfying the condition for discriminant validity.

4.3. Hypothesis Testing

To assess the proposed relationships among constructs, hypothesis testing was conducted using the structural model in SmartPLS 4.0. The analysis includes both direct and indirect effects, with significance determined through the bootstrapping procedure (5,000 resamples). The results of the hypothesis testing, including path coefficients, t-values, and P-values, are presented in the following tables.

The results of the direct effect analysis are summarized in Table 5. The findings show that FinTech adoption significantly influences both financial inclusion ($\beta = 0.640$, $P < 0.001$) and financial literacy ($\beta = 0.681$, $P < 0.001$), supporting H_1 and H_2. Furthermore, financial inclusion ($\beta = 0.265$, $P < 0.001$) and financial literacy ($\beta = 0.669$, $P < 0.001$) both have a significant positive effect on sustainable financial behavior, confirming H_3 and H_4. Interestingly, the direct relationship between FinTech adoption and sustainable financial behavior is not statistically significant ($\beta = -0.017$, $P = 0.655$), indicating that the effect of FinTech adoption on behavior may be indirect—operating through the mediating roles of inclusion and literacy (to be examined in the next section). These results highlight that FinTech alone is insufficient to foster sustainable financial behavior without being accompanied by increased financial access and capability.

The results in Table 6 demonstrate that both financial literacy and financial inclusion significantly mediate the relationship between FinTech adoption and sustainable financial behavior. Specifically, the indirect effect through financial literacy is

Table 3: Construct reliability and validity

Variable	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
FinTech adoption	0.816	0.862	0.877	0.645
Financial inclusion	0.861	0.874	0.915	0.783
Financial literacy	0.907	0.910	0.935	0.782
Sustainable financial behavior	0.878	0.888	0.917	0.734

Source: Output processed using SmartPLS 4.0

Table 4: Discriminant validity

Variable	FinTech adoption	Financial inclusion	Financial literacy	Sustainable financial behavior
FinTech adoption	0.803			
Financial inclusion	0.640	0.885		
Financial literacy	0.681	0.856	0.884	
Sustainable financial behavior	0.608	0.827	0.884	0.857

Source: Output processed using SmartPLS 4.0

Table 5: Correlation testing direct effect

Direct impact	Original sample	Sample mean	Standard deviation	T statistics	P-values	Information
FinTech adoption -> financial inclusion	0.640	0.635	0.060	10.592	0.000	Accepted
FinTech adoption -> financial literacy	0.681	0.673	0.063	10.841	0.000	Accepted
Financial inclusion -> sustainable financial behavior	0.265	0.267	0.041	6.440	0.000	Accepted
Financial literacy -> sustainable financial behavior	0.669	0.666	0.045	14.854	0.000	Accepted
FinTech adoption -> sustainable financial behavior	-0.017	-0.018	0.038	0.447	0.655	Not accepted

Source: Output processed using SmartPLS 4.0

Table 6: Correlation testing Indirect Effect

Indirect impact	Original sample	Sample mean	Standard deviation	T statistics	P-values	Information
FinTech adoption -> financial literacy -> sustainable financial behavior	0.455	0.448	0.053	8.598	0.000	Accepted
FinTech adoption -> financial inclusion -> sustainable financial behavior	0.170	0.169	0.031	5.535	0.000	Accepted

Source: Output processed using SmartPLS 4

statistically significant ($\beta = 0.455$, $t = 8.598$, $P < 0.001$), indicating a strong mediating role in translating FinTech usage into long-term financial responsibility. Likewise, the path through financial inclusion is also significant ($\beta = 0.170$, $t = 5.535$, $P < 0.001$), supporting the hypothesis that access to financial services facilitates behavioral change. These findings confirm that the influence of FinTech adoption on sustainable financial behavior occurs indirectly, through the enhancement of financial capability and access, rather than through a direct path. Thus, H_6 and H_7 are supported, reinforcing the importance of building inclusive and literate digital financial ecosystems.

5. DISCUSSION

The results of this study indicate that FinTech adoption, while significantly associated with financial literacy and inclusion, does not have a direct influence on sustainable financial behavior. This finding suggests that the mere use of FinTech does not automatically translate into responsible financial actions, especially in emerging market contexts such as Indonesia. Rather, it is the indirect pathways—through enhanced access and increased understanding—that explain behavioral outcomes. This supports earlier claims by Demirgüç-Kunt et al. (2018) and OECD and INFE (2016), who argued that access to financial tools must be complemented by the capability to use them effectively. In the Indonesian setting, where financial education remains uneven and digital access varies across regions (World Bank, 2021), FinTech adoption may be growing, but its capacity to transform financial behavior depends largely on how well users understand and engage with the technology.

The strong mediating effect of financial literacy confirms the critical role of cognitive factors in financial decision-making, in line with studies by Lusardi and Mitchell (2014) and Xiao and O'Neill (2016). These scholars emphasize that individuals with higher financial literacy are more likely to plan, save, and avoid debt—behaviors aligned with the concept of financial sustainability. Therefore, FinTech's effectiveness hinges not only on its accessibility, but on how it enhances user knowledge and decision quality. The mediation effect of financial inclusion further confirms that access alone can influence behavioral outcomes, although not as strongly as literacy. This is consistent with findings by Ozili (2021), who noted that inclusion must be meaningful—not just in terms of access, but in usability and user relevance. The construct of "functional inclusion" may be more appropriate in

this context, where simply having access is not enough unless it leads to productive and sustainable financial participation.

The insignificant direct path from FinTech adoption to sustainable behavior also aligns with theoretical expectations from the theory of planned behavior (TPB), which postulates that behavior is not determined solely by external tools, but by internalized attitudes, subjective norms, and perceived control. In this case, FinTech functions as a platform, not a determinant, and its impact is realized only when filtered through the user's financial knowledge and access conditions. Therefore, this research extends the discourse in digital financial behavior by proposing an ecosystem-based view: that FinTech success should be judged not merely by usage metrics, but by the behavioral outcomes it facilitates, particularly in the domains of financial sustainability, resilience, and long-term well-being.

6. CONCLUSION

This study concludes that FinTech adoption does not directly influence sustainable financial behavior, but exerts a significant indirect effect through financial literacy and financial inclusion as mediating variables. These findings highlight that the widespread adoption of digital financial services, while expanding access and convenience, is not sufficient on its own to drive behavioral transformation. Instead, the effectiveness of FinTech in promoting sustainable financial behavior depends largely on users' financial capability and access to inclusive financial systems. Theoretically, this research strengthens the view that models such as the technology acceptance model (TAM) and the theory of planned behavior (TPB) need to be contextually adapted for the digital finance landscape in emerging markets, by incorporating literacy and inclusion as essential mediating factors. Practically, the findings underscore the need for integrated policies that align technological innovation with financial education and equitable access, ensuring that digital transformation leads to meaningful improvements in financial well-being and long-term sustainability.

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