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Exploring the Role of Mobile App Usability and Digital Literacy in Financial Inclusion

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Abstract:

This study examines the role of mobile app usability and digital literacy in driving financial inclusion within urban populations. Utilizing Structural Equation Modelling (SEM), the research analyses the relationships between Financial Inclusion through Mobile Apps (FIM), Usability of Mobile Apps (UM), and Digital Literacy regarding Mobile Apps (DLM). Primary data was gathered from 200 urban respondents through a structured questionnaire.

The findings indicate that both mobile app usability and digital literacy significantly contribute to financial inclusion, demonstrating that user-friendly mobile applications and adequate digital literacy levels enhance accessibility and adoption of financial services. The study offers valuable insights for banks, fintech firms, policymakers, and researchers by highlighting the critical factors that facilitate financial inclusion through digital platforms. Furthermore, the research provides a foundation for developing user-centric mobile banking solutions, improving digital literacy initiatives, and shaping policies that promote broader financial participation in urban areas.

Keywords: Financial Inclusion through Mobile Apps (FIM), Usability of Mobile Apps (UM), and Digital Literacy regarding Mobile Apps (DLM), Structural Equation Modelling (SEM)

Introduction:

The emergence of digital financial services has transformed the way individual interact or access banking and handle their financial resources. Mobile banking apps facilitate as a platform for diverse financial transaction, making banking more convenient and accessible as digital platforms continue to expand, studies have examined the role of usability and ease of navigation in influencing how users engage with financial services (Anwar et al., 2024; Zaimović et al., 2024; Lui & Go, 2024; Raj et al., 2023). Some findings suggest that well-designed mobile apps may contribute to improved user engagement and financial accessibility (Kumar & Singh, 2024; Patel et al., 2023).

Digital literacy has been examined as a factor influencing the adoption of mobile banking. The capability to use digital platforms enable individual in making financial decisions and recognizing online banking services. As mobile applications introduce new features and security measures, studies have examined how digital literacy relates to user adoption (Lui & Go, 2024; Al-Sarraji et al., 2024; Das & Mishra, 2023). Some research suggests that individuals with higher digital literacy levels may be more likely to use digital financial services (Sharma et al., 2024; Banerjee & Mehta, 2023).

With the increasing use of digital transactions, researchers continue to examine the significance of mobile app usability and financial awareness. Some studies focus on the

accessibility of banking applications and their potential role in financial inclusion (Gupta et al., 2024; Verma & Reddy, 2023). As financial technology develops, ongoing research explores how mobile app design and digital literacy may shape financial accessibility (Mehta & Banerjee, 2024; Kapoor et al., 2023).

Existing studies focus on mobile wallets, digital money adoption, and socio-economic factors but lack analysis of how perceived ease of use mediates the relationship between mobile app usability, digital literacy, and financial inclusion. This study explores these interactions in urban areas, addressing gaps in understanding their combined impact on financial inclusion.

Literature Review and Hypothesis Development:

Mobile Usability:

Mobile banking has transformed the financial sector by providing accessible, cost-effective and efficient banking solutions, particularly in urban areas (Mulyono, Raisah, & Rahagi, 2024). The adoption of mobile banking services allows users to conduct transactions, pay bills, transfer funds, and manage savings with ease, reducing dependency on traditional banking channels (Anwar, Astuti, & Sugito, 2024). The perceived ease of use and usefulness of mobile banking applications significantly influence customer adoption, highlighting the importance of intuitive app design and user-friendly interfaces (Zaimović et al., 2024). Moreover, banks that integrate digital literacy programs alongside mobile banking services experience higher customer engagement and financial inclusion rates, as users become more comfortable with digital financial tools (Lui & Go, 2024). By bridging the gap between financial access and technological advancements, mobile banking plays a vital role in promoting inclusive economic growth and fostering digital financial empowerment.

Ho_1: Mobile app usability does not have a positive and significant impact on financial inclusion.

Digital Literacy:

Digital literacy plays a crucial role in enhancing financial inclusion by enabling users to efficiently navigate mobile banking applications (Rahman & Ahsan, 2024). It encompasses the ability to understand and operate digital financial services, ensuring users can securely perform transactions, manage accounts, and access banking services without physical interaction (Adhikari, Ghimire, & Lama, 2024). Higher levels of digital literacy significantly reduce barriers to mobile banking adoption by improving user confidence, minimizing fraud risks, and enhancing transaction efficiency (Al-Sarraji et al., 2024). Studies suggest that individuals with strong digital literacy are more likely to adopt mobile banking services, as they can effectively assess security protocols, interpret banking interfaces, and leverage digital financial tools for better financial management (Annisa, Soma, & Sitorus, 2024). Thus, improving digital literacy is essential for maximizing the potential of mobile banking in achieving broader financial accessibility.

Ho_2: Digital literacy does not have a positive and significant impact on financial inclusion.

Financial Inclusion:

Financial inclusion refers to the accessibility and availability of financial services to individuals and businesses, particularly those in underserved or unbanked communities (Rahman, 2024). It plays a pivotal role in promoting economic growth by ensuring that individuals can participate in formal financial activities such as savings, credit, insurance, and digital transactions (Canguende-Valentim et al., 2024). The rise of digital financial services, particularly mobile banking, has significantly contributed to financial inclusion by reducing geographical and economic barriers to banking (Song & Valencia, 2024). However, financial literacy and digital literacy remain critical enablers in this process, as individuals with limited financial knowledge often struggle to effectively utilize digital banking platforms (Zaimović et al., 2024). By

integrating digital banking with educational initiatives on financial literacy, banks can enhance user engagement, promote responsible financial behaviour, and create a more inclusive financial ecosystem that fosters economic stability and empowerment (Lui & Go, 2024).

Model of Study:

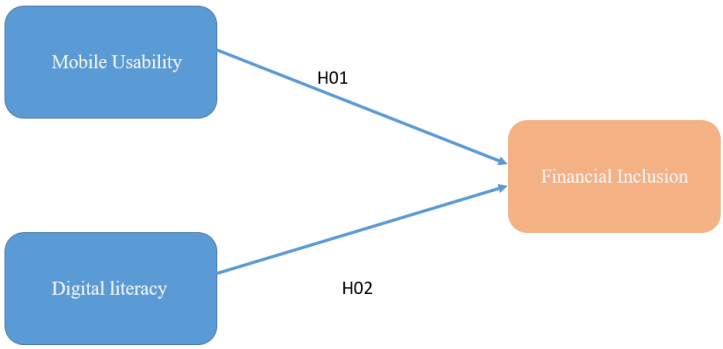

Figure 1: *Conceptual Framework*

Research Methodology:

The research is **quantitative and explanatory** in nature, focusing on the relationship between **digital literacy, mobile banking usability, and financial inclusion** using primary data. This design aims to provide a comprehensive understanding of how digital banking adoption is influenced by digital literacy and usability factors.

This study focuses on **mobile banking users in urban India,** with a sample of **200 respondents** who actively engage in digital financial transactions. A **cross-sectional approach** is employed, and primary data is collected through a **structured questionnaire in 2024** to ensure rigorous statistical analysis and a strong theoretical foundation.

The research investigates the relationship between **digital literacy, mobile banking usability, and financial inclusion**, analysing their combined impact using **Smart PLS (Partial Least Squares) software**. To ensure the reliability and validity of the questionnaire, tests like **Cronbach's alpha and Composite Reliability (CR)** are conducted. Additionally, **Structural Equation Modelling (SEM)** is used to thoroughly test the hypotheses and understand the connections between the key study variables.

Findings:

Demographic Information:

The study surveyed **200 participants**, with a higher representation of **female respondents (70%) compared to male respondents (30%).** The age distribution indicates that a majority of the participants belong to **Generation Z (57.5%),** followed by **Generation Y (29.5%),** and **Generation X (13%),** suggesting that younger individuals are more engaged with mobile banking services.

In terms of educational qualifications, **42% of respondents held an undergraduate (bachelor's) degree**, while **21% had completed senior secondary education,** and **19% had a postgraduate degree.** Additionally, **18% of respondents had professional qualifications**, highlighting a diverse range of educational backgrounds.

The income distribution shows that **48.5% of participants earn less than ₹25,000 per month,** followed by **24% earning between ₹25,000 - ₹50,000,** while **13.5% fall within the ₹50,000 - ₹75,000 range.** Higher-income groups, including those earning **₹75,000 - ₹1, 00,000 (7%)** and **more than ₹1, 00,000 (7.5%),** represent a smaller portion of the sample.

As per the results in **Table 1,** Regarding occupation, the largest group of participants are **students (42.5%),** followed by **salaried employees (28.5%), self-employed individuals (21.5%),** and **unemployed respondents (7.5%).** This distribution suggests that mobile banking usage is prevalent across different employment categories.

In terms of mobile banking usage, **58% of respondents have been using mobile banking for less than two years,** while **29.5% have used it for 2-5 years,** and **12.5% have experience of more than five years.** The frequency of mobile banking usage varies, with **38.5% using it weekly, 33.5% daily, 15.5% monthly,** and **12.5% fortnightly**, indicating a substantial adoption of mobile financial services among participants.

This demographic breakdown provides a comprehensive perspective on mobile banking users in urban areas, offering insights into how age, education, income, and occupation influence financial inclusion through mobile applications.

Table 1: Demographic Information

Variable	Items	Frequency	Percentage (%)
Gender	Male	60	30
	Female	140	70
Age Group	Gen X (1965-1980)	26	13
	Gen Y (1981-1996)	59	29.5
	Gen Z (1997-Present)	115	57.5
Educational Qualification	Senior Secondary (High School)	42	21
	Undergraduate (Bachelor's)	84	42
	Postgraduate (Master's)	38	19
	Professional	36	18
Income Bracket (INR)	Less than ₹25,000	97	48.5
	₹25,000 - ₹50,000	48	24
	₹50,000 - ₹75,000	27	13.5
	₹75,000 - ₹1,00,000	14	7
	More than ₹1,00,000	15	7.5
Occupation	Student	85	42.5
	Employed (Salaried)	57	28.5
	Self-employed (Business)	43	21.5
	Unemployed	15	7.5
Duration of Using Mobile Banking	Less than 2 years	116	58
	2 - 5 years	59	29.5
	More than 5 years	25	12.5
Usage Frequency	Daily	67	33.5
	Weekly	77	38.5
	Fortnightly	25	12.5
	Monthly	31	15.5

Descriptive Statistics:

Partial Least Squares (PLS) is a **variance-based structural equation modelling (SEM) technique** that allows for the simultaneous assessment of both **measurement and structural models** (Hair et al., 2017). The **measurement model** evaluates the **validity and reliability** of three key variables in this study: **DLM (Digital Literacy Measure), UM (Usability Measure), and FIM (Financial Inclusion Measure).**

As per table 2, Factor loadings indicate the strength of the relationship between observed indicators and their respective latent constructs. The results show that most factor loadings exceed **0.70**, confirming that the observed variables are strong indicators of their respective

constructs. However, some loadings, such as **FIM3 (0.625)** and **UM1 (0.641),** are slightly below the preferred threshold but remain within an acceptable range, contributing meaningfully to the overall model.

Reliability and Validity Measures: Cronbach's Alpha, a measure of internal consistency, exceeds **0.80** for all constructs (**DLM: 0.885, FIM: 0.838, UM: 0.849**), indicating high reliability. Composite reliability (CR) values also surpass **0.85** across all variables, further validating the consistency of the constructs. The **Average Variance Extracted (AVE)** for each construct is above **0.50 (DLM: 0.592, FIM: 0.51, UM: 0.525),** confirming that the latent constructs explain a substantial portion of variance from their indicators.

Discriminant Validity: The **HTMT (Heterotrait-Monotrait) ratio** and **Fornell-Larcker criterion** confirm adequate discriminant validity, ensuring that each construct is distinct from the others. The **HTMT values (DLM-FIM: 0.76, DLM-UM: 0.744, FIM-UM: 0.81)** remain within the acceptable range, confirming that the constructs are not highly correlated.

Variance Inflation Factor (VIF): VIF values remain below **2.5** for all observed variables, confirming that multicollinearity is not a concern in this model. The **highest VIF value is 2.244 (DLM3),** which is well within the acceptable limit, indicating no severe collinearity issues.

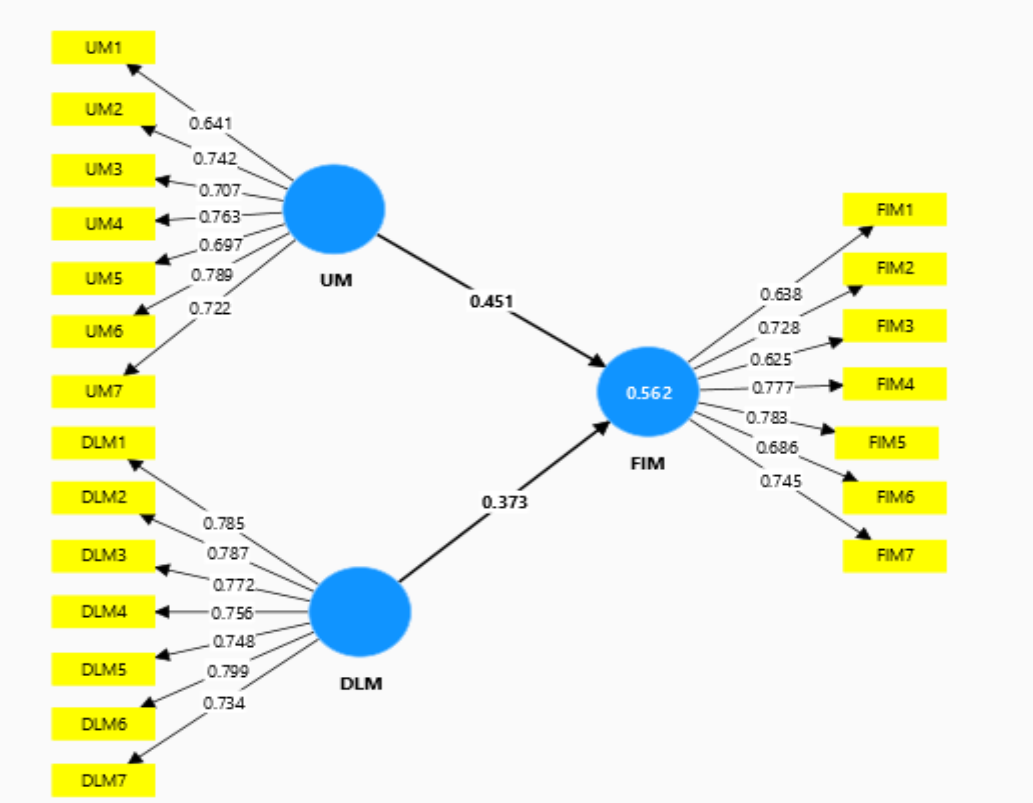

Figure 2: Measurement Model Results

Table 2: The measurement model estimates

Constructs	Items	Factor Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)	R-Square
Digital Literacy (DLM)	**DLM1**	**0.785**				
	DLM2	**0.787**				
	DLM3	**0.772**	**0.885**	**0.91**	**0.592**	
	DLM4	**0.756**				
	DLM5	**0.748**				
	DLM6	**0.799**				
	DLM7	**0.734**				
Financial Inclusion (FIM)	**FIM1**	**0.638**				**0.565**
	FIM2	**0.728**				
	FIM3	**0.625**	**0.838**	**0.879**	**0.510**	
	FIM4	**0.777**				
	FIM5	**0.783**				
	FIM6	**0.686**				
	FIM7	**0.745**				
Mobile App Usability (UM)	**UM1**	**0.641**				
	UM2	**0.742**				
	UM3	**0.707**	**0.849**	**0.885**	**0.525**	
	UM4	**0.763**				
	UM5	**0.697**				
	UM6	**0.789**				
	UM7	**0.722**				

Discriminant Validity Assessment:

To evaluate **discriminant validity** in the **measurement model**, the **Fornell-Larcker criterion** is applied. This method compares the **square root of the Average Variance Extracted (AVE)** of each construct with its correlations with other constructs in the model (**Hair et al., 2017).** For discriminant validity to be established, the **square root of the AVE for each construct must be greater than the highest correlation it shares with any other construct (Hair et al., 2019)**. This confirms that each construct shares **more variance with its own indicators** than with other constructs (**Hair et al., 2017).**

As per the results in **Table 3,** the **Fornell-Larcker criterion is satisfied,** demonstrating that the constructs **(DLM, FIM, and UM**) exhibit **strong discriminant validity**. This indicates that **Digital Literacy, Financial Inclusion, and Usability are distinct from one another,** ensuring that the model is well-specified and that the constructs do not overlap excessively.

Table 3: Fornell-Larcker Criterion

	DLM	FIM	UM
DLM	0.769		
FIM	0.667	0.714	
UM	0.652	0.694	0.724

HTMT (Heterotrait-Monotrait) Ratio Assessment:

The **HTMT (Heterotrait-Monotrait) Ratio** is a key method for assessing **discriminant validity** in **structural equation modelling (SEM).** It compares the **average correlations of indicators across different constructs** with the **average correlations of indicators within the same construct (Franke & Sarstedt, 2019).** For constructs to be considered sufficiently distinct, **HTMT values should be below 0.85 or 0.90 (Hair et al., 2014).**

As shown in **Table 4,** all HTMT values are below the commonly accepted thresholds, indicating that the constructs (**DLM, FIM, and UM**) exhibit **strong discriminant validity**. The **HTMT value between Financial Inclusion (FIM) and Usability Measure (UM) is 0.81**, which is **within the acceptable range,** confirming a moderate distinction between these two constructs while ensuring they remain conceptually separate.

Table 4: HTMT (Heterotrait-Monotrait) Ratio

	DLM	FIM	UM
DLM	-	-	-
FIM	0.760	-	-
UM	0.744	0.810	-

Structural Model;

The Variance Inflation Factor (VIF) values in the table are used to assess collinearity among the indicators in the model. Collinearity occurs when two or more predictor variables in a model are highly correlated, which can affect the accuracy of estimated regression coefficients (Hair et al., 2019). VIF helps detect multicollinearity by measuring how much the variance of a regression coefficient is inflated due to collinearity (Hair et al., 2017).

The test findings provided in Table 5 show that all VIF values are below the threshold of 3.0 and range above 1.4, confirming that there are no severe multicollinearity issues in the model. This ensures that the predictors (DLM, FIM, and UM) are sufficiently independent and do not distort the regression estimates.

Table 5 Multi-collinearity test

	VIF
DLM1	2.069
DLM2	2.171
DLM3	2.244
DLM4	2.046
DLM5	1.917
DLM6	2.211
DLM7	1.95
FIM1	1.455
FIM2	1.824
FIM3	1.483
FIM4	2.198
FIM5	2.054
FIM6	1.887
FIM7	1.849
UM1	1.424
UM2	1.908
UM3	1.887
UM4	2.104
UM5	1.752
UM6	2.184
UM7	1.884

Path Analysis:

The path coefficient values shown in the table are used to assess the strength and significance of relationships between variables in the structural model (Bansal et al., 2023). In this study, the path coefficients represent the direct effect of **Mobile App Usability (UM) and Digital Literacy (DLM) on Financial Inclusion (FIM)**, helping to understand their predictive power (Hair et al., 2019). The results indicate that **UM has a path coefficient of 0.451, while DLM has a path coefficient of 0.373**, suggesting that both variables significantly contribute to FIM. These coefficients are evaluated based on their magnitude and statistical significance to determine the impact of predictor variables on the outcome variable (Hair et al., 2017). The test findings provided in Table 6 confirm that all path coefficients fall within the acceptable range

Table 6 Path Coefficient

	FIM
UM	0.451
DLM	0.373

Hypothesis Testing:

The bootstrapping method was employed in this investigation to ascertain the significance of each structural path.

Ha1 evaluates whether Digital Literacy has a positive and significant impact on Financial Inclusion. The results indicate that the impact of Digital Literacy on Financial Inclusion is significant and positive, as shown by the findings ($\beta = 0.388$, $t = 4.745$, $p < 0.001$). Hence, H1 is supported.

Ha2 examines whether Mobile App Usability has a positive and significant impact on Financial Inclusion. The research findings indicate a positive and significant relationship between Mobile App Usability and Financial Inclusion ($\beta = 0.435$, $t = 5.037$, $p < 0.001$). Therefore, H2 is supported.

The results are presented in Table 7.

Table 7 Hypotheses testing

Hypothesis	Path	B	t-statistics	p-values	Decision
H1	**Digital Literacy → Financial Inclusion**	**0.388**	**4.745**	**<0.001**	**Supported**
H2	**Mobile App Usability → Financial Inclusion**	**0.435**	**5.037**	**<0.001**	**Supported**

Regression Equation Formation:

Financial Inclusion through Mobile Apps=0.388×Digital Literacy through Mobile Apps+0.435×Usability of Mobile Apps+Error term

Conclusion:

This study makes a significant contribution to the expanding field of financial inclusion by offering valuable insights into the role of mobile app usability and digital literacy in driving financial accessibility in urban areas. The findings confirm that both mobile app usability and digital literacy positively influence financial inclusion, reinforcing previous studies (Rahman & Ahsan, 2024; Adhikari et al., 2024; Lui & Go, 2024; Zaimović et al., 2024; Al-Sarraji et al., 2024). The study highlights that while both factors contribute significantly, mobile app usability ($\beta = 0.435$) has a slightly stronger impact than digital literacy ($\beta = 0.388$). This suggests that intuitive, user-friendly mobile banking applications play a more decisive role in financial inclusion than digital literacy alone.

The research underscores the importance of accessible and seamless digital platforms in enhancing financial participation. It provides useful insights for banks, fintech firms, and policymakers to develop mobile banking solutions that improve financial accessibility while integrating digital literacy initiatives. The results demonstrate that investing in user-friendly mobile applications and digital awareness programs can generate social and economic benefits, ultimately fostering greater financial inclusion.

However, the study has some limitations. The findings are based on data from urban populations and may not be directly applicable to rural or less digitally connected areas. Additionally, the study focuses on short-term impacts, suggesting that long-term investigations could provide a more comprehensive perspective. Future research could explore differences in financial inclusion across various demographics, assess the role of emerging technologies, and examine long-term behavioural shifts in mobile banking adoption.

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