



Innovative Financial Practices: A Quantitative Analysis of Bank-wise Mobile Banking Usage in India

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Abstract:

This research offers a nuanced exploration of mobile banking adoption and transaction patterns across different categories of Indian banks, grounded in data for December 2024. Employing descriptive and comparative analysis, the study uncovers significant disparities in transaction volumes, values, and active user engagement, shedding light on the uneven growth of digital banking in India. Public Sector Banks (PSBs) and Private Sector Banks emerge as leaders, collectively processing over 90% of the total transaction value, while smaller entities like Regional Rural Banks (RRBs) and District Central Cooperative Banks (DCCBs) lag behind in digital integration. The analysis reveals a strong positive correlation (0.96) between transaction volume and value, indicating effective digital adoption among major banks. However, weaker correlations observed in Scheduled State Cooperative Banks and RRBs highlight inconsistent user engagement, hinting at barriers such as digital illiteracy, infrastructure challenges, and customer reluctance. Interestingly, Local Area Banks exhibit the highest average transaction value, suggesting a niche, high-value clientele, while Payments Banks cater to a broad user base with frequent, low-value transactions. These contrasting patterns reflect the varied roles of banks in India's evolving digital economy. The study concludes that while mobile banking has transformed financial access, achieving deeper digital inclusion remains a challenge. Addressing adoption barriers, enhancing digital literacy, and refining policy frameworks could bridge these gaps, driving a more inclusive and robust mobile banking ecosystem. Future research should delve into these dynamics to support targeted interventions for sustainable digital growth. The findings offer valuable insights for policymakers and banking institutions aiming to expand digital financial inclusion.

Keywords: Mobile Banking, Internet Banking, Digital Banking, RBI

1 Introduction:

Mobile banking has transformed India's banking landscape, offering convenience and accessibility. However, different banking categories exhibit varying degrees of adoption, transaction frequency, and transaction value. This study aims to understand these variations and suggest strategies for enhanced financial participation.

The increasing penetration of mobile banking in India has reshaped financial transactions, making digital accessibility a key factor in banking efficiency. However, the adoption and utilization of mobile banking vary significantly across different banking segments. A detailed bank-wise analysis of mobile banking transaction values is essential for identifying trends, inefficiencies, and growth opportunities.

1.1 Trends in Mobile Banking Research:

A comprehensive review of prior research reveals significant themes in mobile banking adoption and its role in financial transformation. Several studies have explored:

- **Growth of Mobile Banking in India:** Studies by Agarwal & Sinha indicate that mobile banking has become a preferred channel for financial transactions, especially following the rise of smartphone penetration and government-led digital initiatives [1]. Research by Nikita T and Bhatt D [2] highlights that mobile banking adoption surged post-demonetization, with Unified Payments Interface (UPI) playing a crucial role in expanding digital transactions.
- **Adoption of Mobile Banking:** Various factors influence mobile banking adoption, including security, trust, ease of use, and digital literacy as per Bhuvana & Vasantha [3]. Researchers have applied behavioral models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) to analyze customer attitudes toward mobile banking as per Kesavaraj, Jakhiya and Bhandari [4]. Additionally, a growing number of studies have begun applying Rogers' Diffusion of Innovation (DOI) theory to understand how technological adoption spreads across customer segments and institutions. For instance Mori & Mlambiti [5] found that compatibility, trialability, and relative advantage were key drivers of mobile banking adoption in Tanzania Sembiring, Erlina, & Nasution [6] highlighted that observability and complexity significantly influence adoption in the Indian context, particularly among rural and semi-urban users. Similarly, Dash, Bhushan, & Samal [7] used the DOI lens to demonstrate how institutional readiness, customer education, and regulatory support can collectively accelerate mobile banking diffusion. These findings support the view that DOI offers a comprehensive framework for understanding not just individual consumer behavior but also the broader systemic evolution of digital banking services
- **Digital Payments and Financial Inclusion:** Studies highlight the impact of government initiatives such as demonetization and the Digital India campaign in promoting mobile banking adoption [8] The role of mobile banking in expanding financial access for underbanked populations has also been a significant area of research [9]

- **Impact of the COVID-19 Pandemic on Mobile Banking:** The pandemic accelerated the adoption of digital banking due to restrictions on physical banking transactions. Research suggests that consumers increasingly turned to mobile banking applications for routine transactions, reinforcing the need for digital infrastructure [10].
- **Challenges in Mobile Banking:** While mobile banking has gained traction, various studies have highlighted the challenges:
 - **Cybersecurity Threats:** Studies by Saluja [11] highlight an increase in fraud and phishing attacks, affecting user trust.
 - **Security & Trust:** Mobile banking security remains a concern. Studies indicate that trust in banking institutions and RBI guidelines significantly affect adoption rates [12].
 - **Digital Literacy Gap:** Research by Sharma & Mehta [13] notes that rural and elderly populations often struggle with mobile banking.
 - **Infrastructure Constraints:** Limited network connectivity in remote areas hinders seamless banking experiences as per Kanimozhi & Subathradevi [14].

2 Rationale and Objective of the Study:

2.1 Rationale and Relevance to Management Domain

Despite extensive research on mobile banking, key areas remain insufficiently explored.

- **Lack of Bank-Specific Analysis:** Most studies focus on mobile banking adoption at an aggregate level, analyzing consumer behavior without distinguishing between different types of banks. However, banking institutions vary significantly in their infrastructure, customer base, and digital capabilities, influencing their mobile banking adoption. More granular research is needed to assess mobile banking penetration across different banking categories. This heterogeneity among banking institutions necessitates a differentiated analytical approach that goes beyond user-level behavioral models. Applying a theoretical framework such as Rogers' Diffusion of Innovation (DOI) enables the classification of banks based on their relative pace of digital adoption. Such a framework facilitates the identification of leading and lagging institutions, offering deeper insights into structural barriers, readiness levels, and strategic orientation toward mobile banking. By moving the focus from end-user adoption to institutional innovation patterns, the study contributes to a more nuanced understanding of digital transformation within India's banking ecosystem.
- **Limited Quantitative Studies on Mobile Banking Transactions:** While prior research discusses mobile banking growth, there is limited use of statistical correlation to analyze transaction volumes, values, and user engagement. A more data-driven approach is required to identify underlying trends and inconsistencies in mobile banking adoption.
- **Barriers to Digital Banking in Rural and Cooperative Banks:** Regional Rural Banks (RRBs) and Cooperative Banks serve a significant portion of India's population, yet their digital banking adoption remains inconsistent. Studies have acknowledged

challenges such as low digital literacy, inadequate infrastructure, and limited trust in mobile banking, but further research is required to explore strategies for improving mobile banking penetration in these banking segments [10]

- **Consumer Behavior and Transaction Patterns:** Existing studies focus primarily on mobile banking adoption without assessing transaction size variations across different banking institutions. Understanding whether mobile banking is primarily used for high-value or low-value transactions across banking segments remains an area for further exploration [8] and [3]
- **Comparative Studies of Mobile Banking and Internet Banking:** While mobile banking has grown exponentially, its relationship with internet banking remains an underexplored area. Limited studies compare transaction trends in mobile banking versus internet banking to understand whether mobile banking complements or replaces traditional online banking channels [4].

This paper contributes to the field of management by providing a theory-informed, data-driven examination of digital transformation within Indian banking institutions. By integrating the Diffusion of Innovation (DOI) framework with empirical analysis of transaction patterns, user engagement, and volatility across bank categories, the study offers nuanced insights into the digital maturity and innovation trajectories of different banking segments. These insights enable bank managers, policymakers, and financial strategists to design differentiated digital interventions, align operational priorities with institutional readiness, and advance more inclusive and resilient financial ecosystems..

2.2 Objectives and Research Questions:

The objective of this analysis is to provide a deep, data-driven examination of bank-wise mobile banking transaction values for December 2024.

As mobile banking adoption grows, understanding transaction trends across different banking categories becomes crucial. This study is exploratory in nature, aiming to analyse inconsistencies and identify key parameters that can guide future research on digital banking behaviour. Since the study began without predefined variables, the objective is to uncover meaningful patterns rather than test specific hypotheses.

1. To analyse mobile banking and internet banking transaction data across various banking categories to identify trends, inconsistencies, and anomalies.
2. **Structural and Reporting Insights** – To explore relationships (e.g., negative correlations, variations in transaction behaviour) that may indicate structural gaps, reporting inconsistencies, or inefficiencies in mobile banking operations.
3. To identify future research areas by comparing transaction behaviour across different bank categories and outliers.

By identifying these trends and inconsistencies, this study lays the groundwork for more targeted research, helping financial institutions and policymakers refine mobile banking strategies and improve digital financial inclusion. It also aims to explicitly answer the stated research questions:

- RQ1: What are the patterns of mobile banking adoption across different categories of Indian banks?
- RQ2: How do mobile and internet banking transaction volumes, values, and user engagement vary across banks?
- RQ3: What correlations exist between transaction parameters and digital banking adoption levels?
- RQ4: How does volatility differ in digital banking metrics across bank categories?
- RQ5: What are the future research areas in Mobile and Internet Banking adoption across various banks?

3 Research Methodology and Limitations:

3.1 Data Source:

- This study is based on data sourced from the report titled, “Bankwise Volumes in ECS/NEFT/RTGS/Mobile Transactions” [15] Metrics such as transaction volumes, values, and the number of active mobile banking and internet banking customers were examined.
- The list of Banks was taken from RBI’s website. (rbi.org.in > common man [16].

3.2 Analysis Tools and Techniques:

Quantitative methods, including descriptive statistics and comparative analysis, were employed to assess the data. Visualizations were created to highlight trends and disparities.

To classify Indian banks into the five categories defined by Rogers’ Diffusion of Innovation (DOI) Theory—Innovators, Early Adopters, Early Majority, Late Majority, and Laggards—a step-by-step scoring method was applied using bank-wise mobile banking data. The analysis focused on three key indicators: transaction volume, transaction value (in ₹’000), and the number of active users. Each of these values was normalized using min-max scaling to make them comparable across banks. Then, an average score (called the digital maturity score) was calculated for each bank by combining the three normalized indicators. Banks were grouped based on how their scores ranked: the top 10% were classified as Innovators, the next 10% as Early Adopters, followed by 20% as Early Majority, 20% as Late Majority, and the bottom 40% as Laggards. These classifications were then grouped by bank type to build a profile of mobile banking adoption in India. The results were presented using a stacked bar chart. This method offers a consistent way to compare digital progress across different types of banks.

3.3 Limitations:

- **Bank Name Discrepancies:** Variations in bank names across datasets (e.g., CO-OP BANK in one source and Co-operative Bank in another) created challenges for automated data matching using VLOOKUP.
- **Manual Classification:** In some cases, bank categories were manually assigned to resolve mismatches. Although every effort was made to ensure accuracy through double-checking, the possibility of human error persists.

4 Findings and Analysis

4.1 Mobile Banking Statistics Vs Internet Banking Penetration:

The Internet Banking has been defined as “Internet banking, also known as online banking, e-banking or virtual banking, is an electronic payment system that enables customers of a bank or other financial institution to conduct a range of financial transactions through the financial institution's website.” (17). While mobile banking has been defined in Master Direction by Reserve Bank of India as “Mobile Banking transaction’ means undertaking banking transactions using mobile phones by bank customers that involve accessing / credit / debit to their accounts” (18).

Table 1. Mobile Banking Statistics Vs Internet Banking[illegible]

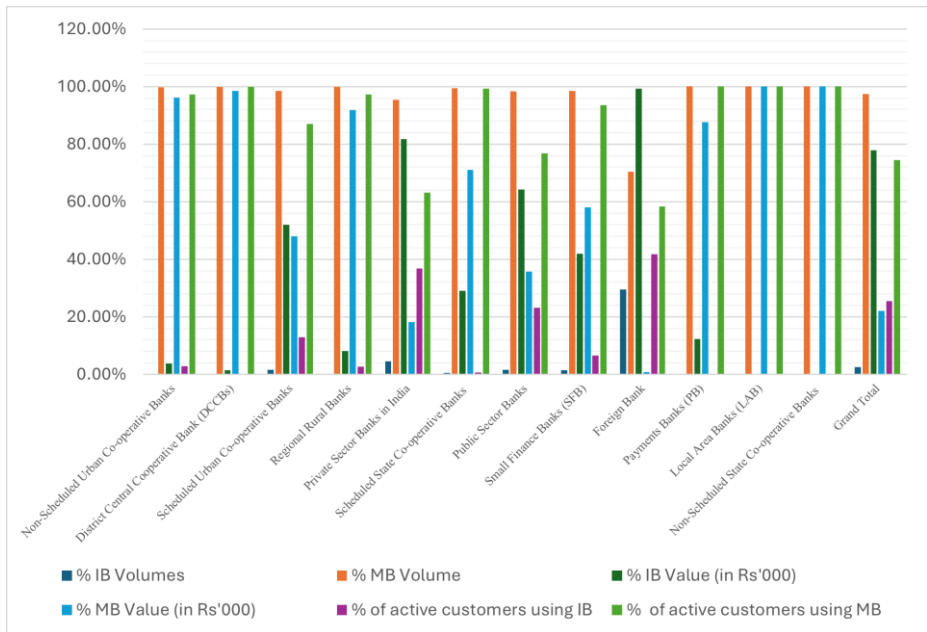


Figure. 1. Mobile Banking vs Internet Banking Volume (in actuals), Value and active Users.

Key Points:

By mapping Bank category to the data of Bank-wise internet banking (IB) and mobile banking (MB) the following trends were noted:

- **Mobile Banking's Wider Reach Across Banks:** A total of 568 banks reported mobile banking (MB) transactions, compared to just 128 banks for internet banking (IB), highlighting MB's broader adoption across banks.
- **MB Dominates Volume, IB Leads in Value:** MB accounts for 97.47% of total transactions, while IB contributes only 2.53%. However, IB processes ₹110.59 trillion versus ₹34.56 trillion for MB, making up 77.93% of value. MB has 251.92 million active users, nearly three times IB's 86.37 million (74.47% preference for MB).
- **NSUCBs: Mobile Banking Takes Over, But IB Shows High Value Per Transaction:** Among Non-Scheduled Urban Co-operative Banks (NSUCBs), MB leads in volume, value, and users. However, only three banks reported IB transactions, with 16,079 users making 33,892 transactions worth ₹552.17 crore—an average transaction value of ₹3.43 lakh, but only two transactions per user. MB users had the second-highest average transaction value at ₹7,700.33 and per active user at ₹2.47 lakh.
- **DCCBs: High IB Value but Limited Adoption:** Only one District Central Cooperative Bank (DCCB) reported IB transactions, with 75 users processing ₹43.29 crore—an average of ₹57.72 lakh per user, far higher than ₹1.23 lakh per MB user. This requires further analysis.

- **SUCBs: MB Dominates, But IB Leads in Transaction Share:** Among Scheduled Urban Co-operative Banks (SUCBs), 40 banks reported MB, while 21 reported IB. MB leads in volume and users, but IB accounts for 52% of total transactions, the highest among co-operative banks. However, MB users make 70 transactions per month, nearly 10 times IB's 7 transactions per user.
- **RRBs: An Outlier in Digital Banking Trends:** Among Regional Rural Banks (RRBs), 30 reported IB transactions, while only 23 reported MB, meaning 7 RRBs had no MB transactions. This deviation from the overall trend needs further study.
- **Private Banks: Near-Parity, But IB Leads in Value:** Private banks show almost equal adoption of IB (21 banks) and MB (20 banks). However, Nainital Bank is the only private bank without MB, suggesting operational or strategic issues. While IB accounts for just 4.56% of transactions, it contributes 81.77% of value and 36.87% of active users. The average IB transaction value per user is ₹16.94 lakh, compared to ₹2.20 lakh for MB.
- **State Co-operative Banks: IB Value Per User is Significantly Higher:** Only one Scheduled State Co-operative Bank reported IB transactions, while 16 reported MB. Like other co-operative banks, MB dominates in volume, value, and users. However, the average IB transaction per user is ₹60.95 lakh, 0.00% 20.00% 40.00% 60.00% 80.00% 100.00% 120.00% % IB Volumes % MB Volume % IB Value (in Rs'000) % MB Value (in Rs'000) % of active customers using IB % of active customers using MB transactions per month (IB: 11, MB: 16).
- **Public Sector Banks: IB Users Make Fewer Transactions but of Higher Value:** All 12 Public Sector Banks have both IB and MB. While private banks lead in IB volume, public banks dominate in MB volume, value, and users. The average IB transaction value per user is ₹7.04 lakh, compared to ₹1.17 lakh for MB. However, IB users make only 4 transactions per month, while MB users complete 67 transactions—indicating MB's higher engagement.
- **Small Finance Banks: Unity SFB an Outlier with No IB Transactions :** Among 11 Small Finance Banks (SFBs), only Unity SFB lacks IB transactions. MB leads in volume, value, and users, but IB users have an average transaction value of ₹18.95 lakh, far higher than ₹1.82 lakh for MB. The average IB transaction is ₹2.28 lakh, compared to ₹4,598 for MB.
- **Foreign Banks: IB Heavily Outweighs MB in Value:** Among foreign banks, 25 reported IB, while only 9 reported MB. Despite IB handling just 29.55% of total transactions, it accounts for 99.23% of total value. The average IB transaction is ₹10.21 lakh, compared to just ₹3,310.73 for MB. Unlike domestic banks, IB and MB users have a smaller gap in transaction frequency.
- **Payments Banks: High-Value IB Transactions, But MB Dominates:** Six Payments Banks reported Mobile Banking (MB) transactions, while only four had Internet Banking (IB). MB's average transaction value is just ₹569.31, whereas IB transactions average ₹65.07 lakh. Notably, only 624 active IB users transacted an average of ₹9.14 crore, an anomaly that warrants further analysis. Payments Banks rely primarily on MB, with IB serving a niche segment handling large transactions.
- **No IB Transactions in Local Area Banks & Non-Scheduled State Co-op Banks:** Local Area Banks (LABs) and Non-Scheduled State Co-operative Banks reported zero

Internet Banking transactions. Whether this is due to regulatory constraints or business decisions requires deeper examination.

- **Weak IB vs. MB Correlation, But Strong Parallel Growth in Volume & Value:** A negative correlation of -0.21 between IB and MB suggests that banks focusing on MB may not necessarily prioritize IB, and vice versa. However, the weak correlation indicates this is not a firm trend but rather a divergence in digital banking strategies. Meanwhile, a strong positive correlation in transaction volume (0.85), value (0.8527), and active users (0.9322) suggests that banks with high IB activity also tend to have high MB activity, reinforcing overall digital adoption.

To summarize:

In alignment with Objective 1 and Research Questions 1 and 2, the study reveals significant disparities in mobile and internet banking adoption across bank categories. Mobile banking has a broader reach and user engagement, while internet banking contributes higher transaction values in select segments like foreign and private banks. These findings reflect diverse digital strategies and user preferences across the Indian banking system.:

- **Mobile Banking Dominates (77.93%)** – Most banks rely heavily on Mobile Banking, especially Payments Banks (87.68%), Small Finance Banks (58.08%), and Regional Rural Banks (91.81%).
- **Foreign Banks Prefer Internet Banking (99.23%)**, likely due to corporate clients.
- **Private Sector Banks Show Balanced Usage (81.77% IB, 18.23% MB)**, indicating continued IB relevance.
- **Public Sector Banks (64.29% IB, 35.71% MB)** suggest a shift towards mobile but with significant IB transactions.
- **Small and Co-operative Banks Vary** – Some rely on MB (DCCBs: 98.57%), while others like Scheduled Urban Co-operative Banks (52.07% IB) have a more even split.
- **Strong Correlation (0.8527)** suggests that banks with high IB transactions also tend to have high MB usage, though with varying preferences based on customer demographics.

4.2 Bank-wise Analysis of Digital Banking Volatility Across Bank Categories :

A bank-wise analysis of volatility helps uncover structural differences in digital banking adoption, operational efficiency, and risk exposure. Different categories of banks—private, public, cooperative, small finance, and payments banks—serve distinct customer segments with varying transaction behaviors. For example, private and foreign banks may exhibit higher volatility due to large-value IB transactions, while payments banks may show fluctuations in MB usage driven by retail customers. Understanding these patterns at a granular level allows regulators and policymakers to tailor digital banking policies, improve financial inclusion, and effectively address systemic risks.

Table 2. Bank-wise Analysis of Digital Banking Volatility Across Bank Categories.

Bank Category	% Standard Deviation					
	Volume		Value		Active Users	
	IB	MB	IB	MB	IB	MB
District Central Coopera- tive Bank (DCCBs)	NA	303%	NA	204%	NA	18%
Regional Rural Banks	156%	259%	169%	189%	240%	303%
Non-Scheduled Urban Co-operative Banks	94%	257%	103%	190%	115%	0%
Small Finance Banks (SFB)	211%	205%	247%	199%	136%	180%
Scheduled Urban Co-operative Banks	146%	188%	147%	143%	131%	146%
Foreign Bank	275%	167%	288%	129%	268%	150%
Private Sector Banks in India	248%	155%	326%	156%	333%	179%
Scheduled State Co-operative Banks	NA	153%	NA	221%	NA	134%
Payments Banks (PB)	164%	135%	173%	131%	161%	207%
Public Sector Banks	234%	130%	258%	145%	302%	207%
Local Area Banks (LAB)	NA	48.84 %	NA	79%	NA	170%
Non-Scheduled State Co-operative Banks	NA	0.00%	NA	0.00 %	NA	266%
Grand Total	480 %	772%	533 %	748%	665 %	1339 %

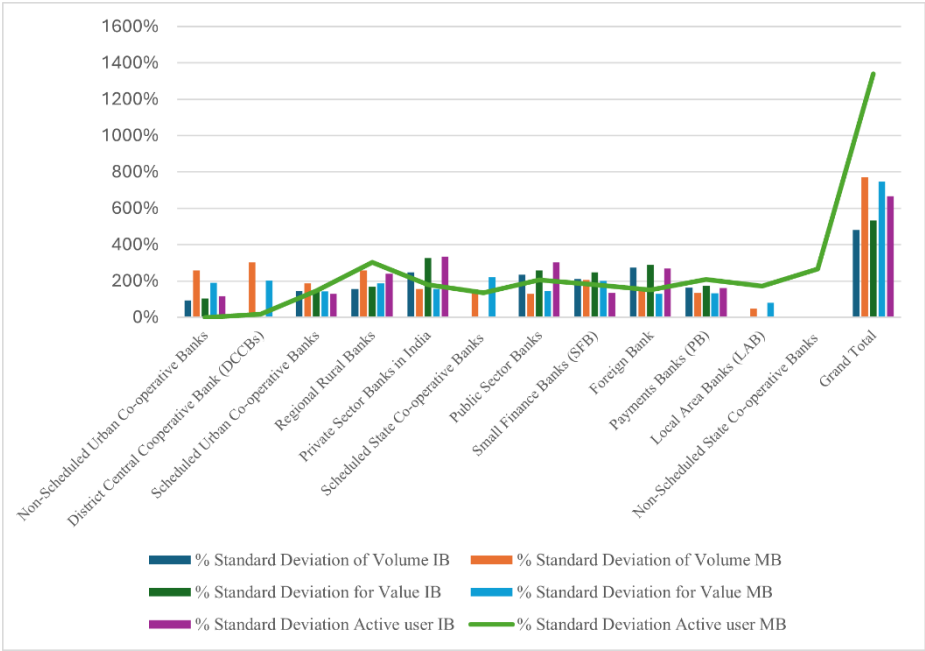


Figure 2.: Bank-wise Analysis of Digital Banking Volatility Across Bank Categories

Key Points:

- **Significant Variability in Transaction Volumes:** The standard deviation of transaction volumes for Internet Banking (IB) and Mobile Banking (MB) is notably high across different bank categories. Foreign Banks exhibit the highest volatility in IB volume (275%), whereas District Central Cooperative Banks (DCCBs) and Regional Rural Banks (RRBs) display substantial fluctuations in MB volumes, reaching 303.07% and 258.94%, respectively. This suggests that digital banking adoption is uneven across different banking segments, likely influenced by customer demographics and banking infrastructure.
- **High Fluctuations in Transaction Value:** Private Sector Banks show the highest volatility in IB transaction value at 325.89%, indicating significant inconsistency in high-value transactions. Similarly, Small Finance Banks (SFBs) and Public Sector Banks report considerable variation in MB transaction value, exceeding 240%. This pattern suggests that some banks cater to customers who make sporadic but high-value transactions, whereas others experience steadier usage patterns.
- **Active Users Show Considerable Volatility:** Internet Banking active users exhibit substantial fluctuations, with Private Sector Banks leading at 332.88%, followed by Regional Rural Banks at 240.05%. For Mobile Banking, Public Sector Banks and Payments Banks show the highest variability at 206.82% and 207.10%, respectively. This indicates that digital banking adoption is dynamic, with periods of rapid user growth or inactivity depending on factors like promotions, seasonal trends, or technological enhancements.
- **Payments Banks Rely More on Mobile Banking:** Payments Banks have a relatively lower standard deviation in IB volume (164%) but a higher deviation in MB volume (135.37%). Their digital banking operations are primarily mobile-driven, with minimal IB adoption. This reinforces the notion that Payments Banks serve a customer base that relies heavily on mobile-based transactions rather than traditional internet banking.

To summarize:

Addressing Objectives 1 and 2 and Research Question 4, the analysis of digital banking volatility uncovers notable variations. Foreign banks exhibit the highest volatility in internet banking volumes, while regional and cooperative banks show inconsistent patterns in mobile banking. These fluctuations suggest differing operational efficiencies, customer behaviors, and readiness levels across banking categories:

- Foreign Banks show the highest volatility in IB transaction volume, while DCCBs and RRBs lead in MB volume fluctuations.
- Private Sector Banks exhibit the most unpredictable IB transaction values, while Public Sector and Small Finance Banks experience high MB transaction value fluctuations.
- Active users of digital banking are inconsistent, particularly in Private Sector Banks (IB) and Public Sector Banks (MB).
- Payments Banks depend primarily on MB, with IB playing a minimal role in their operations.

- This bank-wise analysis highlights the differing levels of digital banking adoption across institutions, emphasizing the need for customized strategies to enhance stability and user engagement.

4.3 Bank-wise Analysis of Correlation in Digital Banking Transactions – December 2024.

Correlation analysis provides valuable insights into how transaction volume, value, active users interact within different banking segments. This correlation study helps banks understand how customer engagement translates into actual transactions. High volume-value correlation suggests stable and predictable usage, while weaker user engagement correlation highlights potential gaps in customer behavior. Banks with lower correlations should focus on improving transaction consistency and user activation strategies to boost digital banking adoption.

Table 3. Bank-wise Analysis of Correlation in Digital Banking Transactions – December 2024

Bank Category	Correlation coefficient					
	Volume & Value		Active User with Volume		Active User with Value	
	IB	MB	IB	MB	IB	MB
Non-Scheduled Urban Co-operative Banks	0.9949	0.5388	-0.1103	NA	-0.2095	NA
District Central Co-operative Bank (DCCBs)	NA	0.7813	NA	1	NA	1
Scheduled Urban Co-operative Banks	0.9754	0.8933	0.8394	0.9882	0.8434	0.995
Regional Rural Banks	0.864	0.9681	0.4958	0.9576	0.1421	0.969
Private Sector Banks in India	0.911	0.9516	0.5951	0.9144	0.2118	0.916
Scheduled State Co-operative Banks	NA	0.2807	NA	0.4375	NA	0.8412
Public Sector Banks	0.9945	0.9984	0.9961	0.7835	0.9982	0.7654
Small Finance Banks (SFB)	0.9975	0.8444	0.7859	0.7574	0.7796	0.3163
Foreign Bank	0.628	0.8414	0.8376	0.5813	0.2893	0.5556
Payment Banks (PB)	0.9992	0.9977	-0.2699	0.3333	-0.3079	0.4499
Local Area Banks (LAB)	NA	1	NA	0.002	NA	0.3347
Non-Scheduled State Co-operative Banks	NA	0.5388	NA	-0.0567	NA	0.0028
Grand Total	0.8808	0.9591	0.8186	0.9044	0.4765	0.8599

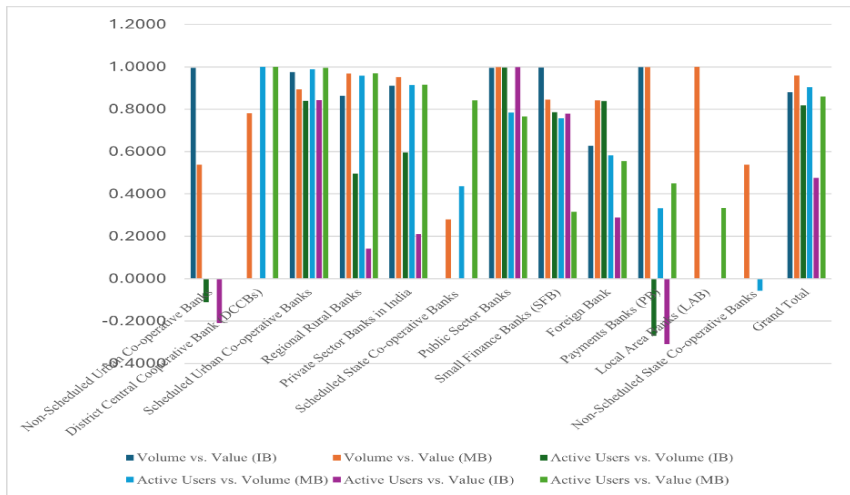


Figure 3. Bank-wise Analysis of Correlation in Digital Banking Transactions – December 2024

Key Points:

- **Strong Volume-Value Correlation in Mobile Banking :** Mobile Banking (MB) exhibits a higher correlation (0.9591) between transaction volume and value compared to Internet Banking (IB) (0.8808). This suggests that customers using MB tend to transact in a more predictable pattern, reinforcing its growing dominance in digital banking.
- **Public and Private Sector Banks Exhibit Stable Transaction Patterns:** Both Public Sector Banks (0.9945 for IB, 0.9960 for MB) and Private Sector Banks (0.9110 for IB, 0.9516 for MB) show strong correlations between transaction volume and value, indicating that digital banking is well-integrated into their customer base. Small Finance Banks also demonstrate similar stability.
- **Foreign and Payments Banks Show Inconsistent Digital Usage:** Foreign Banks (0.6280 for IB, 0.8414 for MB) and Payments Banks (0.9992 for IB, 0.9797 for MB) have fluctuating correlations. While Payments Banks show an extremely high volume-value correlation, their user engagement is inconsistent, reflected in weak correlations between active users and transaction values.
- **Active Users Do Not Always Translate into Higher Transactions:** The correlation between active users and transaction volumes/values is significantly lower than the volume-value correlation, particularly in Internet Banking (0.4765 for IB vs. 0.9044 for MB). This implies that a larger user base does not necessarily mean increased transactions, especially in IB.
- **Regional Rural Banks and Scheduled Urban Co-op Banks Show Moderate Consistency:** Both Regional Rural Banks (0.9681 for MB) and Scheduled Urban Co-operative Banks (0.8933 for MB) have relatively high correlations for volume-value transactions. However, their active user correlations are much weaker, indicating

that while digital transactions occur, they may be driven by a smaller subset of frequent users rather than broad adoption.

- **Why Correlation Analysis Matters for Banks:** This correlation study helps banks understand how customer engagement translates into actual transactions. High volume-value correlation suggests stable and predictable usage, while weaker user engagement correlation highlights potential gaps in customer behavior. Banks with lower correlations should focus on improving transaction consistency and user activation strategies to boost digital banking adoption.

To Summarize:

In response to Objectives 1 and 2 and Research Question 3, correlation analysis demonstrates a strong positive relationship between transaction volume and value in mobile banking. However, correlations between active users and transaction metrics are weaker, especially in internet banking. This indicates that high user registration does not always translate into active digital engagement, highlighting gaps in user activation strategies.:

- **Strong Volume-Value Correlation** – Higher transactions lead to higher value across most banks.
- **Active User Impact Varies** – Some banks see more users translating to more transactions, while others don't.
- **Foreign Banks' Digital Gap** – Weaker correlations suggest diverse user behavior or alternative channels.
- **Negative Correlations Flag Issues** – Some banks show lower transaction intensity per user or inefficiencies.
- **Urban vs. Rural Digital Growth** – Strong adoption in regional banks, but user engagement gaps persist.

4.4 Mobile Banking Adoption Across Indian Bank Categories: Diffusion of Innovation (DOI) Framework Classification – December 2024:

To strengthen analytical interpretation, the adoption of mobile banking across bank categories can be further contextualized through Rogers' Diffusion of Innovation Theory, which explains institutional adoption behavior in terms of innovators, early adopters, early majority, late Majority, and laggards. This framework helps explain the observed disparities in adoption, transaction frequency, and user engagement.

Table 4. Mobile Banking Adoption Across Indian Bank Categories: Diffusion of Innovation (DOI) Framework Classification

Bank Category	Inno- va- tors	Early Adopters	Early Ma- jority	Late Major- ity	Lag- gards	Grand Total
Private Sector Banks	95%	5%				20
Public Sector Banks	92%	8%				12

Scheduled Urban Co-operative Banks	18%	400%	33%	5%	5%	40
Regional Rural Banks	26%	35%	26%		13%	23
Payments Banks (PB)	83%	17%				6
Small Finance Banks (SFB)	45%	36%	18%			11
Foreign Bank	44%	11%	11%		33%	9
Local Area Banks (LAB)				500%	500%	2
District Central Co-operative Bank (DCCBs)		5%	23%	18%	54%	79
Non-Scheduled State Co-operative Banks					100%	1
Non-Scheduled Urban Co-operative Banks		5%	20%	26%	49%	349
Scheduled State Co-operative Banks		19%	19%	44%	19%	16
Grand Total	10%	10%	20%	20%	40%	568

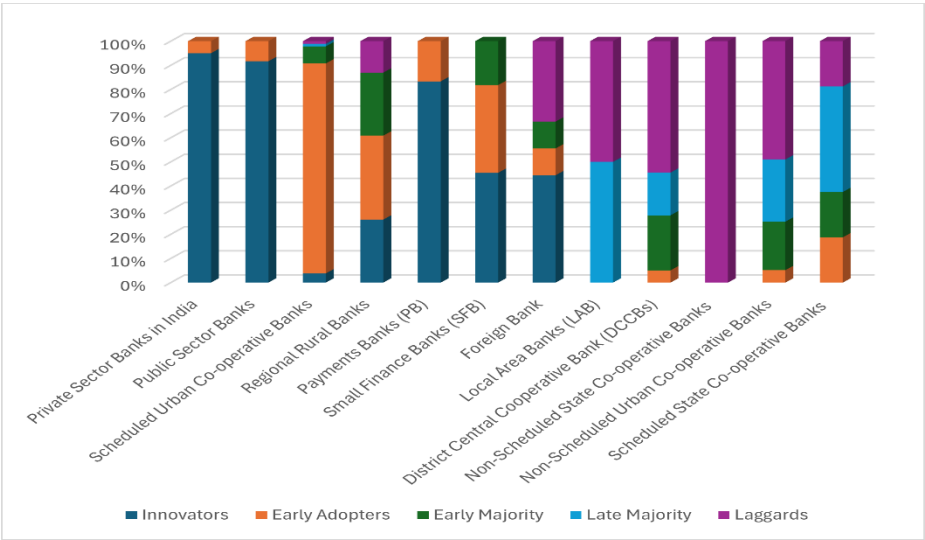


Figure. 4. Mobile Banking Adoption Across Indian Bank Categories: Diffusion of Innovation (DOI) Framework Classification – December 2024

Key Points:

- Private Sector Banks clearly lead digital innovation, with 95% classified as Innovators. This underscores their early investment in mobile infrastructure, robust digital interfaces, and high user engagement.
- Public Sector Banks also rank prominently as Innovators, with the majority demonstrating extensive mobile banking deployment. Their leadership reflects government-backed digital initiatives, large customer bases, and strong branch networks.

- Small Finance Banks and Payments Banks display high agility, with most falling into Innovator or Early Adopter categories. This suggests that smaller, newer banks—despite resource constraints—can successfully embrace mobile banking through targeted strategies and technology integration.
- Scheduled Urban Co-operative Banks exhibit varied digital maturity, spanning all five DOI categories. This heterogeneity suggests differentiated readiness across regions and internal capabilities.
- District Central Co-operative Banks (DCCBs) and Non-Scheduled Urban Co-operative Banks (NSUCBs) remain predominantly in the Late Majority and Laggard categories, highlighting systemic challenges such as legacy systems, low IT budgets, and limited customer digital literacy.
- Regional Rural Banks (RRBs) present a more optimistic picture, with a substantial number progressing from Innovators to Early Majority. This signals positive outcomes of policy interventions, including digital penetration mandates and rural outreach programs.
- Foreign Banks exhibit a mixed pattern, indicating heterogeneity in digital adoption aligned with specific business strategies, technology partnerships, and customer demographics.
- Local Area Banks (LABs) demonstrate a polarized adoption pattern, with a few embracing innovation while others lag significantly, possibly due to their localized nature and inconsistent access to digital infrastructure.
- A significant portion of the Indian banking system—over 60% of the banks—resides in the Late Majority and Laggard categories, reflecting a wide digital divide that must be addressed through structural and capability-based interventions.

To Summarize:

Aligned with Objective 3 and Research Question 5, the study identifies multiple avenues for future research. These include tracking longitudinal trends in digital transactions, studying persistent outlier behavior, assessing the impact of regulatory interventions, and comparing the long-term interplay between mobile and internet banking. These directions can guide deeper investigations into digital banking adoption and efficiency.:

- Private and Public Sector Banks lead in digital adoption, backed by strong infrastructure and policy support.
- SFBs and Payments Banks show that tech focus enables fast adoption despite smaller scale.
- Many Co-operative Banks lag due to outdated systems and limited digital capacity.
- RRBs are improving, driven by rural digital initiatives.
- Digital adoption is uneven, with 60% still in late or lagging stages.
- DOI framework exposes the gap, guiding targeted regulatory action.

5 Future Research Areas:

The objective 3 of the study was to identify future research areas by comparing transaction behaviour across different bank categories and outliers. Based on the findings of the study the, future research can focus on identifying patterns, inefficiencies, and growth opportunities in digital banking transactions across different bank categories. The objectives and hypotheses below can serve as a foundation for further investigation.

5.1 Objectives for Future Research:

- **Track Digital Banking Evolution Over Time:** Examine how transaction volumes, values, and user activity in mobile and internet banking change across different bank categories over multiple years.
- **Track Digital Banking Evolution Over Time:** Examine how transaction volumes, values, and user activity in mobile and internet banking change across different bank categories over multiple years.
- **Analyse Outlier Behaviour Over Time:** Identify whether banks consistently remain outliers in transaction patterns or if these anomalies shift due to market dynamics, regulatory changes, or operational strategies.
- **Study Long-Term Correlation Between MB and IB:** Assess whether the relationship between mobile and internet banking strengthens, weakens, or remains stable over time.
- **Evaluate the Impact of Policy Changes on Digital Transactions:** Investigate how regulatory interventions (such as RBI guidelines, cybersecurity measures, or financial inclusion initiatives) affect digital banking transactions over different time frames.
- **Monitor Digital Banking Volatility Trends:** Determine whether fluctuations in transaction volumes and values are periodic, seasonal, or reflective of structural changes in banking.

5.2 Hypotheses for Future Research:

- **H₀:** There is no significant difference in digital banking transaction behaviour across different bank categories.
H₁: Significant differences exist in mobile and internet banking adoption among public, private, foreign, and payment banks.
- **H₀:** Outlier banks in digital transactions do not follow a specific pattern and are randomly distributed.
H₁: Outlier banks exhibit transaction behaviours influenced by operational strategies, regulatory advantages, or specialized customer segments.
- **H₀:** There is no correlation between mobile and internet banking adoption in banks.

H₁: A strong correlation exists between mobile and internet banking transaction volumes across banks, indicating a complementary or competing digital strategy.

- H₀: The regulatory framework does not significantly impact digital banking adoption.
H₁: Regulatory policies and compliance requirements influence digital transaction volumes and values across different bank categories.
- H₀: Volatility in digital banking transactions is random and does not indicate systemic trends.
H₁: High transaction volatility reflects operational inefficiencies, policy-driven changes, or shifts in banking strategy.
- H₀: Bank size and market position have no impact on digital banking adoption.
- H₁: Larger banks dominate digital transactions, while smaller banks exhibit varied adoption based on niche strategies or customer focus.

5.3 *Future Research Directions.*

The study opens avenues for further research, including:

- Longitudinal Analysis – Examining mobile banking trends over multiple years to assess growth patterns and policy effectiveness.
- Comparative Study of Internet Banking vs. Mobile Banking – Understanding whether mobile banking complements or replaces internet banking.
- Impact of Digital Literacy Initiatives – Evaluating how financial education programs influence mobile banking adoption.
- Role of Financial Inclusion in Banking Growth – Analyzing whether increased mobile banking access leads to greater financial inclusion.
- Behavioural Study on Transaction Patterns – Identifying customer preferences and barriers to digital banking usage.

6 **Conclusion**

This study provides a comprehensive analysis of mobile banking transaction behavior across various banking categories in India. The findings highlight significant disparities in digital banking adoption, with Public Sector Banks (PSBs) and Private Sector Banks processing the majority of transactions, while Regional Rural Banks (RRBs) and Co-operative Banks struggle with lower digital integration. A strong positive correlation between transaction volume and value among major banks underscores the success of digital banking initiatives, whereas weaker correlations in certain bank categories indicate structural and adoption challenges.

6.1 Key insights from the research include:

- **Dominance of Large Banks:** PSBs and Private Banks lead in mobile banking adoption, benefiting from extensive digital infrastructure and customer trust.
- **Struggles of Smaller Banks:** RRBs, Cooperative Banks, and District Central Cooperative Banks (DCCBs) exhibit lower transaction values, primarily due to digital illiteracy, infrastructure gaps, and user reluctance.
- **Unique Transaction Patterns:** Local Area Banks handle high-value transactions despite lower volumes, while Payments Banks cater to frequent, low-value transactions, reflecting diverse banking models.
- **Need for Policy Interventions:** Addressing digital literacy gaps, improving infrastructure, and refining regulations can promote more inclusive digital banking.

Table 5. Alignment of Research Objectives, Questions, and Key Findings

Objective	Research Question(s)	Section	Key Findings
Objective 1: To analyse mobile and internet banking transaction data across various banking categories to identify trends, inconsistencies, and anomalies.	RQ1: What are the patterns of mobile banking adoption across different categories of Indian banks? RQ2: How do mobile and internet banking transaction volumes, values, and user engagement vary across banks?	Findings on MB vs IB	Mobile banking adoption is widespread across banks; internet banking is concentrated in private and foreign banks. MB dominates in volume and users; IB in transaction value.
Objective 2: To explore relationships (e.g., correlations, variations in transaction behavior) that may indicate structural gaps, reporting inconsistencies, or inefficiencies.	RQ3: What correlations exist between transaction parameters and digital banking adoption levels?	Correlation Analysis	Strong volume-value correlation; weak correlation with active users. Indicates inconsistencies in user engagement and activation.
1 and 2	RQ4: How does volatility differ in digital banking metrics across bank categories?	Volatility Analysis	Private and foreign banks show high volatility in IB transactions; regional and cooperative banks show volatility in MB. Highlights infrastructural and behavioural variances.
Objective 3: To identify future research areas by comparing	RQ5: What are the future research areas in mobile and	Future Research	Suggests research on outlier behaviors, longitudinal

transaction behaviour across different bank categories and outliers.	internet banking adoption across various banks?		adoption trends, impact of policy interventions, and urban–rural digital gaps.
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6.2 Financial Management & Policy Implications:

The results of this study offer crucial insights for both financial managers within banking institutions and policymakers overseeing the digital banking ecosystem in India.

- Strategic Shift: High mobile banking use in Public and Private Sector Banks signals a shift to mobile-first models. Financial managers must prioritize mobile UX, analytics, and infrastructure investment.
- Inclusion Challenge: Low digital engagement in DCCBs and RRBs highlights grassroots barriers—digital literacy, trust, and access. Targeted outreach via assisted banking and BC models is essential.
- Policy Urgency: Uneven adoption calls for tiered support. RBI and allied bodies should offer incentives (e.g., cloud subsidies, digital infra tagging) to boost digital readiness in smaller banks.
- Beyond Access: High user counts don’t equal high usage. Banks must focus on active engagement via better UX, support tools, and reward systems.
- New Metrics Needed: Propose outcome-based regulation—tracking engagement, risk resilience, and infrastructure quality. A “Digital Banking Readiness Index” can benchmark progress.
- Systemic Resilience: Volatile transaction patterns demand real-time monitoring and mandatory digital stress testing.

In conclusion, while mobile banking has revolutionized financial transactions in India, achieving widespread adoption remains a challenge. Bridging digital gaps, addressing trust issues, and fostering innovation are key to ensuring sustainable and inclusive digital banking growth.

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