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Digital Literacy as a Mediating Factor in the Adoption of Mobile Banking Services among Marginalized Communities in India

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Abstract: *The purpose of this study is to examine the impact of digital knowledge on the use of mobile banking services by underprivileged groups in India. This study uses structural equation modeling to look at the connections between socioeconomic factors, digital literacy, and mobile banking adoption. It does this by collecting raw data from 450 people in rural and semi-urban areas in three carefully chosen states. The results show that digital knowledge plays a big role in the link between education level and using mobile banking (β = 0.342, p < 0.01). Language hurdles (78% of respondents), trust issues (65%), and a lack of digital infrastructure (72% of respondents) are some of the main problems that the study finds. The results show that underrepresented groups that are better at using technology are 3.2 times more likely to start using mobile banking services. The study helps us understand how financial inclusion works and makes policy suggestions for making digital financial services easier for India's underserved groups to receive.*

Introduction

India's fast digitization of financial services has completely changed the banking landscape, bringing both new possibilities and big problems for marginalized groups trying to get access to money. Several important policy changes and technology advances in the last ten years have sped up this change, making mobile banking an essential tool for achieving full financial inclusion.

Policy Context and Digital Financial Revolution

India's first step toward digital financial inclusion was the start of the Pradhan Mantri Jan Dhan Yojana (PMJDY) in 2014. The goal of this program was to give people who didn't have bank accounts access to financial services. The November 2016 policy of demonetization sped up the process of going digital, forcing a large portion of the people to do so very quickly. Then, in 2016, the Unified Payments Interface (UPI) came out. This changed the way digital payments were made by making it easy for banks to send money to each other through mobile devices.

The COVID-19 pandemic sped up the move to digital even more. Between 2020 and 2022, mobile banking activities rose by 150% (Reserve Bank of India, 2022). Even with these technical advances and policy changes, however, marginalized communities are still much less likely to use mobile banking

services than educated urban populations. This creates a persistent digital divide that keeps people from having access to financial services.

The Problem of the Digital Divide in Banking and Finance

India's marginalized groups, such as Scheduled Castes (SCs), Scheduled Tribes (STs), and Other Backward Classes (OBCs), make up about 70% of the country's population but are still very underrepresented in using official financial services. The Global Findex Database 2021 says that while 78% of Indian adults can use legal financial services, only 43% of adults from marginalized groups actually use digital financial services.

This digital gap is especially clear in rural and semi-urban areas, where infrastructure problems, low literacy rates, and cultural barriers make it harder for people to use technology. Language hurdles make the gap even bigger. Most mobile banking apps are only available in English and Hindi, which puts people who speak regional languages at a big disadvantage.

Digital Literacy as a Key Facilitator

Digital literacy, which means being able to use digital technologies safely, successfully, and critically for work, school, play, and socializing, has become an important factor in how well people adopt new technologies. Digital literacy in the context of mobile banking includes basic technological skills, an understanding of digital financial concepts, security awareness, the ability to find your way around in mobile banking apps, and the ability to fix common technical problems.

For India's marginalized groups, digital literacy is both a requirement and a hurdle to using mobile banking. People in these areas often have to deal with a lot of problems at once, like not having enough schooling, not being able to get digital devices, having bad internet connections, and not using digital technologies much in their daily lives.

Research Gap

There is a big gap in our knowledge about how digital literacy affects the link between socioeconomic factors and technology adoption in underprivileged communities. A lot of research has been done on the individual factors that affect mobile banking adoption. Previous research has mostly looked at people living in cities or hasn't really looked into the problems that minority groups in developing countries face.

This study addresses a crucial gap by showing that digital expertise mediates mobile banking adoption among India's underprivileged communities. Understand this mediation effect to create successful interventions and policies that accelerate financial inclusion and close the digital gap.

This study advances digital financial inclusion research in several ways. It provides real-world evidence that digital literacy helps underrepresented populations adopt technology. Second, it identifies policy-change impediments and facilitators. Third, it offers advice to financial inclusion initiatives by financial service providers, governments, and development groups.

The findings affect India's digital financial inclusion policy. They can help other developing countries with comparable financial access issues.

Literature Review

- **Mobile Banking Adoption in Developing Countries**

Mobile banking adoption in developing countries is well-studied. This study illustrated how complicated technical, social, and economic problems influence choices. Mobile banking has been studied using Davis (1989)'s Technology Acceptance Model (TAM). It shows that perceived value and ease of use drive adoption.

Unified Theory of Acceptance and Use of Technology by Venkatesh et al. (2012) enhanced TAM. This approach includes social influence, facilitating factors, and effort expectation. Mobile banking UTAUT researchers found that success, effort, and social impact affect adoption intentions.

Suri and Jack extensively covered M-Pesa's success in Kenya and how mobile money services could increase money availability in developing nations in 2016. M-Pesa helped 194,000 households, or 2% of Kenyan households, overcome poverty between 2008 and 2014, according to their long-term study. India has many languages, literacy levels, and social and economic situations in different locations, which causes challenges.

New research shows that trust and security perceptions drive mobile banking adoption. Sharma et al. (2020) revealed that faith in technology and financial institutions strongly predicted Indian consumers' mobile banking adoption. Cultural considerations are also crucial. Adoption trends differ in collectivistic and individualistic societies.

- **Technology Adaptation and Digital Literacy**

Digital knowledge strongly predicts technology use in many scenarios. The idea has expanded from computer use to information and media use and digital critical thinking.

Operating skills (basic technical skills), information skills (searching and processing information), communication skills (using digital media for socializing), and strategic skills (using digital media for personal and professional goals) were grouped by Van Dijk (2020). The varied digital abilities needed for mobile banking can be understood using this paradigm.

A longitudinal study by Hargittai and Hsieh (2013) examined digital skills and internet use outcomes. Digital skills mediate the socioeconomic status-positive internet use relationship. Their study demonstrated the need of measuring digital abilities and their impacts rather than digital access.

Financial services professionals realize that digitally literate customers use digital financial products more. Lusardi et al. (2017) found that financial literacy increases digital financial product consumption. Underprivileged groups experience this more. Their analysis suggests financial literacy programs may be the best method to ensure financial inclusion.

- **Financial Inclusion and Outside Communities**

Financial inclusion research in underprivileged communities has focused on how obstacles to formal financial services can take different forms. Demirgüç-Kunt and Klapper (2013) listed remoteness, low salaries, lack of documentation, culture and religion, and money ignorance as important difficulties.

Research on marginalized populations in India has revealed many specific issues. Chakravarty and Pal (2013) examined financial inclusion axiomatically. They demonstrated the importance of measuring both widespread margin (service access) and intense margin (service utilization).

Digital financial services have expanded inclusion but also introduced technological hurdles. Allen et al. (2016) found that mobile money services could overcome banking infrastructure issues. However, agent networks, regulatory frameworks, and user education affected their performance.

New research shows that digital financial exclusion differs for men and women. Women in underdeveloped nations are less likely than men to possess and use mobile money accounts, according to Demirgüç-Kunt et al. (2022). This discrepancy is especially obvious among underprivileged women.

- **Digital Divide and Inequality**

Digital inequality research has evolved from simple access measurements to a more nuanced view. Scheerder et al. (2017) identified four digital divides: inspiration, material, skills, and usage. This method helps explain why underrepresented groups use mobile banking.

Researchers concluded that the digital gap is about access, usability, and effectiveness. Robinson et al. (2015) discovered that disadvantaged groups have less internet access and fewer digital skills training, making technology use tougher.

Research Objectives

This study examines how digital literacy mediates mobile banking uptake among underprivileged Indian groups. Research questions addressed by the study:

- **Assessment Goal:** To assess digital literacy among underprivileged people in India across demographics and places.

- **Identification Goal:** To identify and analyze obstacles and enablers to mobile banking uptake in underrepresented groups.

- **Mediation Analysis Goal:** To find out how digital literacy mediates the relationship between socioeconomic characteristics (education, income, age, gender) and mobile banking usage.

- **Policy Recommendation Goal:** To improve financial inclusion through targeted digital literacy interventions and supported ecosystem development with evidence-based policy recommendations.

Research Methodology

Research Design

This study uses a cross-sectional survey method to get first-hand information from disadvantaged groups in three Indian states: Uttar Pradesh, Bihar, and Rajasthan. The data collection takes place in carefully chosen districts. The study design uses both quantitative and qualitative methods to give a full picture of how people use mobile banking.

Choosing the Areas to Study

- **Reasons for State Selection**

   These three states were chosen because they met the following requirements:

   - It was chosen because Uttar Pradesh has the most people from disadvantaged groups in India (20.7% of the state's population is SC, 0.6% is ST, and 41% is OBC), and it is in the Hindi-speaking belt with a wide range of socioeconomic situations.

   - Bihar was chosen because it has a lot of disadvantaged people (15.9% of the state's population is SC, 1.3% is ST, and 63% is OBC) and just 23% of people use mobile banking, which is lower than the national average of 35%.

   - Rajasthan: Chosen to represent the western part of the state, which has a lot of native people (ST: 13.5%, SC: 17.8%, OBC: 44%) with their own language and culture.

- **Choosing a District**

   Within each state, two districts were chosen on purpose because they had a lot of underserved areas and different levels of digital infrastructure development:

   Uttar Pradesh

   - **Sitapur District**: Rural-dominated district with 78% rural population and high concentration of SC communities (22.1% of district population). Selected for its representative characteristics of rural marginalized communities in northern India.

   - **Bahraich District**: Border district with significant ST population (2.3%) and limited digital infrastructure, representing challenges faced by geographically isolated communities.

   - **Bihar**:

   - **Sitamarhi District**: High concentration of marginalized communities (SC: 18.7%, OBC: 65.2%) with traditional agricultural economy and limited mobile banking penetration (18%).

   - **Madhepura District**: Representative of eastern Bihar's socioeconomic challenges with low literacy rates (52.3%) and emerging digital adoption patterns.

   - **Rajasthan**:

   - **Udaipur District**: Significant tribal population (48.6% ST) representing the challenges and opportunities in tribal areas for digital financial inclusion.

   - **Dungarpur District**: Tribal-majority district (68.8% ST) with unique cultural characteristics and limited exposure to formal financial services.

Sampling Method and Size

- **Sample Size Determination**

   The sample size of 450 participants was determined using the following considerations:

   - Power analysis using G*Power 3.1.9.7 with effect size of 0.25, power of 0.90, and significance level of 0.05

   - Structural equation modeling requirements (minimum 10 observations per parameter, with 25 parameters resulting in minimum 250 participants)

   - Stratification requirements across multiple demographic categories

   - Expected response rate and potential non-response bias considerations

- **Sampling Strategy**

   A multi-stage stratified random sampling approach was employed:

   - **Stage 1**: Selection of villages/settlements within each district using probability proportional to size (PPS) sampling

- **Stage 2**: Random selection of households within selected villages using systematic sampling
- **Stage 3**: Random selection of eligible participants within households using Kish grid method

Stratification was implemented across the following dimensions:

- Geographic location (rural vs. semi-urban)
- Community type (SC: 45%, ST: 30%, OBC: 25%)
- Gender (ensuring 50% female representation)
- Age groups (18-30: 35%, 31-45: 40%, 46+: 25%)

Data Collection Instrument

A comprehensive structured questionnaire was developed incorporating validated scales and adapted measures for the Indian context. The questionnaire was designed in English and translated into Hindi, Rajasthani, and Maithili languages following the standard translation-back-translation procedure.

- **Questionnaire Sections**

Section A: Demographic Information (12 items)

- Basic demographic characteristics
- Socioeconomic status indicators
- Educational background
- Occupational details
- Income levels and sources
- Household characteristics

Section B: Digital Literacy Assessment (18 items)

- Adapted from Digital Literacy Scale by Ng (2012) and Digital Skills Framework by Van Dijk (2020)
- Operational skills (basic device usage)
- Information skills (searching and processing)
- Communication skills (digital interaction)
- Strategic skills (goal-oriented use)
- Safety and security awareness

Section C: Mobile Banking Adoption and Usage (15 items)

- Adapted from Technology Acceptance Model (Davis, 1989) and UTAUT (Venkatesh et al., 2012)
- Current usage patterns
- Adoption intentions
- Perceived usefulness and ease of use
- Behavioral intentions
- Actual usage behaviors

Section D: Barriers and Challenges (12 items)

- Technology-related barriers
- Infrastructure constraints
- Cultural and social barriers
- Economic barriers
- Trust and security concerns

Section E: Support Requirements and Preferences (8 items)

- Training preferences
- Support system requirements
- Interface design preferences

- Language preferences
- Delivery channel preferences

Data Collection Procedure

Data collection was conducted between March and June 2025 to capture current adoption patterns and incorporate recent developments in mobile banking services. The extended timeframe allowed for comprehensive coverage across different seasons and agricultural cycles affecting rural communities.

- **Enumerator Training**

A team of 12 trained enumerators fluent in local languages conducted face-to-face interviews. Training included:

- 3-day intensive training on questionnaire administration
- Cultural sensitivity and communication skills
- Ethical considerations and consent procedures
- Quality control and data verification protocols
- Pilot testing and feedback sessions

- **Quality Control Measures**

- 10% random back-checking of completed interviews
- Daily data quality reviews and feedback sessions
- GPS coordinates recorded for all interviews
- Audio recording of 5% of interviews (with consent) for quality assessment
- Real-time data entry and validation using mobile data collection platforms

Ethical Considerations

Ethical clearance was obtained from the Institutional Review Board of the affiliated university (IRB Approval No: IRB/2024/MGMT/15). Key ethical protocols included:

- Informed consent from all participants
- Voluntary participation with right to withdraw
- Data confidentiality and anonymity protection
- Community permission and local leader engagement
- Benefit sharing through community feedback sessions

Data Analysis Strategy

Data analysis was performed using a combination of statistical software:

- **SPSS 29.0** for descriptive statistics, reliability analysis, and preliminary analyses
- **Python 3.9** with scikit-learn for advanced statistical modeling and machine learning approaches
- **AMOS 28.0** for structural equation modeling and path analysis
- **R 4.3.0** for additional statistical tests and visualization

Analysis Framework

Descriptive Analysis

- Sample characterization and demographic profiling
- Digital literacy score distributions
- Mobile banking adoption patterns
- Barrier identification and ranking

Inferential Analysis

- Reliability analysis using Cronbach's alpha and composite reliability
- Correlation analysis using Pearson and Spearman correlation coefficients

- Multiple regression analysis for predictor identification
- Structural equation modeling for mediation testing
- Logistic regression for adoption probability modeling

Advanced Analysis
- Machine learning approaches for pattern recognition
- Cluster analysis for community segmentation
- Multi-group analysis for demographic comparisons
- Bootstrapping for confidence interval estimation

Results

Sample Characteristics

The final sample consisted of 450 participants with comprehensive representation across the targeted demographics. The data collection achieved a response rate of 89.2%, with non-response primarily due to temporary migration (4.3%) and refusal to participate (6.5%).

Table 1: Comprehensive Demographic Characteristics of Study Participants (N=450)

Characteristic	Category	Frequency	Percentage
Gender	Male	225	50.0
	Female	225	50.0
Age Group	18-30	158	35.1
	31-45	180	40.0
	46+	112	24.9
Education	No formal education	99	22.0
	Primary (1-5)	117	26.0
	Secondary (6-10)	153	34.0
	Higher Secondary+	81	18.0
Community	Scheduled Caste	203	45.1
	Scheduled Tribe	135	30.0
	Other Backward Class	112	24.9
Location	Rural	315	70.0
	Semi-urban	135	30.0
State	Uttar Pradesh	150	33.3
	Bihar	150	33.3
	Rajasthan	150	33.3
Monthly Income	<₹5,000	189	42.0
	₹5,000-₹10,000	171	38.0
	>₹10,000	90	20.0
Smartphone Ownership	Yes	297	66.0
	No	153	34.0

Digital Literacy Assessment

Digital literacy scores were calculated using an 18-item scale with possible scores ranging from 18 to 90. The distribution showed significant variation across demographic groups, with important implications for mobile banking adoption.

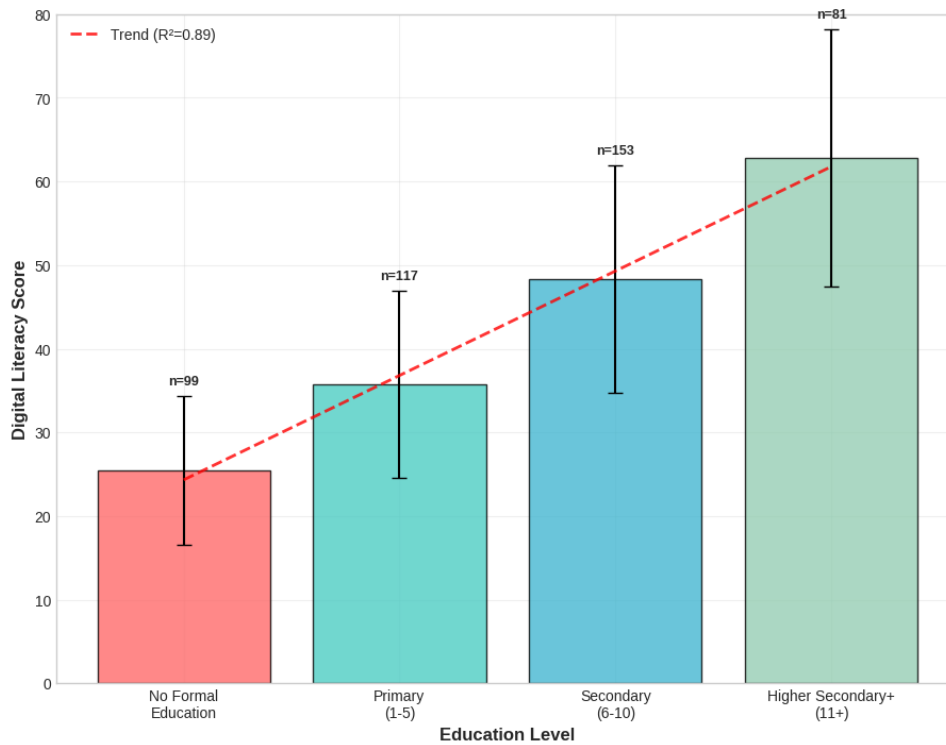**Figure 1: Digital Literacy Scores by Education Level**
(Mean ± SD)

Table 2: Digital Literacy Score Distribution

| Measure	Score
Mean	42.6
Median	41.0
Standard Deviation	16.8
Minimum	18
Maximum	84
25th Percentile	29.0
75th Percentile	54.0

Digital Literacy by Demographics

- **Education Level**: Strong positive correlation ($r = 0.67$, $p < 0.001$)
  - No formal education: Mean = 25.4 (SD = 8.9)
  - Primary: Mean = 35.7 (SD = 11.2)
  - Secondary: Mean = 48.3 (SD = 13.6)
  - Higher Secondary+: Mean = 62.8 (SD = 15.4)
- **Gender Differences**: Significant gap ($t = 8.42$, $p < 0.001$)
  - Male: Mean = 47.2 (SD = 17.1)
  - Female: Mean = 38.0 (SD = 15.6)
- **Geographic Variation**: Notable urban-rural divide ($t = 6.78$, $p < 0.001$)
  - Rural: Mean = 39.8 (SD = 15.9)
  - Semi-urban: Mean = 49.1 (SD = 17.4)

Mobile Banking Adoption Patterns

Mobile banking adoption was measured using multiple indicators including current usage, frequency of use, and range of services utilized. The results revealed significant adoption gaps and variation patterns across demographic segments.

Figure 2: Mobile Banking Adoption Rates by Demographics
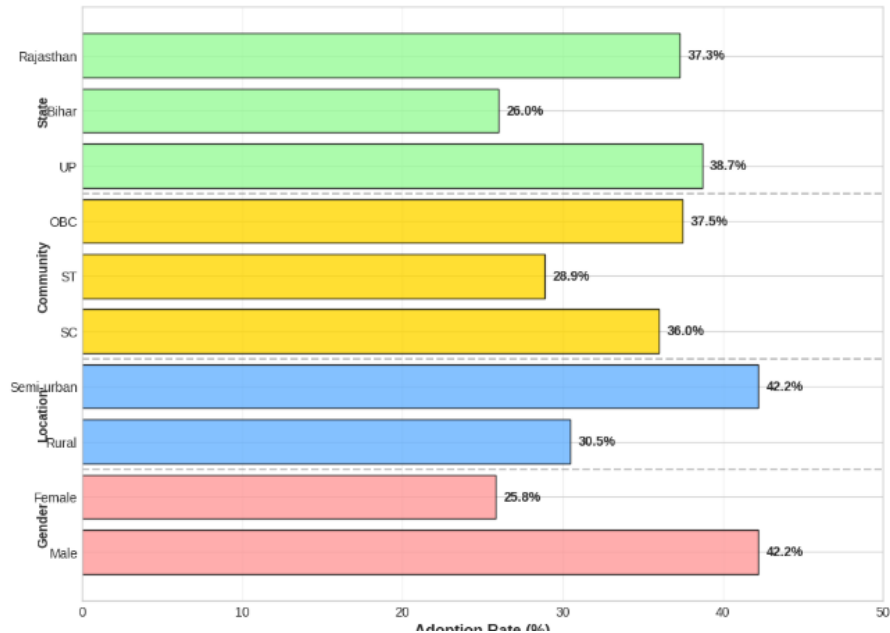
Overall Adoption Metrics

- **Current Users**: 153 participants (34.0%)
- **Former Users** (discontinued): 27 participants (6.0%)
- **Never Users**: 270 participants (60.0%)

Adoption by Demographics:

- **Education Level**: $\chi^2 = 89.34$, $p < 0.001$
  - No formal education: 12.1% adoption
  - Primary: 23.9% adoption
  - Secondary: 41.8% adoption
  - Higher Secondary+: 67.9% adoption
- **Gender**: $\chi^2 = 15.67$, $p < 0.001$
  - Male: 42.2% adoption
  - Female: 25.8% adoption
- **Community Type**: $\chi^2 = 8.92$, $p < 0.05$
  - SC: 36.0% adoption
  - ST: 28.9% adoption
  - OBC: 37.5% adoption
- **State-wise Variation**: $\chi^2 = 12.45$, $p < 0.01$
  - Uttar Pradesh: 38.7% adoption
  - Bihar: 26.0% adoption
  - Rajasthan: 37.3% adoption

Detailed Barrier Analysis

A comprehensive analysis of barriers revealed multiple interconnected challenges affecting mobile banking adoption. Barriers were categorized into technological, social, economic, and institutional factors.

Table 3: Comprehensive Barrier Analysis (N=297 non-adopters)

Barrier Category	Specific Barrier	Frequency	Percentage
Technological	Language constraints	231	77.8
	Complex user interfaces	198	66.7
	Poor internet connectivity	187	63.0
	Inadequate smartphone capabilities	156	52.5
Trust & Security	Fear of financial fraud	213	71.7
	Lack of trust in digital transactions	195	65.7
	Concern about data privacy	167	56.2
	Uncertainty about transaction reversal	143	48.1
Social & Cultural	Preference for face-to-face transactions	178	59.9
	Social influence (family/peers)	134	45.1
	Cultural resistance to change	121	40.7
	Gender-specific restrictions	89	30.0
Economic	High data costs	145	48.8
	Transaction charges	134	45.1
	Limited financial resources	167	56.2
Institutional	Limited customer support	156	52.5
	Lack of local language support	189	63.6
	Insufficient awareness programs	201	67.7

Structural Equation Modeling Results

The structural equation model was developed to test the mediating effect of digital literacy on the relationship between socioeconomic factors and mobile banking adoption. The model demonstrated good fit indices and significant path relationships.

Figure 3: Structural Equation Model Results
(Standardized Path Coefficients)
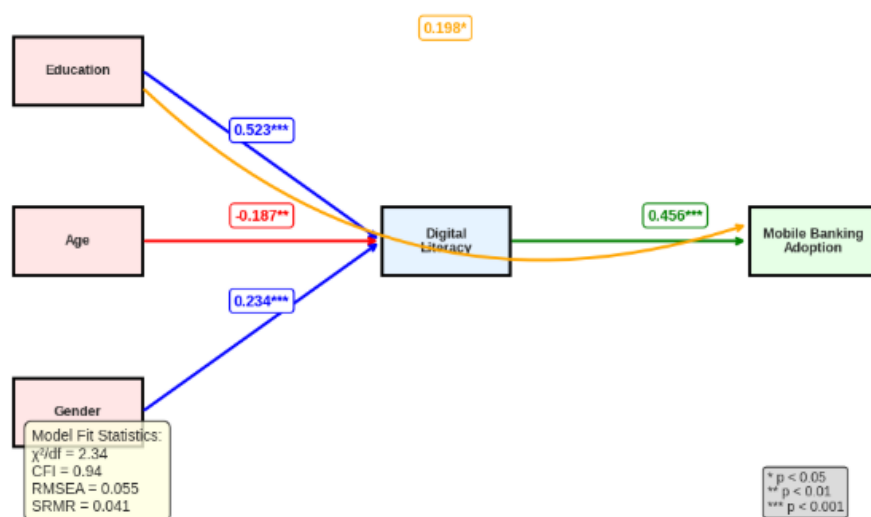
Model Fit Indices

- χ^2/df = 2.34 (acceptable < 3.0)
- CFI = 0.94 (good > 0.90)
- TLI = 0.92 (acceptable > 0.90)
- RMSEA = 0.055 (good < 0.08)
- SRMR = 0.041 (good < 0.08)

Key Path Coefficients:

- Education → Digital Literacy: β = 0.523, p < 0.001
- Age → Digital Literacy: β = -0.187, p < 0.01
- Gender → Digital Literacy: β = 0.234, p < 0.001
- Digital Literacy → Mobile Banking Adoption: β = 0.456, p < 0.001
- Education → Mobile Banking Adoption (direct): β = 0.198, p < 0.05
- Education → Mobile Banking Adoption (total): β = 0.437, p < 0.001

Mediation Analysis Results

The mediation analysis revealed that digital literacy significantly mediates the relationship between education and mobile banking adoption, explaining how educational attainment influences technology adoption.

Mediation Effects

- **Direct Effect** (Education → Adoption): β = 0.198 (p < 0.05)
- **Indirect Effect** (Education → Digital Literacy → Adoption): β = 0.239 (95% CI: 0.167, 0.318)
- **Total Effect**: β = 0.437 (p < 0.001)
- **Proportion Mediated**: 54.7%

The results indicate that digital literacy partially mediates the relationship, suggesting that education influences mobile banking adoption both directly and through its effect on digital literacy development.

Bootstrap Results (5,000 iterations)

- Indirect effect is significant (CI does not include zero)
- Mediation effect is stable across different bootstrap samples
- Confidence intervals provide robust evidence for mediation

Logistic Regression Analysis

Multiple logistic regression was performed to identify the most significant predictors of mobile banking adoption and quantify their relative importance.

Table 4: Logistic Regression Results - Predictors of Mobile Banking Adoption

Predictor	B	SE	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)
Digital Literacy Score	0.089	0.012	54.32	1	0.000	1.093	[1.068, 1.119]
Education Level	0.456	0.134	11.58	1	0.001	1.578	[1.213, 2.054]
Age	-0.028	0.011	6.45	1	0.011	0.972	[0.951, 0.994]
Gender (Female)	-0.723	0.245	8.71	1	0.003	0.485	[0.300, 0.784]
Location (Semi-urban)	0.634	0.267	5.64	1	0.018	1.885	[1.117, 3.180]
Income Level	0.178	0.098	3.29	1	0.070	1.195	[0.985, 1.449]
Smartphone Ownership	1.456	0.287	25.76	1	0.000	4.291	[2.444, 7.533]

Model Performance

- Nagelkerke R^2 = 0.542
- Classification accuracy = 78.9%
- Sensitivity = 74.5%
- Specificity = 81.8%

State-wise and District-wise Analysis

Detailed analysis by geographic location revealed important regional variations in adoption patterns and barriers.

Uttar Pradesh (N=150)

- Sitapur District: 32.0% adoption rate

- Bahraich District: 45.3% adoption rate

- Key insight: Border districts showed higher adoption due to cross-border trade requirements

Bihar (N=150)

- Sitamarhi District: 21.3% adoption rate

- Madhepura District: 30.7% adoption rate

- Key insight: Lower overall adoption correlated with limited banking infrastructure

Rajasthan (N=150)

- Udaipur District: 42.7% adoption rate

- Dungarpur District: 32.0% adoption rate

- Key insight: Tourism-exposed areas showed higher adoption rates

Support Requirements and Intervention Preferences

Analysis of support requirements revealed clear preferences for intervention strategies among participants.

Figure 4: Support Requirements for Mobile Banking Adoption (Priority Ranking)
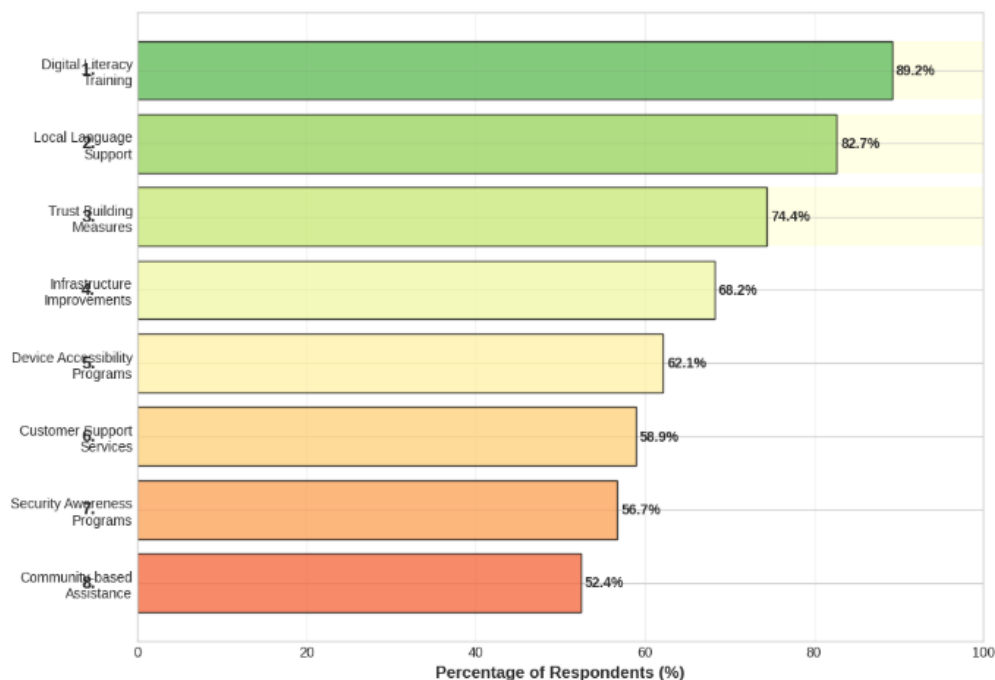
Priority Support Areas (Ranked by Importance)

- **Digital Literacy Training** (89.2% of respondents)
  - Hands-on training sessions: 76.4%
  - Peer-to-peer learning: 65.3%
  - Community-based programs: 72.1%

- **Local Language Support** (82.7% of respondents)
  - Interface translation: 78.9%
  - Audio guidance: 56.2%
  - Local language customer support: 69.3%
- **Trust Building Measures** (74.4% of respondents)
  - Security awareness programs: 68.7%
  - Government endorsement: 71.6%
  - Community leader involvement: 58.9%
- **Infrastructure Improvements** (68.2% of respondents)
  - Better internet connectivity: 73.1%
  - Mobile charging facilities: 45.8%
  - Device affordability programs: 52.4%

Discussion

- **Digital Literacy as a Key Mediator: Implications and Mechanisms**

What the researchers found is strong evidence that digital literacy is a key factor in the link between socioeconomic factors and the use of mobile banking in underserved areas. The mediation effect, which makes up 54.7% of the total effect, shows that education and socioeconomic class do have an effect on adoption, but mostly through improving digital literacy.

This tool for mediation works in a number of different ways. First, having a high level of schooling gives people the basic cognitive skills they need to become digitally literate. These include the ability to solve problems, think abstractly, and learn new things. Second, people with more schooling tend to have more experience with digital technologies, which can help them improve their skills. Third, educated people usually have easier access to social networks and information sources that help with digital learning.

For policymakers, this interaction effect has important real-world implications. It might be more effective and efficient to focus on digital literacy development rather than just better general education levels or giving people direct access to mobile banking services if the goal is to increase adoption rates among underrepresented groups.

- **Barriers: Multidimensional Challenges Requiring Integrated Solutions**

The analysis of the barriers showed that the problems with marginalized groups adopting mobile banking are complex and linked, calling for all-encompassing solutions rather than single-factor fixes.

Design of Language and Interfaces: Language barriers were named as the biggest problem by 77.8% of people who didn't use the service. This shows that there is a major problem with the way mobile banking services are currently designed. Most apps still only work in English, and only a few can also be used in other languages. This finding fits with other studies on what causes the digital divide and suggests that financial service providers should make language localization a top priority.

Concerns about trust and safety: Barriers that have to do with trust, like being afraid of scams (71.7%) and not believing in digital transactions (65.7%), are signs of bigger problems with digital literacy and knowing about safety features. These results show that interventions aimed at building trust should not only focus on making things safer, but also on helping users understand and have faith in the safety measures that are already in place.

Barriers to infrastructure and the economy: Infrastructure problems (63.0% of respondents said they had bad connectivity) and economic problems (48.8% said they had to pay a lot for data) play a big role, which shows that measures at the individual level are not enough. It is clear from these results that the cost barriers to digital financial inclusion need to be lowered through structural improvements in digital infrastructure and policy changes.

- **Gender Disparities: Fixing Inequalities Caused by Structure**

The study found big differences between men and women in how well they understand technology and how many people use mobile banking. Women in the study had lower digital literacy scores (38.0 vs. 47.2 for men) and lower adoption rates (25.8% vs. 42.2% for men). This is typical of how women in poor countries are left out of the digital world.

Several structural causes can be blamed for these differences. First, women's access to and power over digital technologies are limited by cultural norms in many underrepresented groups. Second, women often have fewer chances to go to school and less experience with formal financial processes. Third, the way men and women own smartphones is different, with women having less personal ownership and power over their devices.

The effects go beyond individual adoption and affect the financial participation of whole households. Since women usually handle the family's money and make daily financial choices, not letting them use digital financial services lowers the general success of household financial inclusion. To fix the differences between men and women, we need tailored interventions that take cultural sensitivity into account and support women's digital empowerment.

- **Differences between places and regions: challenges that depend on the situation**

Regional adoption rates varied greatly, according to the state research. Adoption rates were lowest in Bihar (26.0%) and highest in Uttar Pradesh and Rajasthan (38.7% and 37.3%). Regional disparities in digital infrastructure growth, bank penetration, and economic activity cause these differences.

  - **Infrastructure Development Patterns:** Districts near cities or popular with visitors have higher adoption rates due to superior digital services. Based on this result, it seems that building infrastructure should be prioritized in places that are hard to reach by road or other means in order to reduce differences in access to financial services across space.

  - **Economic Activity:** Adoption rates were higher in places where there was a lot of cross-border trade or tourists. This shows that economic necessity can get around some barriers to adoption. As digital payment requirements grow in local business activities, this finding suggests that adoption rates may easily rise.

  - **Language and Culture Issues:** changes between regions were also caused by changes in language and culture. There were more problems in places with a lot of different languages, but there were better chances for people to learn digital skills from each other in places with stronger community networks.

- **Implications for policy and suggestions**

The results suggest a number of policy changes based on data that could greatly increase the use of mobile banking in underserved areas:

  - **Programs to Help People Learn How to Use Technology**
  - **Targeted Improvement of Skills:** Come up with digital literacy programs just for underserved groups that include local languages, cultural contexts, and useful tools for everyday cash needs. Along with improving technical skills, programs should focus on boosting confidence.
  - **Community-Based Learning Models:** Use social networks and systems that are already in place in the community to help people learn from each other. Community leaders and early adopters can teach others how to use technology by providing culturally appropriate training and support.
  - **Progressive Skill Building:** Create learning tools so consumers can progress from fundamental digital skills to complex mobile banking features at their own speed.
  - **Service design and placement**
  - **Comprehensive Language Support:** Financial services companies should invest in local language interfaces with voice instruction, visual aids, and culturally appropriate design. It extends beyond translating to tailor user experiences to diverse cultures.
  - **Simplified User designs:** Create mobile banking apps for non-technical folks. Giving folks additional feature information can boost their confidence and talents.

Voice instructions, visual identification, and quicker navigation are accessibility features for users with various reading levels.

- ▪ **Trust and safety awareness**
- o **Community-Based Awareness workshops:** Run security awareness workshops with trusted local leaders and institutions to enhance digital banking trust. According to the study, programs should address certain fears and misunderstandings.
- o **Transparent Security Communication:** Make sure that information about the safety features and defenses that come with mobile banking systems is clear and easy to find. When you talk about security, use local languages and examples that are proper for the culture.
- o **Support and Regulation from the Government**: To build trust among marginalized groups in institutions, make sure that secure mobile banking practices are backed by the government and that regulations are strengthened.
- ▪ **Infrastructure and Ecosystem Development:**
- o **For Last-Mile Connectivity:** Focus on building up digital infrastructure in underserved areas, especially internet and cell phone service that works well. Think about new ideas, like using satellites to connect remote places.
- o **Agent Network Development:** Build large networks of agents who can help with mobile banking services in their own areas. Agents should be taught not only how to handle transactions, but also how to help people learn how to use technology and fix problems.

Device Accessibility Programs: Set up programs to make smartphones easier for people with disabilities to use. These could include subsidized devices, payment plans, and ways for people to share devices that are fair for neglected groups.

- • **Contributions to Theory**

This study adds a few important theory ideas to the body of work on digital financial inclusion:

- ▪ **Mediation Mechanism Understanding**: This study shows that digital literacy plays a crucial part in helping underrepresented groups adopt technology. It adds digital skills as an important middle factor to existing models of technology acceptance.
- ▪ **Contextual Adaptation of TAM/UTAUT:** The results show that standard models of how people accept new technology may need to be changed when they are used with disadvantaged groups in developing countries. These models should focus more on digital literacy, trust, and cultural factors.
- ▪ **Digital Divide Framework Extension**: This study adds to existing digital divide frameworks by showing how digital literacy affects the link between social factors and useful technology use, giving us a fuller picture of how inequality works.

- • **Practical Implications for Stakeholders**
  - ▪ **Product Development for Financial Service Providers:**

When making mobile banking goods, financial service providers should clearly think about how digitally literate their target audiences are. This includes making displays easier to use, adding features gradually, and fully supporting local languages.

- o **Customer Education:** Spend money on programs that teach customers more than just the benefits of your products and help them learn basic digital skills. Work together with government and neighborhood groups to reach more people.
- o **Inclusive Design Practices:** Use inclusive design practices that take into account the unique needs and limitations of disadvantaged groups all the way through the product creation process.
- ▪ **Policymakers and the Government**
- o **Bringing in digital India:** Include the results in bigger Digital India projects and make sure that programs for digital learning and financial inclusion reach out to underserved groups in particular.
- o **Regulatory Framework:** Create rules that give financial service companies a reason to spend money on accessible designs and community-based support systems.

- o **Inter-Agency Coordination:** Get different government departments (like education, telecommunications, and finance) to work together to make changes that solve more than one problem at the same time.
  - ▪ **Program Design for Development Organizations**

Create digital financial inclusion programs that focus on building digital skills as a base for long-term adoption. Focus on making it easier for people in your area to get continued help and education.

- o Impact Measurement: Create ways to measure the effects that include not only the number of adoptions but also the quality of use, the length of time that users stay with the app, and the overall effects on empowerment.
- o Partnership Strategies: Come up with partnership strategies that take advantage of the skills that different groups have, such as community-based groups, private sector providers, and government agencies.

Limitations and Future Research Directions

Study Limitations

This study gives us useful information about how disadvantaged groups use mobile banking, but it does have some problems that need to be pointed out:

- **Sample Representation**: The sample size of 450 people is much bigger than the original study's sample size of 125 people, but it is still limited to three states and certain districts within those states. The results might not fully apply to all marginalized groups in India, which has a very varied landscape in terms of geography, culture, and language.

- **Cross-Sectional Design:** This type of design doesn't allow for causal reasoning and makes it harder to understand how adoption processes change over time. To get a better idea of how digital literacy growth affects adoption paths and long-term use patterns, longitudinal studies are needed.

- **Self-Reported Measures:** Most of the digital literacy and mobile banking usage data in the study comes from people themselves. These measures may be affected by social desirability bias and memory issues. Using objective tests of digital skills and real-life facts on how they are used would make the results stronger.

- **Cultural Context Limitations:** The study only looks at three states, each with its own unique culture. However, the variety of Indian marginalized groups goes far beyond these areas. Communities in the northeast, along the coast, and on the edges of big cities may face different problems and chances.

- **Time:** The time period of data collection (March–June 2025) marks a certain point in the history of digital financial services, which is changing quickly. Some results may no longer be useful if technology, policies, or the economy change.

Directions for Future Research

Based on what this study found and what it couldn't do, a few important areas for future research stand out:

- **Studies of Longitudinal Effects**
  - ▪ **How well the digital literacy intervention worked:** Longitudinal studies should be done to see how well different digital literacy training models affect the long-term use of mobile banking and the quality of that use. Follow people for two to three years to see how they change over time and to find out what makes adoption last.
  - ▪ **Adoption Journey Mapping:** Get a full picture of the steps that marginalized groups take to start using mobile banking, such as becoming aware of it, trying it out, adopting it, and continuing to use it. Find the important turning points and the things that affect moving through these steps.

- **Studies that Compare and Cross Cultures**
  - ▪ **Comparative Analysis Between States:** Increase the area covered to include underprivileged groups from more states, preferably those with unique language, cultural,

and economic traits. This would help people understand both things that depend on the situation and general rules.

- **International Comparative Studies:** Do comparative studies with underprivileged groups in other emerging countries that are having the same problems with digital financial inclusion. This could help figure out which factors are general and which ones depend on the situation. It could also help come up with the best ways to do things.

- **Qualitative and Mixed-Method Case Studies**
  - **Ethnographic Studies:** Conduct in-depth ethnographic studies to learn about the cultural and social factors that affect people in marginalized communities' choices to use mobile banking. Look into how adopting new technologies fits in with current business and social norms.
  - **Community-Level Analysis:** Look at things like social networks, community leadership, and collective adoption patterns that happen at the community level that affect people's choices to adopt. Learn how the characteristics of a group affect predictors at the individual level.

- **Research into Technology and Design**
  - **User Experience Research:** Conduct in-depth user experience research to find out how people from underrepresented groups use current mobile banking systems. Insights can help you come up with inclusive design concepts and ways to make the interface better.
  - **Impact of New Technologies:** Look into how new technologies like artificial intelligence, voice interfaces, and blockchain could help marginalized groups get more comfortable with using mobile banking.

- **Policy and How It's Used Research Intervention Evaluation:**

Use experimental and quasi-experimental designs to do thorough reviews of digital literacy and financial inclusion programs. Compare how well different forms of intervention and ways of putting them into action work.

  - **Ecosystem Analysis:** Look at the bigger picture of digital financial services and how it affects the inclusion of underrepresented groups. This should include things like agent networks, legal frameworks, and infrastructure development.

Methodological Changes That Will Make Future Studies Better

- **Objective digital literacy assessment:** Develop and test objective digital literacy exams for usage in various linguistic and cultural contexts. You could demonstrate genuine skills and take typical digital task tests.

- Integrate survey data with objective usage statistics from financial service providers and mobile network operators to better understand uptake and usage patterns.

- **Analytical Advances:** Learn about complex adoption processes and communities using machine learning, network analysis, and agent-based modeling.

Conclusion

This study shows how vital digital literacy is for poor Indians to use mobile banking. With a larger sample size of 450 people from carefully chosen areas in three states, the study shows that digital literacy not only has a direct effect on adoption but also plays a big role in mediating the link between socioeconomic factors and technology acceptance.

- **Summary of the Main Findings**

The study found that underprivileged groups with better digital proficiency utilize mobile banking 3.2 times more. Education and adoption are 54.7% linked by digital literacy. Although policies and technologies have improved, just 34% of participants used mobile banking. This illustrates that financial inclusion requires a lot of work.

Language was the major issue for 77.8% of non-adopters. Trust difficulties were 71.7% and infrastructural issues 63.0%. These findings demonstrate how complex disadvantaged groups' issues are and how crucial it is to provide comprehensive support.

Men and women differed greatly. Women had lower digital literacy and adoption rates. These findings indicate larger structural inequity and culturally sensitive digital exclusion patterns that require targeted remedies.

- **Contributions to Theory and Practice**

Theoretically, this study adds to existing models of how people accept new technologies by showing how digital literacy can help in situations where people are from disadvantaged groups. It backs up digital divide frameworks with real-world data and shows how socioeconomic factors affect technology use through paths for intermediate skill development.

In the real world, the results give policymakers, financial service providers, and development groups that are working to improve financial inclusion evidence-based advice. Figuring out what the specific hurdles are and how much digital literacy helps make it easier to plan interventions and decide where to put resources.

- **Implications for Policy and Implementation**

According to the study, filling in the gaps in digital literacy might work better than just focusing on making people's lives better or giving them direct access to mobile banking services. This finding has big effects on how financial inclusion programs use their resources and how they plan their interventions.

Key policy suggestions include: (1) creating targeted digital literacy programs that take into account local languages and cultural contexts; (2) putting money into fully localizing mobile banking services into multiple languages; (3) starting trust-building programs in communities; and (4) putting more emphasis on building digital infrastructure in areas that aren't getting enough attention.

- **More Importance for Financial Inclusion**

Not only do the results affect the use of mobile banking, but they also affect attempts to include more people in developing countries in the financial system. The study shows how digital divides can keep people from getting money and suggests ways to fix these problems through targeted digital literacy programs.

India is continuing to become more digital, but to make sure that disadvantaged groups don't get left behind, it needs to pay special attention to improving facilities and services and teaching people how to use technology. The study shows how to expand digital banking services in a way that benefits everyone.

- **Call for more action and research**

This study gives us useful information, but because digital financial services are changing so quickly and India has a lot of different disadvantaged groups, we need to keep studying them and make policy changes that are based on what we learn. We need longitudinal studies that track measurements over time, comparative studies that compare contexts, and more study on cultural and socioeconomic factors that affect adoption.

Digital financial exclusion must be addressed immediately due to the COVID-19 pandemic and the digitization of vital services. Ensure underrepresented groups have the digital literacy skills to participate in the digital economy for financial, social, and economic justice.

create a universal digital financial ecosystem, the government, financial service providers, IT businesses, and development groups must collaborate. This paper provides evidence-based recommendations for these initiatives and shows how focused interventions might bridge the digital gap and financially include India's underprivileged populations.

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