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The role of women's perceived empowerment in sustaining mobile banking engagement: Evidence from rural Indonesia

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ABSTRACT

Digital financial inclusion aims to ensure equitable access to financial services; however, rural women continue to face structural, cultural, and psychological barriers that limit their ability to adopt and sustain mobile banking usage. This study extends the Theory of Planned Behavior (TPB) by incorporating Perceived Women's Empowerment (PWE) as both a direct predictor and a moderating variable influencing long-term digital financial engagement. A quantitative approach using Partial Least Squares Structural Equation Modeling (PLS-SEM) was conducted on data collected from 420 rural women mobile banking users in Indonesia. The measurement and structural models demonstrated strong reliability, validity, and significant relationships among all hypothesized paths. Attitude toward technology ($\beta = 0.199$), subjective norm ($\beta = 0.164$), and perceived behavioral control ($\beta = 0.487$) significantly predicted behavioral intention. Behavioral intention strongly influenced continuous usage ($\beta = 0.470$), which subsequently had a major impact on digital financial inclusion ($\beta = 0.742$). Perceived women's empowerment directly affected usage patterns ($\beta = 0.141$) and significantly strengthened the relationship between behavioral intention and continuous usage. The findings highlight empowerment as a critical behavioral catalyst that enables rural women to move from basic digital access toward meaningful and sustained financial engagement. The proposed framework emphasizes the need for gender-sensitive financial inclusion strategies that build psychological readiness and agency, allowing policymakers and practitioners to design more inclusive and effective digital financial systems for developing regions.

Contribution/Originality: This study contributes to the existing literature by integrating empowerment into TPB for digital finance. This study uses robust PLS-SEM methodology. This study is among the few examining rural women's sustained mobile banking behavior. The paper's primary contribution is finding that empowerment significantly strengthens intention-behavior pathways.

1. INTRODUCTION

Mobile banking services have quickly spread throughout developing countries, yet rural women encounter major differences between their ability to start using these services and their ability to maintain ongoing usage. Long-term digital financial services adoption faces essential non-technical obstacles because women lack financial literacy and digital skills, and because cultural norms limit their ability to make financial decisions (Colpo, Rabenschlag, De Lima, Martins, & Sellitto, 2022). The social rules that follow gender norms, together with insufficient infrastructure design,

result in distinct usage behaviors and user maintenance levels between male and female users (Tay, Tai, & Tan, 2022). The Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB) explain why people first adopt technology, but these models do not account for the behavioral and environmental factors that influence continued use in marginalized communities (Alnemer, 2022). Research should focus on studying the psychological elements of rural women and their level of empowerment to develop behavioral models that are inclusive of all users (Ali & Puntoni, 2016). Research shows that digital literacy programs combined with financial education enable women to gain better financial inclusion because these programs help them develop money management skills and decision-making abilities (Bhatia & Singh, 2019). Financial inclusion strategies that respond to gender needs establish permanent pathways for women to participate in household and community activities.

The research and studies have built upon this base to explore the emergence of financial accessibility as supported by financial literacy and digital competence through empowerment. Al-Shami, Damayanti, Adil, Farhi, and Al Mamun (2024) suggest that individuals who understand economics and technology are more likely to adopt digital financial services, which encourages their continued use of these services. Kumari, Giri, and Saruparia (2025) demonstrate that women require financial literacy training with digital tools to become empowered. Specific programs help women gain economic independence and join the workforce. Research indicates that mobile banking adoption necessitates a unified approach combining behavioral models with empowerment constructs to accurately analyze rural mobile banking usage behaviors. The Theory of Planned Behavior (TPB) and Technology Acceptance Model (TAM) serve as essential frameworks for technology adoption, yet they need to incorporate empowerment as an additional element to fully explain user conduct patterns.

Ajzen's (1991) Theory of Planned Behavior (TPB 1991) functions as the overarching framework supporting this study. According to TPB, behavioral intention is regarded as the closest predictor of actual behavior, and this intention is determined by three core components: attitude toward the behavior (ATT), subjective norm (SN), and perceived behavioral control (PBC). Mobile banking relies on these constructs because users evaluate technology, social standards, and their digital platform capabilities when making choices. The study employs ATT to assess user opinions about mobile banking services, SN to reflect the influence of family, peers, and community standards, and PBC to measure users' self-assessed ability to utilize mobile banking services. Behavioral Intention (BI) serves as the primary link that allows antecedents to influence Continuous Usage (CU) and promotes Digital Financial Inclusion (DFI). While previous research on mobile banking adoption has primarily utilized TAM and TPB models to examine initial adoption, these models do not adequately explain how rural women sustain their mobile banking behaviors over time. Existing financial decision models often overlook psychological empowerment, which is essential because individuals require control and agency to participate effectively in financial activities (Al-Shami et al., 2024). The gap between access to technology and ongoing usage presents a significant challenge, as consistent technology use is crucial for achieving meaningful inclusion outcomes. Furthermore, current research has not explored the moderating role of empowerment within the TPB framework, and no empirical studies have tested this relationship.

The research fills this knowledge gap through its implementation of Perceived Women Empowerment (PWE) as both a direct variable and a moderating factor within the Theory of Planned Behavior (TPB) framework. The proposed model meets the requirement for context-specific models, which Neves, Oliveira, Santini, and Gutman (2023) and other researchers have supported. The research by Yang, Huang, and Gao (2022) and Yang, Wu, and Huang (2023) examines how empowerment affects mobile banking intention and long-term usage through behavioral evaluation. The financial systems require immediate design modifications to reflect the everyday experiences of rural women who need digital access for empowerment. The study investigates how rural women sustain mobile banking services based on their self-perceived empowerment status, addressing an essential knowledge gap in academic research. It builds upon the Theory of Planned Behavior (TPB) framework by incorporating empowerment as a behavioral construct, resulting in a new approach to digital financial inclusion. The research explores the financial needs of rural areas in developing nations, as standard financial discussions often overlook these requirements. The

findings aim to develop new conceptual frameworks and operational tools for financial systems, enhancing system value delivery to users and promoting their ongoing engagement. The research design seeks to improve understanding of behavioral adaptation in digital spaces and to develop financial systems that provide equitable services to all users.

The research bases its investigation on this conceptual framework to test the extended TPB model through the addition of Perceived Women Empowerment (PWE) as a behavioral construct. The research establishes operational guidelines through specific objectives and testable hypotheses, which direct the study. The research design includes components that measure empowerment effects directly and as moderators of traditional TPB variables to study mobile banking behavior among rural women.

1.1. Research Objectives

1. To examine the influence of attitude, subjective norm, and perceived behavioral control on behavioral intention to use mobile banking services.
2. To assess the effect of behavioral intention on continuous mobile banking usage and its impact on digital financial inclusion.
3. To evaluate the direct role of perceived women's empowerment in sustaining mobile banking engagement.
4. To analyze the moderating effect of perceived women's empowerment on the relationship between behavioral intention and continuous usage.

1.2. Research Hypotheses

H_1: Attitude toward mobile banking positively influences behavioral intention.

H_2: Subjective norm positively influences behavioral intention.

H_3: Perceived behavioral control positively influences behavioral intention.

H_4: Behavioral intention positively influences continuous usage.

H_5: Perceived women's empowerment moderates the relationship between behavioral intention and continuous usage.

H_6: Continuous usage positively influences digital financial inclusion.

2. LITERATURE REVIEW

Ajzen (1991) developed the Theory of Planned Behavior (TPB), which serves as a comprehensive model for studying human conduct in various contexts, including technology acceptance. The Theory of Planned Behavior (TPB) demonstrates that actual behavior results from behavioral intention, influenced by three essential factors: Attitude Toward the Behavior (ATT), Subjective Norm (SN), and Perceived Behavioral Control (PBC). These three constructs represent how individuals evaluate the value of the behavior, social norms, and their personal belief in their ability to perform the behavior.

Research in digital finance uses TPB to study how people interact with financial technology systems, especially when they face psychological and structural obstacles (Ly & Ly, 2022). Mobile banking adoption depends on how users perceive the service's usefulness and accessibility, as well as its level of security, which ATT measures. Social Network (SN) research shows that family, peer groups, and community standards have the most influence on financial behavior in collectivist societies because financial conduct in these societies functions within established social systems (Cucinelli, Gandolfi, & Soana, 2017; Elouaourti & Ibourk, 2024). PBC encompasses users' digital competencies and resource availability, which together shape their confidence in navigating financial platforms (Alnemer, 2022). The three antecedents create Behavioral Intention (BI) that leads to Continuous Usage (CU), which results in Digital Financial Inclusion (DFI), according to Hong et al. (2022) as active digital financial system participation. The current applications of TPB and TAM focus on first-time adoption, yet they fail to consider how social psychological elements affect long-term usage among disadvantaged groups, including rural women. The research fills this knowledge gap

through its extension of TPB by using Perceived Women Empowerment (PWE) as both a direct predictor and a moderating variable. The theory of empowerment bases its definition of psychological agency on financial literacy, digital skills, and decision-making autonomy, which together determine behavioral engagement (Al-Shami et al., 2024).

Research evidence shows that empowerment is a fundamental component driving digital financial systems, according to scientific findings. Women who understand finance and digital skills tend to use mobile banking services, start their own businesses, and achieve superior financial results (Yang et al., 2022). The research team of Tay et al. (2022) measures behavioral engagement through user interaction duration, platform usage time, service variety, and transaction counts. DFI requires an active approach for its definition rather than being treated as a fixed state. The research applies PWE to the TPB framework to address the need for models that recognize the daily realities of underprivileged populations (Neves et al., 2023). The framework provides comprehensive information about rural women's mobile banking behavior by explaining empowerment as a behavioral motivator that enables them to use mobile banking services for financial activities.

2.1. Hypothesis Conceptualization

The research bases its six hypotheses on the Theory of Planned Behavior (TPB) to analyze rural women's mobile banking service adoption. The research hypotheses derive from theoretical models and existing scientific evidence to address the current models' inability to measure long-term commitment and empowerment elements.

2.1.1. Attitude Toward Technology (ATT)

The Theory of Planned Behavior (TPB) is based on Attitude as a core element, which indicates how individuals evaluate specific behaviors. The adoption of mobile banking depends on perceptions of its usefulness, security, and accessibility, as stated by Ly and Ly (2022). Rural areas benefit most from positive perceptions, according to Ramayanti, Rachmawati, Azhar, and Azman (2024), because skepticism towards digital platforms persists in these regions. People's behavioral intentions are influenced by their attitudes, which serve as their motivational force.

H_1: Attitude Toward Technology contributes positively to behavioral intention to utilize mobile banking services.

2.1.2. Subjective Norm (SN)

Subjective norm refers to perceived social pressure to perform or not perform a behavior. In collectivist rural communities, social referents such as family, peers, and community leaders exert strong influence over individual decisions (Cucinelli, Palozzi, & Polizzi, 2017). The research of Elouaourti and Ibourk (2024) shows that normative support makes mobile banking more acceptable and decreases psychological barriers to adoption. Social endorsement functions as a key factor that determines intention in situations where community values hold the most influence.

H_2: Subjective Norm positively affects Behavioral Intention to utilize mobile banking.

2.1.3. Perceived Behavioral Control (PBC)

Perceived behavioral control captures individuals' beliefs about their capacity to perform a behavior. Digital finance requires users to trust their ability to handle mobile interfaces, perform transactions, and solve problems. Sathye (1999) established that mobile banking adoption depends on how users perceive the system's ease of use and their sense of control. The study by Alnemer (2022) demonstrates that perceived competence serves as the main solution to address the dual issues of psychological and infrastructural challenges faced by rural areas with low literacy levels. PBC thus reflects self-efficacy in digital engagement.

H_3: Perceived Behavioral Control positively affects Behavioral Intention to utilize mobile banking.

2.1.4. Behavioral Intention (BI)

Behavioral intention is the immediate antecedent of actual behavior in TPB. Ajzen (1991) describes intention as a motivational element that indicates the likelihood of someone performing an action. Panchasara, Shah, and Singh (2019) confirm that, in digital contexts, intention reliably forecasts sustained usage. Mobile banking requires users to connect their natural tendencies toward banking with continuous platform interaction, which serves as the essential foundation for behavioral transformation.

H_4: Behavioral Intention positively influences Continuous Usage of mobile banking services.

2.1.5. Perceived Women Empowerment (PWE)

The fundamental components of empowerment theory consist of agency, autonomy, and control, which motivate human conduct (Ali & Puntoni, 2016). Research shows that women who achieve financial autonomy, decision-making confidence, and digital competence demonstrate better engagement with financial services (Al-Shami et al., 2024). Neves et al. (2023) support moderation analysis to demonstrate the relationship between empowerment and behavioral pathways. The research shows that PWE helps users achieve long-term usage of the app in regions with restricted access.

H_5: Perceived women's empowerment moderates the relationship between behavioral intention and continuous usage, strengthening the link at higher levels of empowerment.

2.1.6. Continuous Usage and Digital Financial Inclusion (DFI)

Digital financial inclusion requires more than basic access, as users must actively utilize digital financial services with purpose. Hong, Tian, and Wang (2022) demonstrate that users who remain engaged with financial services through continuous usage experience better well-being due to their access to these services. The UNSGSA (2023) predicts that the long-term adoption of digital financial services will foster inclusive outcomes that contribute to achieving the SDGs. Therefore, continuous usage is conceptualized as a behavioral gateway to financial inclusion.

H_6: Continuous Usage positively influences Digital Financial Inclusion.

The research establishes these hypotheses to fill a significant knowledge gap in TPB studies because most TPB research fails to consider empowerment and sustained behavioral commitment among disadvantaged groups. The framework provides a better understanding of digital financial inclusion for rural women because it conducts analysis through specific contexts while recognizing gender-based differences.

3. METHODOLOGY

The following section explains the research methodology, which investigates how rural women perceive their empowerment status to affect their mobile banking usage patterns based on their behavioral intentions. The research uses quantitative methods from the Theory of Planned Behavior (TPB) to study digital financial inclusion empowerment variables. The research design unites empirical power with particular concepts and appropriate methods to study how mobile banking usage differs between male and female users.

3.1. Research Philosophy and Design

The research employs a positivist methodology to study social events as measurable data, which scientists analyze through experiments and statistics. The study benefits from positivism because it enables researchers to establish cause-and-effect relationships and generate findings applicable to multiple population groups (Ajzen, 1991). The research design utilizes survey-based quantitative methods through a cross-sectional study to collect data at a single point in time.

Scientists employ this research design to analyze variables in actual environments through hypothesis testing for relationship assessment.

The conceptual framework in Figure 1 integrates TPB components: Attitude Toward Technology, Subjective Norm, Perceived Behavioral Control, and Behavioral Intention, with additional variables: Perceived Women Empowerment (PWE) and Digital Financial Inclusion (DFI). The framework illustrates theoretical connections and moderating factors that researchers will use to conduct their empirical study. The research defines each construct through established measurement indicators, utilizing standardized survey tools for detailed statistical analysis. The inclusion of Figure 1 aids researchers in understanding the theoretical connections and directional predictions that form the basis of this study. The research section employs structural equation modeling (SEM) to validate theoretical concepts through empirical evidence based on this framework.

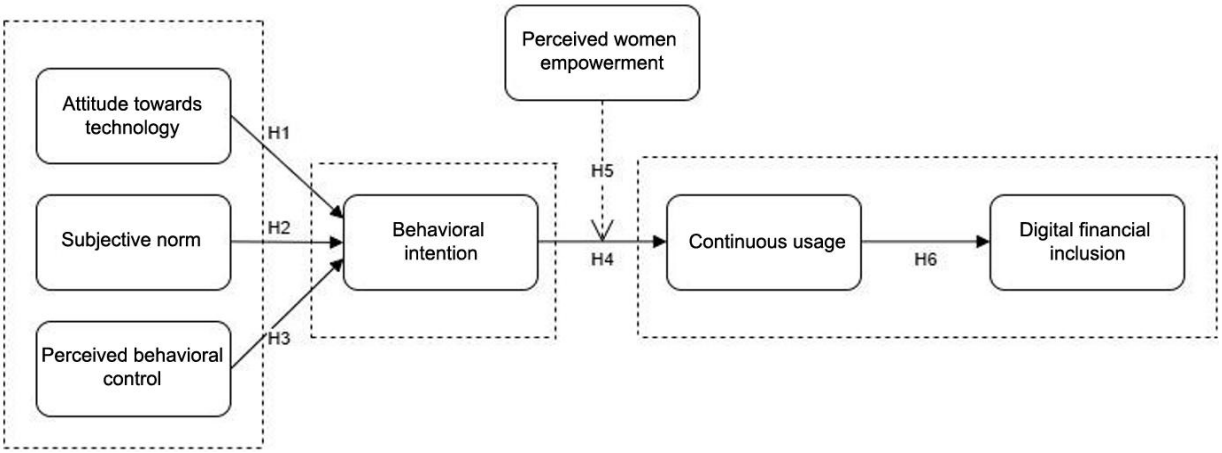

Figure 1. TPB for digital financing inclusion.

The research employs the Theory of Planned Behavior (TPB) and the Technology Acceptance Model (TAM) as its theoretical foundation because these models have demonstrated effectiveness in digital finance research (Ly & Ly, 2022). The TPB explains how behavioral intention develops through three core components: Attitude Toward Behavior, Subjective Norm, and Perceived Behavioral Control (Ajzen, 1991). TAM builds upon this framework to demonstrate that users select technology based on their perceptions of its functionality and user-friendliness. The study incorporates Perceived Women's Empowerment (PWE) as a modifying factor into TPB to explore why rural users continue to use mobile banking services.

3.2. Population and Sampling Strategy

The study investigates rural Indonesian women who use mobile banking because they represent the essential group to address digital financial exclusion between men and women and urban and rural areas (Tay et al., 2022). Rural women encounter multiple barriers to digital financial platform engagement due to their limited access to technology, low digital skills, and disadvantaged economic position. These barriers hold strategic significance for this population group; however, digital finance research has not adequately studied them. The research goals required participants to be selected through purposive sampling methods. This non-probability method is appropriate for research focusing on specific, hard-to-reach groups that possess unique characteristics relevant to the inquiry. The research participants needed to fulfill three requirements: being female, residing in rural areas, and having experience with mobile banking services. The research design enabled researchers to study user behavior among individuals experiencing the intersection of gender identity, geographic location, and digital financial services usage.

The survey was conducted over three months across multiple rural regions in Indonesia. The survey instrument used Bahasa Indonesia as its language to guarantee both cultural and linguistic understanding, which resulted in better participant understanding and more dependable responses. A total of 420 valid responses were obtained, exceeding the minimum sample size of 286 as determined by Cochran's (1977) formula for statistical power. The

research design selects a participant number that meets the requirements for Partial Least Squares Structural Equation Modeling (PLS-SEM) to study intricate models with moderating variables (Hair, Risher, Sarstedt, & Ringle, 2019).

3.3. Instrumentation and Variable Operationalization

The research employed a structured questionnaire that incorporated proven measurement tools from previous studies to evaluate seven core constructs, including Attitude Toward Behavior, Subjective Norm, Perceived Behavioral Control, Behavioral Intention, Perceived Women's Empowerment, Continuous Usage, and Digital Financial Inclusion. The survey utilized a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), to measure participants' opinions regarding mobile banking and empowerment, as well as their demographic details such as age, education level, occupation, and residential area. The research instrument was based on established theoretical frameworks and included validated measurement instruments, ensuring both construct validity and operational precision (Maune, Nyamwange, & Mumba, 2021; Panchasara et al., 2019). The research on Subjective Norm examined how family members, peers, and community members influence mobile banking decisions, as social networks shape human actions (Cucinelli, Gandolfi, et al., 2017). Mobile banking service usage depends on three elements of Perceived Behavioral Control, which include resource availability, digital skills, and platform navigation ability (Sathye, 1999). The Theory of Planned Behavior demonstrates that behavioral intention serves as the main factor driving people to perform actual behavior (Ajzen, 1991; Ramayanti et al., 2024).

The three dimensions of Perceived Women's Empowerment (PWE) include financial literacy, autonomous financial decision-making, and digital competency, which help women overcome financial challenges to gain more power in their homes and business activities (Al-Shami et al., 2024). The outcome variable, Continuous Usage (CU), evaluates mobile banking engagement through three elements: service access frequency, platform duration, and transaction variety (Tay et al., 2022). The study by Hong et al. (2022) and Digital financial inclusion measures mobile banking success through service reach and adoption statistics, which prove its effectiveness in changing rural areas with restricted access.

3.4. Design of the Questionnaire and Data Collection Procedures

The researchers used an online digital platform to distribute their survey instrument because it allowed them to contact numerous participants at a reduced cost. A small number of participants participated in the preliminary test to identify unclear points, which resulted in better clarity of the instrument. The pre-test feedback led to small modifications to wording and structure, improving the reliability and validity of the final instrument. The data collection process lasted for the entire duration of four weeks. The survey participants joined voluntarily while receiving promises of complete confidentiality and anonymity protection. The researchers obtained 420 complete responses, which underwent screening for data quality before starting the analysis process.

3.5. Data Analysis Methodology

The research employed Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 to analyze data, aligning with the exploratory research design and theoretical framework. PLS-SEM was selected due to its flexible methodology, supporting both reflective and formative constructs, and its strong performance with limited samples and non-normal data distributions, which is suitable for behavioral studies of marginalized groups (Hair et al., 2019). The study extended the Theory of Planned Behavior (TPB) by incorporating Perceived Women's Empowerment (PWE) as a moderating factor, enabling the examination of direct causal paths and combined effects on mobile banking usage. The analytical process involved a two-stage approach: initially, Cronbach's Alpha, Composite Reliability, AVE, and outer loadings were used to establish internal consistency and convergent validity of the measurement model; subsequently, the Fornell-Larcker criterion and HTMT ratio (Fornell & Larcker, 1981)

were employed to assess discriminant validity. Path coefficient analysis, combined with bootstrapping, was utilized to validate the structural model through interaction terms and slope analysis, providing insights into PWE's influence on behavioral intention (Neves et al., 2023). The study generated quantitative data on digital financial inclusion for rural women, which developers used to enhance financial technology systems and behavioral models aimed at empowerment.

4. RESULTS

The quantitative analysis section presents research findings on how Perceived Women Empowerment (PWE) influences rural mobile banking adoption through the constructs of the Theory of Planned Behavior. The study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 software to analyze the data because this method is suitable for complex models containing both formative and reflective constructs, and it handles non-normal data and small sample sizes (Hair et al., 2019). The research used 420 valid responses from rural women mobile banking users to determine the appropriate sample size for statistical analysis. The research model results follow a structured format, beginning with the validation of the measurement model's psychometric properties before evaluating its structural relationships and testing hypotheses.

4.1. Sample Descriptive Statistics

The research depends on sample demographics to understand the habit constructs that this study investigates. The research selected 420 rural women who use mobile banking services through purposeful sampling because it focused on digital financial inclusion for marginalized groups. The study investigates rural women because they remain outside conventional financial networks due to their distant location, limited access to infrastructure, and cultural restrictions. The research sample contains participants from various age groups, educational backgrounds, and income levels, which enables researchers to study behavioral patterns between different subgroups. The research sample meets the structural equation modeling requirements, resulting in enhanced statistical power and more applicable study results. The study population characteristics match the research site, making it suitable for developing financial inclusion plans that address gender inequality.

Table 1. Demographic profile of rural women mobile banking users in Indonesia.

Categorized	Detail	Number	%
Gender	Female	420	100%
Geographic Location	Aceh	368	87.9%
	West Sumatera	14	3.3%
	North Sumatera	13	3.1%
	West Java	13	3.1%
	Riau	10	2.4%
	South Sulawesi	1	0.1%
	South Kalimantan	1	0.1%
Age	Under 20 years old	6	1%
	21-30 years old	143	34%
	31-40 years old	201	48%
	41-50 years old	60	14%
	Over 50 years old	10	3%
Educational Background	Elementary School	34	8%
	Junior High School	46	11%
	Senior High School	189	45%
	Undergraduate	147	35%
	Others	4	1%
Occupation	Trader	210	50%
	Employee	101	24%
	Farmer/Fisherman/Gardener	76	18%
	Housewife	25	6%
	Others	8	2%

As detailed in Table 1, the majority of participants in the study belonged to the 31 to 40 age range, which made up 48% of the total sample, while participants aged 21 to 30 years accounted for 34%. The age distribution in this study includes working adults who use financial technology for managing their households and operating small businesses. The research includes participants from both younger and older age groups, specifically under 20 years and above 50 years, which broadens the range of behavioral data collection. The data about age groups helps in creating digital literacy programs targeted at specific life stages, as it demonstrates how mobile banking adoption and usage patterns evolve throughout different periods of life. The survey participants exhibited high educational achievement, with 45% having completed senior high school and 35% holding undergraduate degrees. Individuals who complete formal education tend to develop digital financial literacy competencies, including mastering platform operations, assessment, and usage techniques. The research indicates that individuals with elementary and junior high school education require tailored design solutions and outreach programs that match their reading comprehension levels. The study supports the TPB model because users' educational backgrounds influence their ability to navigate digital financial environments and their confidence in using these systems.

The study benefits from occupational data, which provides supplementary information about participant activities. The research participants consisted of 50% traders, 24% employees, 18% farmers/fishers/gardeners, 6% housewives, and 2% other occupations. Mobile banking functions as an essential resource for rural women because they perform multiple financial responsibilities in their various work roles. Mobile banking demonstrates high potential to retain traders and micro-enterprise members because they conduct many transactions and handle their finances independently. The occupational distribution among participants shows connections to empowerment elements because work-based economic activities help people acquire decision-making authority and financial autonomy, which are central to this research.

4.2. Model Assessment

The structural model analysis in Figure 2 demonstrates robust empirical evidence supporting the expanded Theory of Planned Behavior (TPB) framework for digital financial inclusion studies among rural women. The model exhibited high explanatory power, with all path coefficients between latent constructs reaching statistical significance at $p < 0.001$, with values ranging from 0.141 to 0.742. The diagram indicates that Attitude Toward Behavior ($\beta = 0.199$), Subjective Norm ($\beta = 0.164$), and Perceived Behavioral Control ($\beta = 0.487$) all had significant effects on Behavioral Intention, thereby supporting the core elements of TPB. The research suggests that users are likely to adopt mobile banking services based on their individual evaluation of the service and their perception of how others view it.

The structural framework in Figure 2 demonstrates that Perceived Women Empowerment (PWE) directly influences Behavioral Intention with a path coefficient of 0.141. The research findings indicate that women require financial decision-making autonomy and agency to attain their goals. Integrating PWE into the Theory of Planned Behavior (TPB) framework enables women to control their financial choices, which leads to higher adoption rates of digital financial services, consistent with the Empowerment theory. The model reveals that Behavioral Intention is a strong predictor of Continuous Usage ($\beta = 0.470$), which confirms that intention effectively predicts user engagement. Additionally, the research shows that Digital Financial Inclusion outcomes improve more significantly from Continuous Usage ($\beta = 0.742$) than from mere financial service access, as users who sustain their financial service usage achieve superior financial inclusion results.

The measurement model achieves reliability and validity through the factor loadings that connect latent constructs to their indicators, as shown in Figure 2. The observed variables demonstrate strong relationships with their corresponding latent variables, which proves both internal consistency and discriminant validity. The visual presentation enables readers to grasp the model better while strengthening the evidence supporting the proposed framework. Research indicates that digital financial inclusion requires more than infrastructure access because users

need behavioral commitment, psychological empowerment, and ongoing participation. The study provides new insights into the field by demonstrating that empowerment functions as a fundamental element and a dominant factor, indicating that financial inclusion programs must evolve from basic technological solutions to support users' mental growth.

The research supports financial system development through user empowerment initiatives, which should include community-based training programs, peer support networks, and user-friendly digital platforms. Financial institutions and fintech providers should focus on improving user trust and control perception because this approach leads to better user retention and increased customer engagement. The structural model presented in Figure 2 offers a complete, evidence-based framework to study behavioral factors that influence digital financial inclusion among disadvantaged groups.

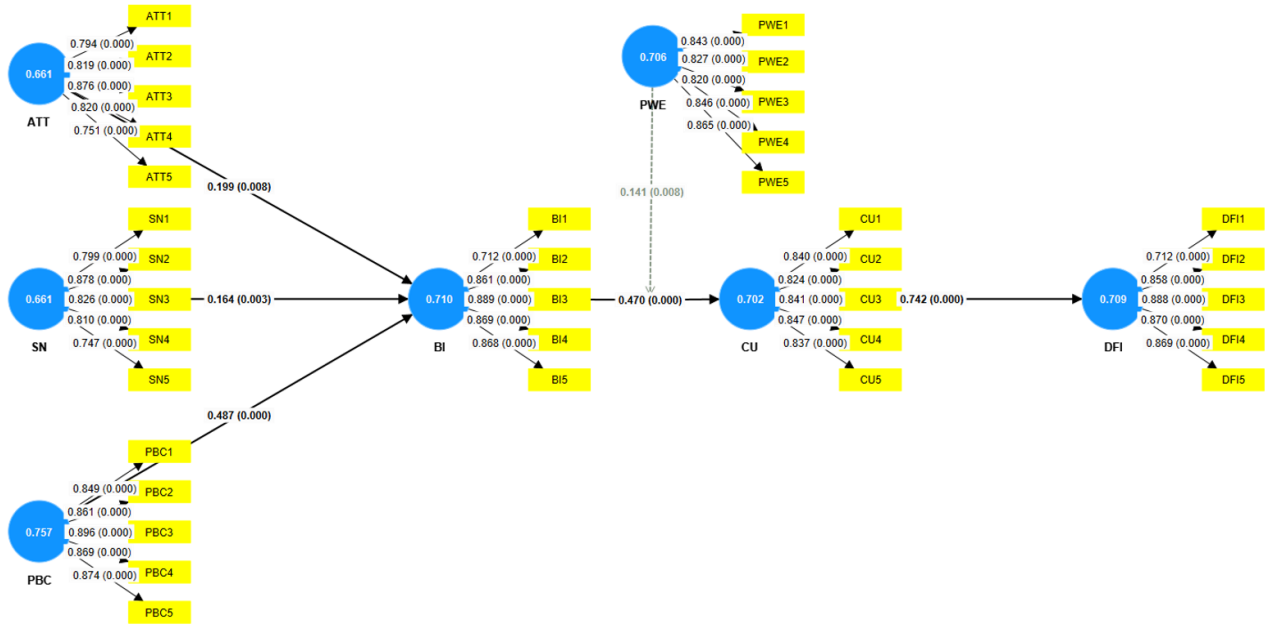

Figure 2. Structural equation model assessing behavioral drivers of mobile banking engagement and digital financial inclusion among rural women.

4.3. Divergent Validity

HTMT analysis will be used to check the discriminant validity of latent constructs in the proposed structural model, which demonstrates their conceptual separation. The Heterotrait-Monotrait Ratio (HTMT) serves as a reliable criterion for variance-based structural equation modeling, according to Henseler, Ringle, and Sarstedt (2015). The method provides the most effective results for models with closely related constructs because it offers a more precise evaluation than using cross-loadings or the Fornell-Larcker criterion separately.

As presented in Table 2, the HTMT values for all construct pairs, including Attitude Toward Technology (ATT), Behavioral Intention (BI), Continuous Usage (CU), Digital Financial Inclusion (DFI), Perceived Behavioral Control (PBC), Perceived Women Empowerment (PWE), Subjective Norm (SN), and the interaction term between PWE and BI (PWE × BI), fall below the recommended threshold of 0.85. The results indicate that each construct exists independently from the others because they do not share common conceptual elements, which validates the discriminant validity of the measurement model. The model includes the interaction term (PWE × BI) to enhance its theoretical foundation by allowing the analysis of moderating effects while maintaining the clarity of its constructs. The HTMT analysis provides a solid basis for evaluating the structural model and testing its hypotheses.

Table 2. Discriminant validity of latent constructs based on the Heterotrait-Monotrait (HTMT) ratio.

	ATT	BI	CU	DFI	PBC	PWE	SN
ATT							
BI	0.736						
CU	0.401	0.521					
DFI	0.280	0.429	0.819				
PBC	0.810	0.821	0.495	0.404			
PWE	0.382	0.518	0.268	0.232	0.406		
SN	0.721	0.734	0.435	0.307	0.840	0.424	
PWE x BI	0.194	0.317	0.057	0.036	0.160	0.621	0.201

Note: Attitude Toward Technology (ATT), Behavioral Intention (BI), Continuous Usage (CU), Digital Financial Inclusion (DFI), Perceived Behavioral Control (PBC), Perceived Women Empowerment (PWE), Subjective Norm (SN).

The HTMT analysis indicates that the extended TPB model maintains strong discriminant validity, as all inter-construct correlations remain below the conservative threshold of 0.85. The highest correlations observed are between SN and PBC (0.840), BI and PBC (0.821), and CU and DFI (0.819), which suggest moderate conceptual similarity but are within acceptable limits, supporting their empirical separation. The TPB framework aligns with the theoretically expected relationships, including between BI and SN (0.734), ATT and BI (0.736), and ATT and SN (0.721), all demonstrating moderate strength.

Table 3. Reliability and Convergent Validity of Latent Constructs in the Extended TPB Framework.

Variable	Items	Factor loading	CA (>0.7)	CR (rho_a)	CR (rho_c)	AVE (>0.5)
Attitude toward technology	ATT1	0.794	0.871	0.876	0.907	0.661
	ATT2	0.819				
	ATT3	0.876				
	ATT4	0.820				
	ATT5	0.751				
Behavioral intention	BI1	0.712	0.897	0.911	0.924	0.710
	BI2	0.861				
	BI3	0.889				
	BI4	0.869				
	BI5	0.868				
Continuous usage	CU1	0.840	0.894	0.894	0.922	0.702
	CU2	0.824				
	CU3	0.841				
	CU4	0.847				
	CU5	0.837				
Digital financial inclusion	DFI1	0.712	0.896	0.911	0.924	0.709
	DFI2	0.858				
	DFI3	0.888				
	DFI4	0.870				
	DFI5	0.869				
Perceived behavioral control	PBC1	0.849	0.920	0.921	0.940	0.757
	PBC2	0.861				
	PBC3	0.896				
	PBC4	0.869				
	PBC5	0.874				
Perceived women's empowerment	PWE1	0.843	0.896	0.900	0.923	0.706
	PWE2	0.827				
	PWE3	0.820				
	PWE4	0.846				
	PWE5	0.865				
Subjective norm	SN1	0.799	0.871	0.876	0.907	0.661
	SN2	0.878				
	SN3	0.826				
	SN4	0.810				
	SN5	0.747				

Note: Cronbach's alpha (CA), Composite reliability (CR), and Average variance extracted (AVE).

Financial inclusion outcomes reveal a clear separation between attitudinal and empowerment constructs, evidenced by low HTMT values such as ATT and DFI (0.280), PWE and DFI (0.232), and CU and PWE (0.268). The interaction term PWE × BI shows limited overlap with other constructs, with correlations ranging from 0.036 to 0.317, confirming its independent status and role as a separate moderating factor. Overall, the results demonstrate that the proposed model incorporates both fundamental and additional constructs, which maintain structural coherence and remain distinct from each other.

4.4. Reliability and Validity

The study results of reliability and validity testing demonstrate that all measured constructs, namely Attitude Toward Technology (ATT), Behavioral Intention (BI), Continuous Usage (CU), Digital Financial Inclusion (DFI), Perceived Behavioral Control (PBC), Perceived Women Empowerment (PWE), and Subjective Norm (SN), meet rigorous statistical standards. The Cronbach's Alpha and Composite Reliability (CR) values surpass the recommended threshold of 0.70, indicating high internal consistency. The Average Variance Extracted (AVE) values, ranging from 0.661 to 0.757, show that each construct explains more than half of its indicator variance, thus meeting the requirements for convergent validity. The model indicates that Behavioral Intention (BI) and Continuous Usage (CU) serve as fundamental decision-making elements. The reliability of BI is high (CR = 0.924), and its validity is high (AVE = 0.710), which means that respondents' intention to use mobile banking is measured with precision. The behavioral engagement metric, CU, demonstrates excellent psychometric properties, with a CR value of 0.922 and an AVE value of 0.702, establishing its essential role in measuring digital financial inclusion.

The research data confirms the Theory of Planned Behavior (TPB) model and previous studies, which demonstrate that financial technology adoption requires individuals to transform their intentions into actual actions. The Perceived Women Empowerment (PWE) construct maintains its theoretical value because it generates dependable results (CR = 0.923) and shows convergent validity (AVE = 0.706). The PWE model predicts future usage patterns while enhancing the relationship between behavioral intentions and their actual execution. The acquisition of financial education, digital skills, and decision-making freedom leads individuals to maintain their commitment to online learning. The research findings confirm the TPB model and show that agency-based methods effectively promote digital financial inclusion for underserved rural areas. The results establish a solid empirical foundation, enabling researchers to conduct structural model analysis and verify their theoretical predictions. The measurement results in Table 3 demonstrate that all constructs achieve high internal consistency, convergent validity, and discriminant validity, which proves the measurement model's reliability.

The research framework based on behavior demonstrates both methodological integrity and contextual accuracy according to these results. The indicators exhibit strong psychometric properties because they effectively assess Attitude Toward Technology, Behavioral Intention, Continuous Usage, Perceived Women Empowerment, and Digital Financial Inclusion. The empirical robustness of this method reinforces our confidence in the structural relationships, which will be tested further, and confirms that the model meets both statistical criteria and theoretical expectations. The validated model illustrates how rural women behave when using digital financial services, enabling developers to create financial systems that promote gender equality and empowerment.

4.5. Hypothesis Testing

The research findings from hypothesis testing are presented in Table 4, which displays the results of seven main paths in the proposed structural model that integrates the Theory of Planned Behavior (TPB) with women's empowerment constructs for digital financial inclusion. The Partial Least Squares Structural Equation Modeling (PLS-SEM) method analyzed each path, providing standardized coefficients, p-values, and variance results. The research supported all seven hypotheses (H1–H7) at a 99% confidence level, as their p-values remained below 0.01.

Table 4. Hypothesis testing results for the extended TPB model with empowerment constructs.

Hypothesis	Path	Path coefficients	P values	Conclusion
H1	ATT -> BI	0.199	0.008	Supported
H2	SN -> BI	0.164	0.003	Supported
H3	PBC -> BI	0.487	0.000	Supported
H4	BI -> CU	0.470	0.000	Supported
H5	PWE x BI -> CU	0.141	0.008	Supported
H6	CU -> DFI	0.742	0.000	Supported

Note: Attitude toward technology (ATT), Behavioral intention (BI), Continuous usage (CU), Digital financial inclusion (DFI), Perceived behavioral control (PBC), Perceived women empowerment (PWE), Subjective norm (SN).

The research findings indicate that users who hold positive attitudes toward technology will show stronger intentions to use digital financial services ($\beta = 0.199$, $p = 0.008$). The study confirms the Theory of Planned Behavior (TPB) in digital environments through its findings that Perceived Behavioral Control (PBC) directly influences Behavioral Intention (BI) ($\beta = 0.487$, $p < 0.001$), and Subjective Norm (SN) directly affects BI ($\beta = 0.164$, $p = 0.003$). The study shows that Behavioral Intention (BI) creates a direct link to Continuous Usage (CU) ($\beta = 0.470$, $p < 0.001$), which then affects Digital Financial Inclusion (DFI) ($\beta = 0.742$, $p < 0.001$). People select financial services because they want to achieve specific goals, which also leads them to maintain their service usage for better financial inclusion.

The study confirms that psychological empowerment is a key factor that helps women maintain their digital financial behavior. The research shows that social norms influence how customers plan to use products ($\beta = 0.141$, $p = 0.008$) and their actual product usage behavior. The data support the extended Theory of Planned Behavior (TPB) because all six tested hypotheses produced statistically significant results Table 4. Each path in the structural model, ranging from ATT, SN, and PBC to BI, CU, and DFI, was supported with positive path coefficients and p-values below 0.01, affirming the robustness of the proposed behavioral framework.

The model receives more information from Perceived Women Empowerment (PWE), which functions as both a direct and moderating factor to demonstrate how psychological agency results in sustained digital participation among underrepresented populations. The policy framework enables these relationships through its fintech strategies, which extend beyond infrastructure development to include empowerment-based interventions. The model shows practitioners that mobile banking services must be both technologically accessible and psychologically and socially enabling for rural women who encounter structural barriers. The model receives validation through empirical data, which simultaneously supports behavioral finance research and digital inclusion for women, as well as sustainable financial technology adoption in developing markets.

4.6. Moderating Effect of Perceived Women's Empowerment

The slope analysis graph in Figure 3 shows how Perceived Women Empowerment (PWE) affects Behavioral Intention (BI) to predict Continuous Usage (CU) in digital financial inclusion systems. The graph displays three regression lines representing low (-1 SD), moderate (mean), and high (+1 SD) PWE levels, with BI on the x-axis and CU on the y-axis. The data reveal that all lines show positive BI-CU relationships, but the slope intensity increases as PWE levels rise. The green line (+1 SD PWE) demonstrates the steepest slope, indicating that behavioral intention has a more significant effect on prolonged usage when empowerment levels are high. Conversely, the red line (-1 SD PWE) shows a flat pattern because empowerment levels below a certain point hinder intentions from generating consistent behavioral responses.

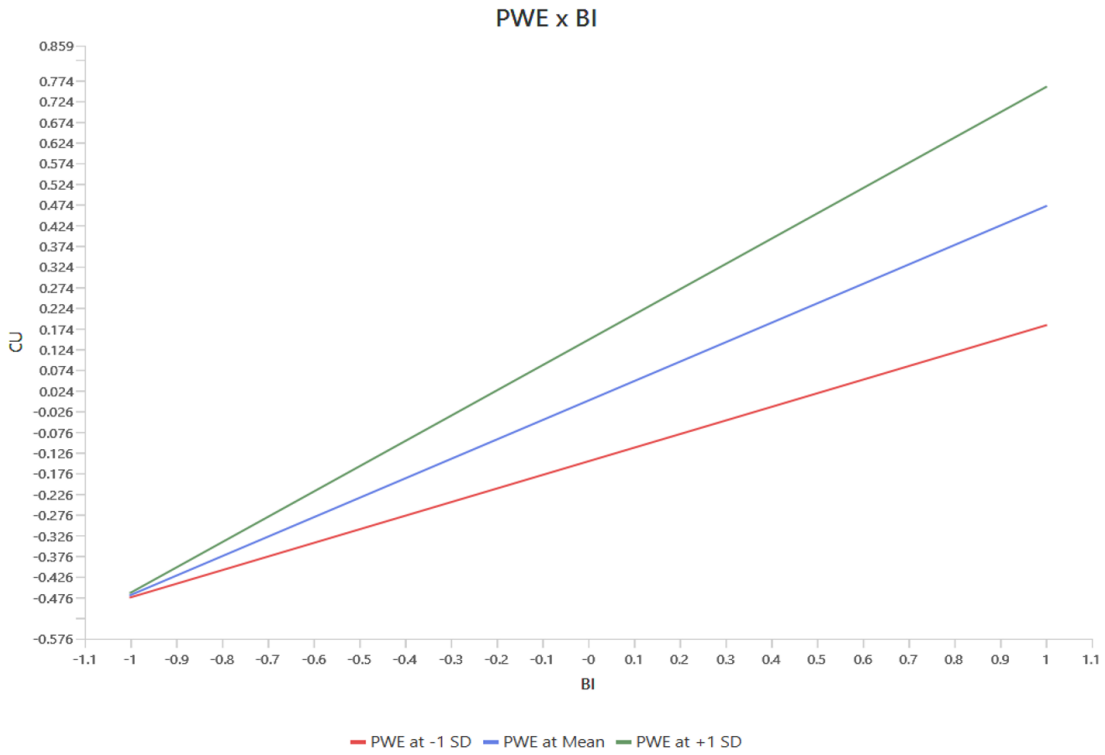

Figure 3. Slope analysis illustrating the moderating effect of perceived women's empowerment on the relationship between behavioral intention and continuous usage.

The research established that PWE functions as a moderator, which strengthens the relationship between BI and CU. Women's empowerment functions as a direct predictor of digital engagement while simultaneously strengthening the relationship between behavioral intention and sustained digital participation. The research confirmed the interaction model derived from structural analysis, which showed that behavioral frameworks require psychological user conditions to function as essential enabling elements. The rural environment benefits from empowerment through digital transformation, which brings benefits to all citizens while creating sustainable growth that endures.

5. DISCUSSION

The research investigated digital financial inclusion behavioral patterns among rural women through an extension of the Theory of Planned Behavior (TPB) by adding Perceived Women Empowerment (PWE) as a new construct. The discussion evaluates each hypothesis systematically by analyzing existing research while examining its theoretical value and practical applications. The results of Hypothesis 1 demonstrate that Attitude Toward Technology (ATT) strongly affects Behavioral Intention (BI) ($\beta = 0.199$, $p = 0.008$). The findings validate the fundamental principle of TPB, which states that positive self-assessments about behavior create stronger intentions, as proposed by Ajzen (1991). It also supports empirical evidence from Ly and Ly (2022), and the study by Chen, Mohd, and Sabri (2025) shows that perceived usefulness, security, and accessibility are key factors in digital adoption. According to the research, rural areas need positive attitudes toward technology adoption because residents tend to doubt new technological advancements. Mobile banking promotion requires user-focused design methods and trust-based approaches to help users experience greater value and overcome psychological obstacles.

Second, the results of Hypothesis 2 showed that Subjective Norm (SN) has a positive effect on Behavioral Intention ($\beta = 0.164$, $p = 0.003$). The study confirms the significance of social influence in collectivist societies because family members, peers, and community leaders determine behavioral standards (Cucinelli, Gandolfi, et al., 2017; Elouaourti & Ibourk, 2024). Digital financial campaigns for rural women need to utilize social validation and peer recommendation strategies to promote mobile banking acceptance. Additionally, community-based digital literacy

programs can serve as normative reference points to strengthen behavioral intentions by fostering shared values and expected behaviors.

Third, the results of Hypothesis 3 established Perceived Behavioral Control (PBC) as the most influential factor determining Behavioral Intention ($\beta = 0.487$, $p < 0.001$). The study results align with previous research by Sathye (1999) and Alnemer (2022), which demonstrates how self-efficacy affects digital participation. The limited digital infrastructure and low digital literacy in rural areas make perceived control the primary factor influencing user behavior. The findings indicate that users require digital competence training, user-friendly interfaces, and support systems to foster empowerment and sustain their intention to use digital services. These results highlight the importance for designers to develop inclusive systems that accommodate users with varying levels of digital proficiency.

Fourth, the results of Hypothesis 4 showed that Behavioral Intent $p < 0.001$). The study results confirm TPB's prediction that intention directly influences behavior (Ajzen, 1991) and match the findings presented by Panchasara et al. (2019). Intentions directly affect Continuous Usage (CU) with a significant relationship ($\beta = 0.470$). The strong relationship between intention and behavior demonstrates that intention serves as a dependable indicator for maintaining user engagement. The findings support the argument that digital financial inclusion requires assessment through behavioral patterns rather than just access metrics. The superficial measurement of inclusion fails to show actual user engagement, according to Hong et al. (2022) and Tay et al. (2022). Policy frameworks need to adopt behavioral indicators that demonstrate the depth, frequency, and relevance of user engagement.

The fifth research question examined how Perceived Women Empowerment (PWE) affects the connection between Behavioral Intention and Continuous Usage. The interaction term (PWE × BI) achieved statistical significance at $\beta = 0.141$ ($p = 0.008$), supporting the proposed moderating effect. People's sense of empowerment directly influences their ability to achieve lasting adoption of new technologies. The research shows that BI and CU become more connected as empowerment levels rise, with the highest relationship observed at +1 SD PWE. The behavioral pathway becomes less effective when individuals have low levels of empowerment. Studies support empowerment theories because psychological readiness, including agency, autonomy, and competence, enables people to adopt technology successfully (Al-Shami et al., 2024). The research indicates that digital financial strategies require development beyond basic technical access, as they must address both physical and mental obstacles that prevent effective financial management. The core design principle of digital inclusion programs must be empowerment, and their evaluation systems should measure this core principle.

Sixth, the research established that Hypothesis 6 ($\beta = 0.742$, $p < 0.001$) demonstrates that continuous usage strongly affects digital financial inclusion (DFI). The research supports the transition from access-based inclusion to behavior-based inclusion, as noted by Hong et al. (2022) and UNSGSA (2023). Users can obtain substantial advantages from financial services through sustained engagement, which includes savings, credit, and financial planning. Digital financial inclusion requires ongoing user-service provider interaction for trust development and capability growth. The system necessitates continuous tracking and flexible policy tools that adapt to student behavioral changes, rather than relying solely on static enrollment statistics.

Theoretical studies indicate that PWE incorporates environmental elements into the TPB model, representing the actual social and psychological conditions experienced by rural women in their daily lives. Traditional behavioral models often overlook how structural and cultural obstacles in marginalized communities influence technology adoption. This research offers a comprehensive understanding of digital financial behavior through the application of empowerment principles. It supports the notion that individuals make financial decisions based on a combination of rational thinking, social influences, emotional, and psychological factors (Cabeza, González, & García, 2019; Mahendru, 2020). Methodologically, the model demonstrates strong psychometric properties. The research data showed that all constructs achieved high internal consistency, with Composite Reliability values exceeding 0.90 and Average Variance Extracted values above 0.70. The Heterotrait-Monotrait Ratio (HTMT) demonstrated

discriminant validity, as all inter-construct correlations remained below the conservative threshold of 0.85 (Henseler et al., 2015). These results confirm that the structural framework is valid and that the research data are reliable.

6. CONCLUSION

The study advances both theoretical knowledge and empirical data about rural women's digital financial conduct through its combination of the Theory of Planned Behavior (TPB) with women's empowerment constructs into a comprehensive structural model. The study demonstrates that attitudes toward technology, along with subjective norms and perceived behavioral control, influence behavioral intention, which in turn leads to long-term usage and digital financial inclusion. Research indicates that women's empowerment plays dual roles: directly shaping their actions and increasing the likelihood that their intentions translate into actual behavior. The results of slope analysis reveal that sustaining digital engagement requires higher levels of empowerment, as this enhances behavioral intention outcomes. Users need to develop both psychological readiness and social preparedness to utilize digital financial services, since access to technology alone is insufficient for achieving digital financial inclusion. The structural framework exhibits high discriminant validity and lacks multicollinearity, confirming its reliability. The research findings suggest that digital financial service development and policy initiatives should incorporate empowerment strategies, such as community education, accessible interfaces, and local support, to improve user retention and social benefits. The proposed model explains digital financial inclusion behavior through sustainable financial systems that foster lasting equality in rural communities.

The research supports the theoretical development of TPB because digital financial inclusion consists of various elements. Scientists must analyze empowerment as an independent variable and a variable that affects other factors to understand all behavior patterns of marginalized populations. The research provides policymakers with the ability to create fintech strategies that unite technology access with empowerment initiatives for large-scale implementation. The model demonstrates to practitioners that mobile banking services must offer both operational capabilities and psychological and social support to users. The study confirmed the model's predictive accuracy while discovering new information about digital inclusion, behavioral finance, and sustainable rural fintech system adoption by women.

6.1. Theoretical Implications

The research extends the Theory of Planned Behavior (TPB) by adding Perceived Women Empowerment (PWE) as a direct predictor and a moderating factor for digital financial inclusion. The study demonstrates that empowerment leads to better outcomes between intention and sustained usage, confirming that psychological agency influences financial decision-making behavior. The research model illustrates that digital financial inclusion functions as a behavioral outcome that surpasses access limitations, as users require psychological and social readiness to operate technology. This new framework enables researchers to examine behavioral models of empowerment during digital transformation initiatives that serve disadvantaged communities.

6.2. Practical Significance

The research results provide useful information that helps policymakers, financial institutions, and digital service designers create financial systems that serve all users equally. The research shows that behavioral intention and perceived empowerment are essential factors for maintaining mobile banking adoption, which requires the development of solutions that go beyond basic infrastructure setup. The most successful programs combine empowerment-based methods, linking local financial education to peer mentoring and community-led digital onboarding to help users build psychological readiness and stay involved in the long term. Digital financial services require trust-based systems and user-friendly interfaces, which should be integrated into their adoption and retention strategies while considering cultural sensitivity. These elements influence user behavior through their impact on social impact and self-regulation beliefs, which need environments that promote personal autonomy and self-

determination. The research indicates that digital financial services must be designed for users with different abilities and social situations to achieve genuine user engagement. It assists policymakers in creating financial inclusion systems that utilize behavioral agency and community integration approaches to support gender-sensitive development. Government organizations can leverage these findings to develop specific programs addressing rural gender disparities in financial access, while financial organizations should base their product development and outreach efforts on empowerment metrics to create more relevant services that customers will continue to use. Stakeholders can foster economic growth and regional stability through policy and program development that incorporates behavioral constructs.

6.3. Research Limitations and Future Research

The study demonstrates solid empirical evidence regarding digital financial inclusion behaviors of rural women, but researchers must assess various study limitations. The study used a cross-sectional research design, which prevented researchers from establishing cause-and-effect relationships and tracking participant behavior changes across different time points. Research needs to conduct longitudinal studies that follow participants to understand the long-term effects of empowerment and intention on usage patterns. The research sample from a specific rural location makes it impossible to generalize its findings to other social environments and economic situations. The research should broaden its investigation to analyze performance differences between various geographic areas and population groups. The model examined psychological and behavioral elements, but it would achieve a more comprehensive understanding of digital financial inclusion by incorporating institutional, technological, and policy aspects. Future research must analyze empowerment as a mediating factor while developing advanced empowerment models to enhance theoretical accuracy. The following guidelines will help improve behavioral models to develop financial strategies that are more effective across different situations.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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