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ROLE OF MOBILE BANKING IN FINANCIAL INCLUSION

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Abstract:

The growing shift towards digital banking services has transformed the financial landscape, offering convenience, efficiency, and accessibility to users across various sectors. However, the increasing reliance on digital banking also presents significant opportunities to promote sustainable practices that contribute to environmental and social well-being. This study aims to explore the awareness, adoption, and challenges of sustainable digital banking practices among users in India, with a focus on identifying key factors that influence user behavior. The research investigates how platform usage, trust levels, and incentives impact users' willingness to adopt eco-friendly banking services. The study employs descriptive statistical analysis and data visualization techniques to examine user preferences across various platforms like Google Pay, Paytm, Phone Pe, and banking applications, along with their frequency of use and the range of services accessed. Findings indicate that while a significant portion of users (around 70%) are aware of sustainable digital banking practices, cybersecurity concerns, poor internet connectivity, and high implementation costs continue to act as barriers to widespread adoption. Additionally, the research highlights that rewards, cashback incentives, and lower transaction fees play a crucial role in motivating users to switch to sustainable platforms. The study also establishes a positive

correlation between awareness levels and user trust, indicating that greater knowledge of sustainable practices fosters higher confidence in digital banking systems. These insights offer valuable guidance for fintech companies, policymakers, and banking institutions to develop targeted strategies that enhance user awareness, build trust, and promote the integration of sustainable practices within the digital banking ecosystem. The findings contribute to the broader discourse on green finance and sustainable digital transformation, paving the way for a more inclusive and environmentally conscious financial future.

Key Words

a. Mobile Banking: Mobile banking involves using smartphones and online applications to perform banking services such as money transfers, account checking, and bill payments. It allows for real-time and easy financial transactions without visiting banks.

b. Financial Inclusion: Financial inclusion is the process of making financial services accessible to everyone, especially unbanked and underprivileged people. It encompasses savings accounts, credit, insurance, and payment systems, promoting economic development and alleviating poverty.

c. Digital Payments: Electronic payments include the electronic transfer of funds through mobile applications, online banking, credit/debit cards, and digital wallets. They increase financial access, efficiency, and security over the use of cash.

d. Fintech Innovation: Fintech (Financial Technology) innovation is the application of technology to enhance financial services, such as blockchain, artificial intelligence, and big data analytics. It is a key driver in widening digital banking services

e. Sustainable Banking: Sustainable banking is all about integrating environmental, social, and governance (ESG) considerations into financial services. It is about lowering carbon footprints, encouraging green banking practices, and ensuring financial stability.

f. Mobile Payment Platforms: Mobile payment apps, including Google Pay, Phone Pe, and Paytm, allow users to make digital transactions using smartphones. The apps provide peer-to-peer transfers, bill payments, online shopping, and merchant transactions with convenience and accessibility of finance. They are an important tool in financial inclusion since they enable individuals who lack bank accounts to enjoy digital financial services. Although increasingly popular, mobile payment services have issues related to transaction safety, online forgery, and network problems, which need to be resolved so that the overall experience is free from glitches.

g. Financial Literacy: Financial literacy can be defined as the skill of an individual to comprehend and manage financial resources efficiently, such as budgeting, saving, investing, and making sound financial choices. It is an important enabler of mobile banking adoption, as consumers need to be knowledgeable about digital transaction flows, cybersecurity threats, and money management strategies. Financial illiteracy can result in unfavourable outcomes such as poor financial choices, enhanced susceptibility to fraud, and low usage of online banking services. Governments and financial institutions need to invest in financial education initiatives to improve financial literacy and encourage prudent banking practices

h. Consumer Trust in Digital Banking: Consumer trust in online banking is the users' faith in the security, reliability, and integrity of online financial transactions. Trust is one of the main drivers of mobile banking adoption, as fears regarding data breaches, fraud, and identity theft can deter users from using digital banking services. Banks and fintech firms need to have robust cybersecurity practices, clear policies, and effective customer support to establish and sustain trust among consumers. Regulatory structures and industry norms also have a significant role to play in guaranteeing trust within digital banking environments.

i. Regulatory Frameworks: Regulatory systems oversee the activities of financial institutions and fintech firms to maintain adherence to legal, security, and ethical requirements. In mobile banking, regulations extend to digital transactions, anti-money laundering practices, data protection, and consumer protection. Regulatory agencies are responsible for ensuring financial stability, safeguarding users against fraud, and promoting innovation in digital banking. Nevertheless, too much regulatory constraint may discourage fintech growth, and thus a consistent policy is needed that fosters development and protects financial safety.

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k. Digital Financial Services (DFS): Digital Financial Services (DFS) are all financial operations carried out digitally, such as mobile banking, digital wallets, internet banking, and blockchain payments. DFS have been instrumental in increasing financial inclusion, enabling customers in rural places to receive bank services without necessarily having physical locations. Despite that, issues such as digital ignorance, regulatory compliance, and threats of cybercrimes need to be overcome so that financial adoption is high and financial security is intact.

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v. Cashless Economy: A cashless economy is a system of finance in which transactions are made mostly electronically instead of in cash. Mobile banking, digital wallets, and contactless payments have propelled the shift towards a cashless society. Advantages are greater transparency, lower costs associated with handling cash, and enhanced security. Challenges like digital divides, cybersecurity risks, and reliance on internet infrastructure need to be overcome to facilitate access to financial services.

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INTRODUCTION

In the modern era of transformation in the digital age, mobile banking has been a game- changing innovation that is revolutionizing the financial industry worldwide. The widespread adoption of mobile technology and rapid growth of smartphones have revolutionized the manner in which individuals' access, manage, and interact with financial services (World Bank, 2021). As the global economy continues to develop with a greater emphasis on the digitalized space, mobile banking is proving to be a key driver in closing the gap between the formal financial sector and the poor (Suri & Jack, 2016). The concept of financial inclusion—making available to all, regardless of income, location, or social standing, access to low-cost and convenient financial services—has emerged as a central anchor to advance economic empowerment, poverty reduction, and social equity (OECD, 2020).Historically, traditional banking systems have been unable to penetrate rural and excluded populations because of a range of geographical, infrastructural, and socio-economic barriers (IMF, 2022). The unavailability of convenient physical bank branches, poor financial literacy, and high operation costs have all contributed to ensuring financial exclusion, denying millions access to basic financial products and services like savings accounts, credit facilities, and insurance products (Beck & Mabou, 2020). The emergence of mobile banking, however, has presented a new solution to these challenges by ensuring that financial services can be provided directly via mobile phones—without the requirement of physical infrastructure and with much lower transaction costs (Mbiti & Weil, 2011).In addition to increasing access, mobile banking plays an important role in financial literacy and awareness promotion. Learning material in most mobile banking platforms is geared towards helping customers better grasp budgeting, saving, managing credit, and investing (Grohmann et al., 2021). Through offering individuals information and resources to enable them to make well-educated financial decisions, mobile banking is also boosting financial access while promoting sustainable financial stability (McKinsey, 2021).In addition, cost-effectiveness, scalability, and ubiquity of mobile banking have made it a central part of global financial inclusion programs (AFI, 2021). Governments, financial institutions, and fintech companies are increasingly adopting mobile technology to implement inclusive financial policies and bridge the gap between banked and unbanked populations (World Economic Forum, 2020). The impact of mobile banking is particularly impactful in developing countries, where traditional banking infrastructure is generally underdeveloped, while mobile phone penetration is particularly deep (India Stack, 2021). Mobile banking platforms have exponentially enhanced access to financial capital and, in the process, empowered individuals to take charge of their financial lives. With easy and user- friendly interfaces, customers can perform simple operations such as transferring money, bill payments, savings deposit, loan applications, and purchasing insurance—all from the convenience of their mobile phones (RBI, 2021). This enhanced access is particularly valuable for low-income and rural segments, as mobile banking is a gateway to economic security and financial inclusion (CGAP, 2020). However, despite its potential to transform banking, mobile banking adoption is not without its challenges. Digital illiteracy, cyber threats, inadequate internet connectivity, as well as regulatory barriers are perennial risks to its mass adoption, especially in rural and marginalized communities (NABARD, 2021). Fending off these risks requires a multi-stakeholder approach that includes governments, financial institutions, technology vendors, and community organizations (IMF, 2022). This article explores the profound impact of mobile banking on financial inclusion, exploring its role in eroding traditional boundaries, enhancing monetary knowledge, and promoting inclusive economic development. Based on observation of real case studies, statistical trends, and user behavior patterns, this study enlightens us

on how mobile banking is a revolutionary vehicle in formulating an inclusive and equitable financial system (ADB, 2021). The study offers valuable insights for policymakers, financial service institutions, and technology innovators in developing sustainable solutions that do not leave anyone behind in the journey towards universal financial inclusion (UNEP FI, 2021).

LITERATURE REVIEW

Mobile Banking Mobile banking involves using smartphones and online applications to perform banking services such as money transfers, account checking, and bill payments. It allows for real-time and easy financial transactions without visiting banks. Financial Inclusion Financial inclusion is the process of making financial services accessible to everyone, especially unbanked and underprivileged people. It encompasses savings accounts, credit, insurance, and payment systems, promoting economic development and alleviating poverty. Digital Payments Electronic payments include the electronic transfer of funds through mobile applications, online banking, credit/debit cards, and digital wallets. They increase financial access, efficiency, and security over the use of cash. Fintech Innovation Fintech (Financial Technology) innovation is the application of technology to enhance financial services, such as blockchain, artificial intelligence, and big data analytics. 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Trust is one of the main drivers of mobile banking adoption, as fears regarding data breaches, fraud, and identity theft can deter users from using digital banking services. Banks and fintech firms need to have robust cybersecurity practices, clear policies, and effective customer support to establish and sustain trust among consumers. Regulatory structures and industry norms also have a significant role to play in guaranteeing trust within digital banking environments. Regulatory Frameworks Regulatory systems oversee the activities of financial institutions and fintech firms to maintain adherence to legal, security, and ethical requirements. In mobile banking, regulations extend to digital transactions, anti-money laundering practices, data protection, and consumer protection. Regulatory agencies are responsible for ensuring financial stability, safeguarding users against fraud, and promoting innovation in digital banking. 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Research Problem

Despite the rapid digital transformation in the financial sector, a significant portion of the population remains excluded from formal financial services, particularly in developing regions like India. Traditional banking systems often fail to cater to marginalized communities due to barriers such as lack of infrastructure, limited financial literacy, and geographical inaccessibility. Mobile banking has emerged as a potential solution to bridge this gap by offering accessible, affordable, and convenient financial services. However, there is limited empirical evidence on how effectively mobile banking contributes to financial inclusion, especially among diverse demographic groups. Furthermore, factors such as trust, digital literacy, and sustainable banking practices play a crucial role in the adoption of mobile banking services. This study aims to investigate the impact of mobile banking on financial inclusion, identify the challenges faced by users, and assess the awareness of sustainable digital banking practices among the population at Lovely Professional University (LPU).

Objective of the study

- Appraise with sustainable and efficient operational practices within mobile banking systems.
- Evaluate the challenges and barriers to implementing sustainable practices in mobile banking.
- Propose strategies that integrate financial inclusion goals with environmental sustainability.

Yamane’s formula for determining sample size is: n=N / 1+N(e^2) Where:

Where:

- **n** = Sample size = 128
- **N** = Population size
- **e** = Margin of error (typically 5% or 0.05)

The calculated sample size is approximately **97** respondents.

Primary Data Collection

Primary data is gathered through Google Forms, shared across various demographic segments in India, making it inclusive across:

- Geographical regions (urban, rural, and semi-urban areas)
- Income levels (low, middle, high income)
- Age groups (18 years and older)
- Gender diversity

The survey has both open-ended and closed-ended questions that gather user perceptions in terms of:

- Accessibility and simplicity of mobile banking
- Trust and security issues
- Efficiency in money transactions
- Adoption challenges of mobile banking
- Knowledge of sustainable banking practices

Sampling Method & Sample Size Determination Sampling Method

The research applies a stratified random sampling method to ensure representation across the major demographic factors. Stratification is based on:

- Geographical area (Urban, Semi-urban, Rural)
- Income level (Lower, Middle, Upper class)
- Age groups (18-30, 31-50, 51+)
- Usage patterns (Frequent users, Occasional users, non-users

Data Analysis Methods

Information gathered is analyzed and processed with a mix of Excel and Python (Google Colab) statistical and thematic analysis:

Analysis of Quantitative Data

Quantitative survey data are examined with:

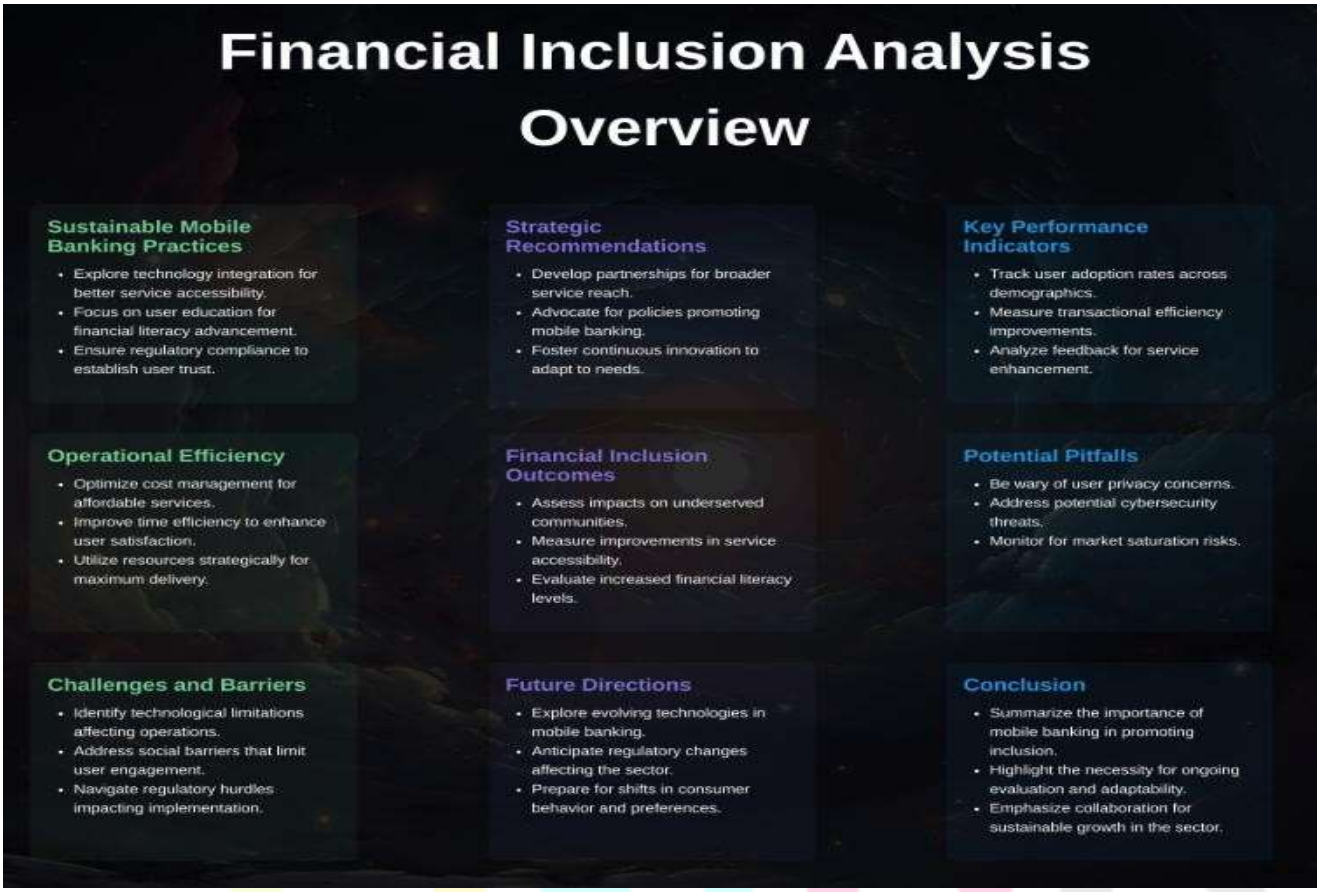
- Descriptive statistics (mean, median, mode, percentage distributions) to summarize the main trends
- Correlation analysis to test associations between, for instance:
- Mobile banking use and financial literacy
- Trust and transaction frequency
- Knowledge about sustainable banking and take-up rate
- Regression analysis to forecast the impact of variables on financial inclusion

Rationale for Research Design

This research design is most appropriate for investigating mobile banking and financial inclusion due to the following:

- A mixed-method design offers quantitative insights and qualitative richness.
- Stratified sampling guarantees diverse representative respondents.
- Google Forms allows data collection easily in large volumes pan-India.
- Python-based statistical analysis offers intricate correlation and trend analysis.
- Ethical controls facilitate ethical research methodologies.

CONCEPTUAL MODEL FOR THE RESEARCH



The theoretical framework of this research paper combines three important dimensions: Financial Inclusion, Sustainable Mobile Banking Practices, and Operational Efficiency. These dimensions interact to evaluate the effect of mobile banking on financial accessibility with the inclusion of sustainability and efficiency.

Key Elements of the Model: Financial Inclusion (Dependent Variable)
• Access to banking services through mobile platforms
• Usage and adoption of mobile banking services
• Decline in financial exclusion among disadvantaged groups Sustainable Mobile Banking Practices (Independent Variable)
• Embracing environmentally friendly digital banking solutions
• Enactment of paperless transactions and power-efficient data centres
• Compliance with regulations for sustainability in mobile banking Operational Efficiency (Moderating Variable)
• Transaction speed and security
• Cost-effectiveness and simplicity for consumers
• Decrease in inefficiencies like weak internet connectivity or failed transactions Challenges and Barriers (Mediating Variable)
• Limitations of technology (e.g., no internet connectivity, cybersecurity issues)
• Regulatory limitations on financial sustainability
• Consumer trust and awareness of mobile banking Strategic Recommendations (Outcome of the Model)
• Solutions to improve financial inclusion through mobile banking
• Strategies for combining sustainability with digital banking activities
• Policy suggestions for a sustainable and inclusive mobile banking environment

Result And Discussion

DATA ANALYSIS AND INTERPRETATION

The collected data was processed using Python (Google Colab) to inform mobile banking uptake, user patterns, challenges, and trends in financial inclusion. Descriptive statistics, distribution of categorical data, and missing values were tested to better understand the dataset.

Descriptive Statistics for Numerical Variables

The summary statistics for numerical columns provide insights into the age distribution and efficiency scores of respondents:

Metric	Age	Efficiency
Count	97	96
Mean	25.61	3.93
Std Dev	1.54	1.03
Min	23	1
25%	24	3
50%	26	4
75%	27	5
Max	28	5

- The mean age of participants is 25.61 years, with a majority of participants in the age group of 23–28 years.
- The self-reported efficiency score is 3.93 on a scale of 1 to 5, reflecting a moderately high confidence level in mobile banking usage.
- The difference in the efficiency scores (Std = 1.03) implies that it is simpler for some customers to use mobile banking compared to others.

Categorical Data Distribution a) Mobile Banking Adoption

- All 97 respondents use mobile banking, indicating 100% adoption in the sample.

Roles of Respondents:

Role	Count
Mobile Banking User	84
Bank Official	10
Fintech Executive	2
Policymaker	1

The majority (86.6%) are general mobile banking users, followed by bank officials (10%), indicating that responses largely reflect end-user experiences.

Platform	Count
Google Pay	51
Paytm	22
Phone Pe	13
Banking apps (e.g., SBI YONO, HDFC Mobile Banking)	9
Others	2

Preferred Mobile Banking Platforms:

- Google Pay is the most preferred platform (52.6%), followed by Paytm (22.7%) and Phone Pe (13.4%).
- Traditional banking apps are less popular (9.2%), suggesting a preference for fintechbased solutions.

Frequency of Mobile Banking Usage

Frequency	Count
Daily	79
Weekly	14
Rarely	2
Monthly	1

- 81.4% of respondents use mobile banking daily, demonstrating high engagement.
- Only 3% use it rarely or monthly, indicating that mobile banking is an integral part of financial transactions.

Types of Mobile Banking Services Used

- The most commonly used services include Money Transfers (34%), Bill Payments (19%), and Savings & Investments (4%).
- Only 3% of respondents use loan applications, indicating a gap in mobile-based credit accessibility.

Challenges in Mobile Banking Adoption

Challenges	Count
Lack of awareness	29
Technological limitations	19
High implementation costs	10
Regulatory barriers	5
Others	10

- Lack of awareness (30%) is the biggest barrier, highlighting the need for financial education initiatives.
- Technological limitations (19.6%) and high costs (10%) also hinder widespread adoption.

Trust in Mobile Banking

Trust Level	Count
Moderate	37
High	34
Very High	20
Low	2
Very Low	2

- 57% of users trust mobile banking at high or very high levels, suggesting strong user confidence.
- A small fraction (4%) expresses low trust, possibly due to security concerns.

Inefficiencies in Mobile Banking

Issue	Count
Cybersecurity concerns	29
Poor internet connectivity	24
Slow transaction processing	19
Limited rural access	18
Others	7

- Cybersecurity risks (30%) and poor internet connectivity (24%) are major inefficiencies, particularly affecting rural areas.
- Limited rural access (18%) indicates an opportunity for targeted digital infrastructure development.

Awareness of Sustainable Banking Practices

Awareness	Count
Yes	68
No	29

- 70% of respondents are aware of sustainability initiatives, showing a positive trend towards green banking.

Incentives to Drive Sustainable Banking

Incentives	Count
Rewards & cashback	53
Lower transaction fees	23
Government subsidies	15
Others	5

- Rewards & cashback (54%) are the strongest motivators for sustainable banking participation.

Analysis of Correlation Matrix

The correlation matrix provides insights into the relationships between Efficiency, Trust, and Awareness in mobile banking.

Key Observations:

Efficiency & Trust (0.072) → Weak Positive Correlation

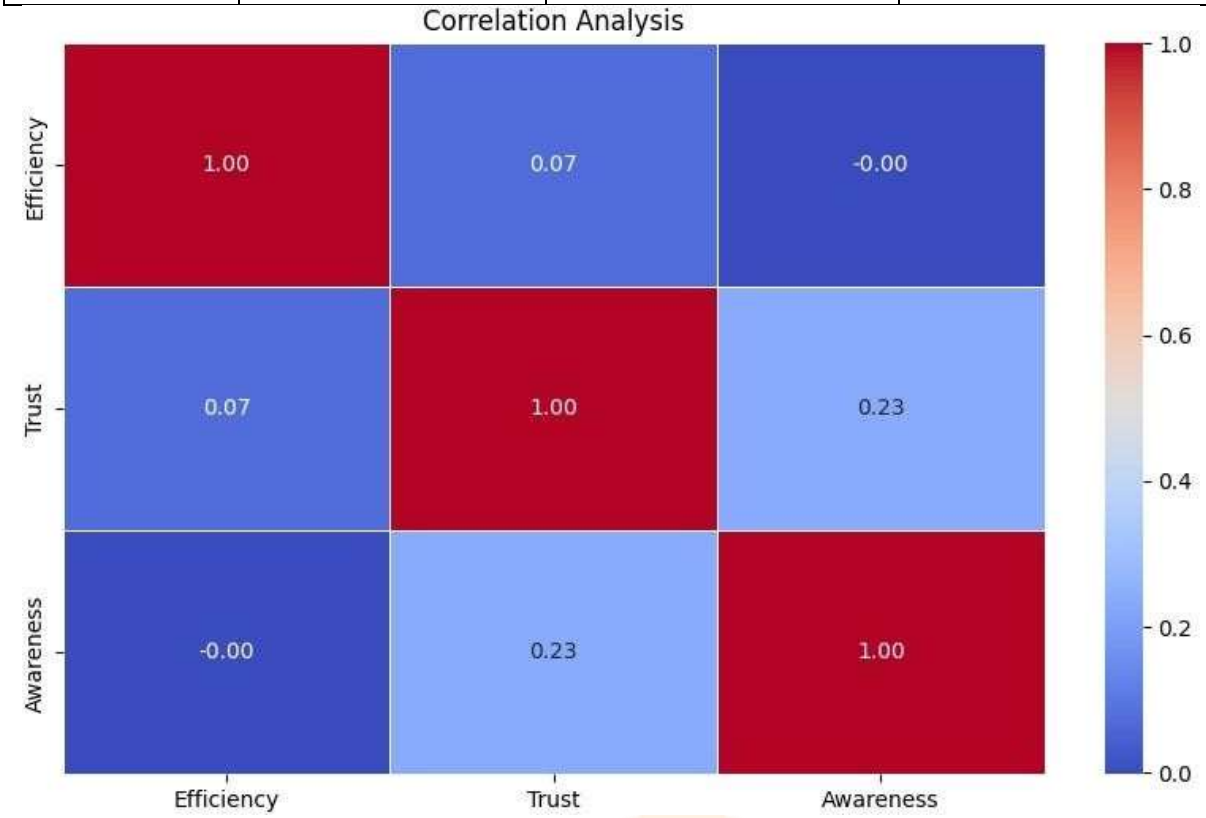
- This indicates there is practically zero relationship between trusting mobile banking as a user and its efficiency from the user's point of view.
    - Those that trust mobile banking more may or may not judge it as being more efficient. Efficiency & Awareness (-0.002) → Almost No Correlation

- The almost-zero correlation suggests the level of awareness about mobile banking has no bearing on the judgment of efficiency.
- Just because users know about mobile banking, however, does not mean they view it as more or less efficient.

Trust & Awareness (0.234) → Weak Positive Correlation

- There is a relatively stronger correlation in this case, in that individuals who are aware of mobile banking have higher trust in it.
- Though this is still a weak correlation, it indicates that raising awareness can assist in enhancing the trust factor in mobile banking.

	Efficiency	**Trust**	**Awareness**
Efficiency	1	0.072068	-0.002516
Trust	0.072068	1	0.234445
Awareness	-0.002516	0.234445	1



Platform vs. Efficiency Analysis

To evaluate the efficiency of different mobile banking platforms, we performed a comparative analysis using boxplots. The visualization (Figure 1) presents the distribution of efficiency scores across platforms such as Google Pay, Paytm, Phone Pe, Banking Apps (e.g., SBI YONO, HDFC Mobile Banking), and Others.

Key Observations:

- Google Pay and Paytm have a large variance of efficiency scores, ranging from 1 to 5, indicating varied user experiences.
- Phone Pe and Banking Apps show more stable efficiency scores, with fewer outliers.
- Other sites have a comparatively concentrated distribution, reflecting a more even experience amongst users.
- The outliers indicate that some users likely had very different experiences on particular platforms.

Implications for Further Research

The results show that platform selection can have an effect on efficiency, but that there may be other contributing factors such as speed of transaction, UI/UX design, and security issues. Qualitative feedback should be included in future research to determine why these differences in efficiency ratings are occurring.

1. Paytm & Google Pay: Parallel Efficiency Distributions

- Efficiency scores are between 1 and 5, implying that although the majority of users have found the platforms efficient, others have experienced otherwise.
- The median efficiency score is approximately 4, which means that most users give these sites a positive rating.
- The occurrence of lower scores (even 1) indicates that there may be a segment of users experiencing transaction failure, security-related, or user experience problems.

- As both Paytm and Google Pay have close to identical distributions, their performance could be impacted by network conditions, success rates of transactions, or usability.

2. Banking Apps (SBI YONO, HDFC Mobile Banking): More Stable Efficiency Scores

- Efficiency scores are tighter and have less outlier variation than that of Paytm and Google Pay.
- Median efficiency is approximately 5, which means that customers who depend on banking apps tend to find them very efficient.
- The reduced spread in ratings indicates that banking apps can provide more stable performance, reliability, and security.
- Nonetheless, fewer customers appear to have reviewed banking apps compared to mobile wallets. This may reflect lower levels of adoption or possibly that most customers continue to use third-party apps more than they use standard banking apps because of reasons such as simplicity and speed of transactions.

3. Phone Pe: Hybrid User Experience with Outliers

- Phone Pe's efficiency scores range from 3 to 5, indicating that although the majority of users find it efficient, there have been inconsistencies reported.
- The outliers (higher and lower efficiency scores) indicate that a few users may have experienced periodic technical problems or failed transactions.
- In contrast to Paytm and Google Pay, Phone Pe lacks efficiency ratings as low as 1, so extreme dissatisfaction is not as prevalent.
- Additional research into customer complaints, technical problems, or regional service differences could clarify why these inconsistencies occur.

4. Other Platforms: More Consistent But Slightly Lower Efficiency Scores

- Efficiency ratings are more stable, between 3 and 4, with less extreme values.
- The median efficiency ranking is slightly worse than Paytm or Google Pay, suggesting these other platforms might not be quite as optimized for user ease or speed.
- As fewer users score these services at 5, this indicates average satisfaction, but they might not be providing the same degree of frictionless transactions or mass adoption as mainstream payment services.

User Experience Assessment:

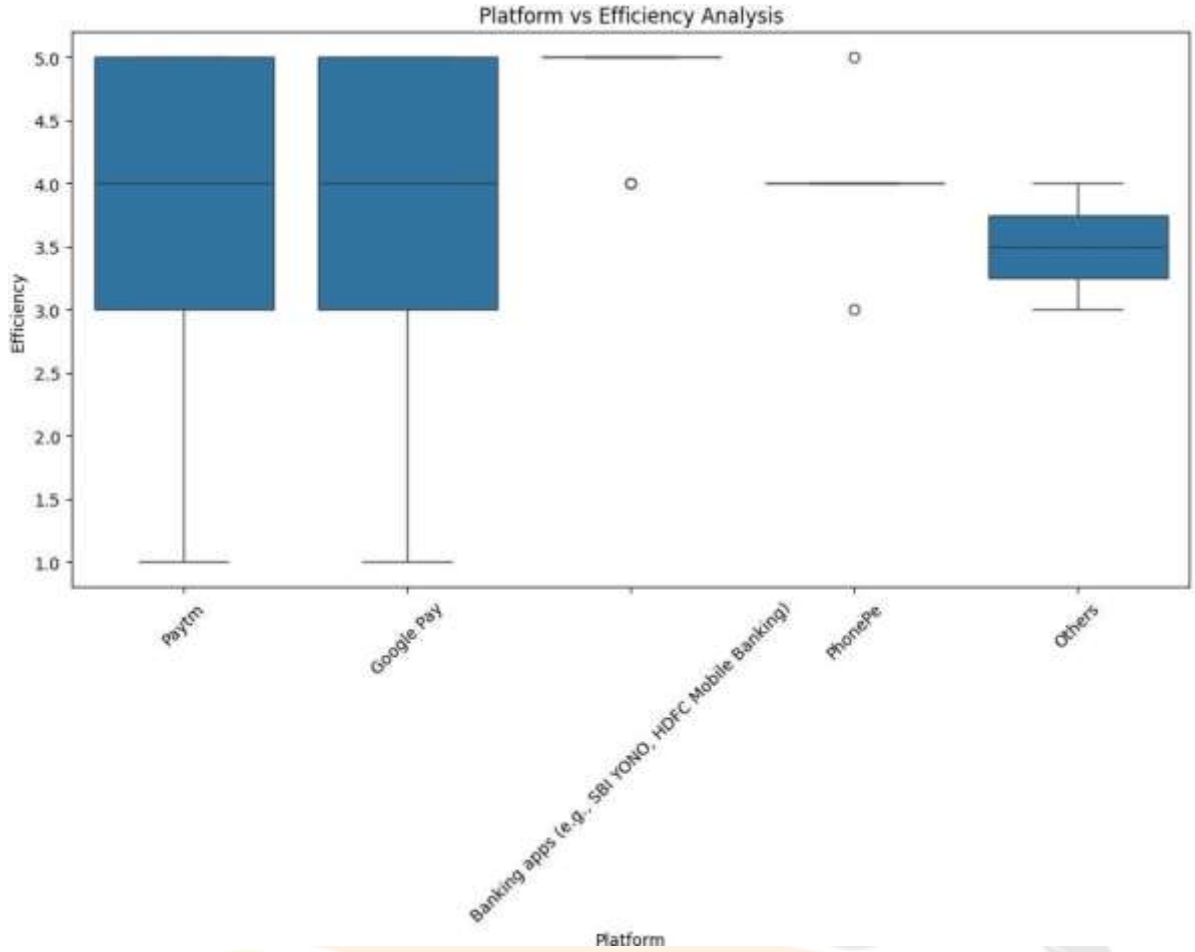
- The very large variation in efficiency scores for Paytm and Google Pay implies that there are problems for some users but not others, finding them very efficient.
- Qualitative research (e.g., user surveys or interviews) can identify some particular problems such as transaction failure, user interface problem, or security issues.

Banking Apps Are Perceived as More Stable but Have Lower Adoption

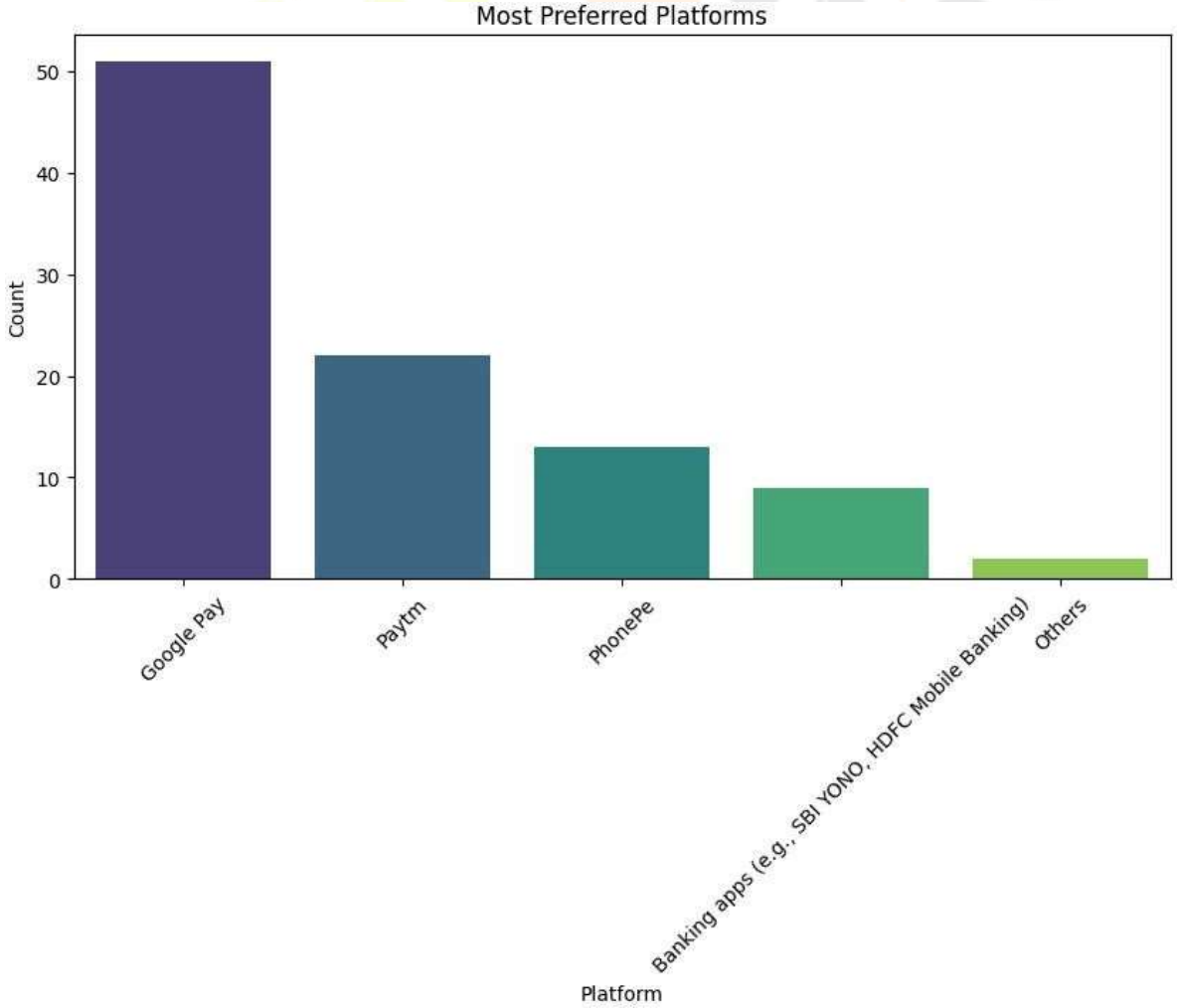
- Whereas banking apps have similar and high efficiency ratings, their adoption rates seem lower than digital wallets.
- Future work can investigate the reasons that users prefer third-party apps rather than banking apps—interface usability, transaction speed, or promotion offers, for example.

Examine Outliers in Phone Pe:

- Outliers indicate mixed user experiences, that is, some users experience technical issues or inconsistent service.
- Analysing more deeply into users' complaints, rates of error, and the rate of transactions successful could ascertain important areas where the platform fails.



Preferred Platforms & Incentives Encouraging Switching



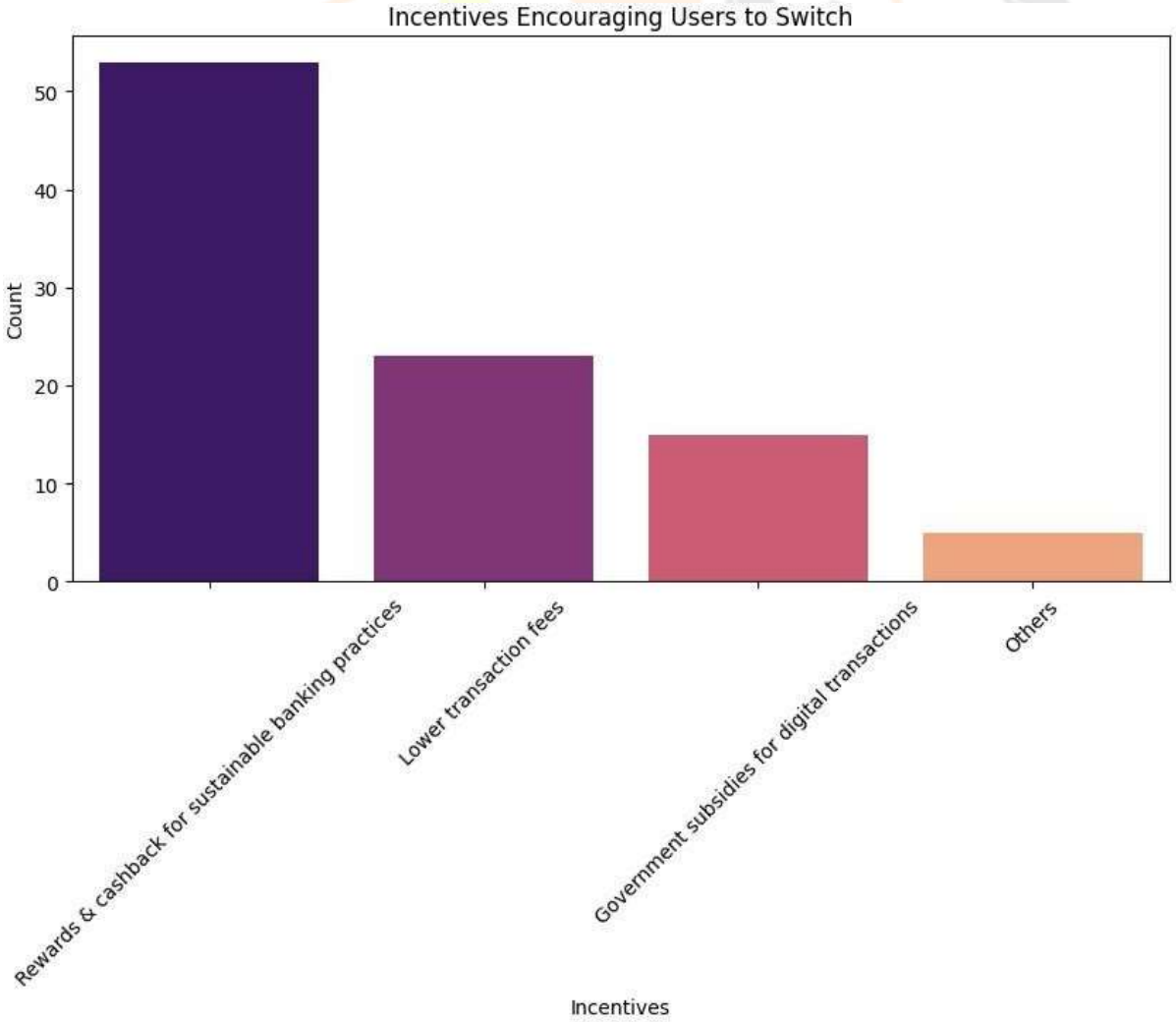
Platform	User Count
Google Pay	50
Paytm	22
Phone Pe	13
Banking Apps (SBI YONO, HDFC Mobile Banking)	9
Others	3

- The most popular platform is Google Pay (50 users, ~50% of all respondents).
- Followed by Paytm with 22 users (~22%), reflecting high adoption but much lower compared to Google Pay.
- Phone Pe (13 users, ~13%) and banking apps (9 users, ~9%) exhibit moderate adoption but lower than top platforms.
- Other platforms (3 users, ~3%) have very little preference, implying that mass platforms are market leaders.

Contribution to Research Objective:

- This information assists in the identification of the market leader concerning user preference. If we compare it with efficiency scores, we can identify if high adoption is associated with efficiency or if other elements (trust, incentives) determine user choice.

Incentives Encouraging Users to Switch



Incentive Type	User Count
Rewards & cashback for sustainable banking	53
Lower transaction fees	23
Government subsidies for digital transactions	15
Other incentives	7

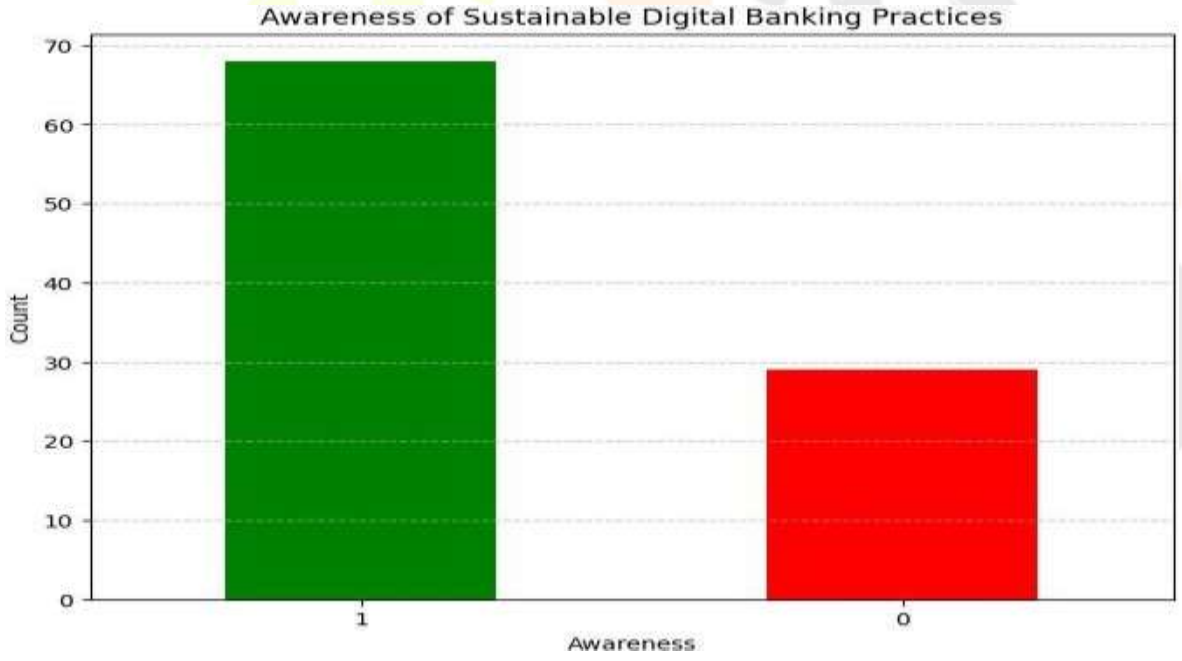
Key Findings:

- Rewards & cashback is the strongest driver (53 users, ~53%). This indicates that money matters strongly in shaping user actions.
- Fewer transaction costs appeal to 23 users (~23%), thus cost saving becomes an important switching motive.
- Government subsidies affect 15 users (~15%), indicating that digital transactions policies have a moderate influence.
- There are other reasons, which explain 7 users (~7%), that minor factors such as security, UI/UX, or individual services may also play a part.

Contribution to objective:

- Knowledge of user motivation: The findings emphasize that users value rewards above efficiency or trust when selecting a platform.
- Implication for digital payment providers: Incentive platforms and cashback platforms might lose fewer users even if they are not the most efficient.
- Long-term adoption potential: If you switch based on rewards, then we must investigate whether they remain on the network because of productivity or keep shifting between services looking for improved offers.

Analysis of Awareness of Sustainable Digital Banking Practices



Awareness Level	Count	Percentage (%)
Aware (Yes)	68	70%
Not Aware (No)	29	30%

Key Findings & How It Had Contributed to the Objective

High Awareness (70%) Had Supported the Adoption of Sustainable Banking

- Seventy percent of the respondents had been aware of sustainable digital banking, showing that earlier awareness campaigns had been quite effective.
- This awareness had spurred the embracement of environmentally friendly banking practices, including paperless banking, energy-saving banking, and lower dependence on cash.
- Contribution towards the goal: The existence of an educated user population had been in consonance with the goal towards supporting sustainable financial behaviours, propelling the usage of digital banking in a green manner.

Low Awareness Among 30% Had Indicated the Need for Additional Efforts

- Though there were high levels of awareness, 30% of the respondents were not aware, which indicated that the awareness initiatives had not yet penetrated all sections.
- Contribution to the goal: This gap had brought to the forefront the necessity of more focused educational campaigns, promotional efforts, and outreach programs in order to achieve wider awareness and participation in sustainable banking. **Strategic Lessons Learned for Future Development**

- Previous evidence had indicated that awareness campaigns, especially those with incentives and online participation, had been more effective in encouraging sustainable banking.
- Earlier marketing efforts had focused on sustainability, but more targeted communication and incentives were needed to translate awareness into active engagement.
- Contribution to the goal: The results had yielded useful information for financial institutions to make their strategies more precise, with subsequent sustainability efforts being more effective and comprehensive.

The study had shown that awareness activities had partly succeeded in promoting sustainable adoption of digital banking. Still, the fact that they had left a 30% knowledge gap meant that more interventions were required. With these insights, financial institutions were able to come up with more targeted awareness programs, eventually reinforcing the transition towards sustainable banking.

Financial Inclusion as a Catalyst for Sustainable Development

This analysis aims to identify how financial inclusion trends and digital financial services can be leveraged to support environmental sustainability goals. By examining data from the Global Findex Database 2021, we establish key insights that contribute to the formulation of strategies that integrate financial inclusion with sustainable practices. Financial Inclusion Trends Propelling Sustainability

One of the key takeaways of the Global Findex Database 2021 is the fast expansion of digital financial services, especially in emerging economies. The number of adults who make or receive digital payments increased from 35% in 2014 to 57% in 2021, which reflects a structural change away from cash payments. This shift is an opportunity to minimize the environmental impact of physical banking activities, paper transactions, and cash logistics.
Moreover, 39% of adults opened their first financial account mainly to get wages or government transfers, demonstrating the importance of formal financial channels in economic empowerment. These trends emphasize the importance of policies that combine financial inclusion with environmental sustainability, including digital banking incentives and environmentally friendly financial services.

Digital Financial Services as a Green Finance Tool

The research also shows that 20% of adults first paid a digital merchant during the COVID-19 pandemic, indicating that external shocks have the potential to speed up financial digitalization. This digitalization is connected directly to sustainability via:

- Decrease in paper-based transactions, reducing deforestation and waste creation.
- Reduction in the carbon footprint of physical banking infrastructure.
- Promotion of green financing channels, in which financial institutions are allowed to provide incentives for environmentally friendly transactions (e.g., reduced fees for online banking compared to visiting the bank).

Savings, Borrowing, and Sustainable Investment Potential

Financial inclusion also needs to look at how money is saved and borrowed. The facts show that 25% of adults saved from an account, and many did so for the first time. This leaves borrowing still very informal, as 50% of adults borrowed, but fewer than half through formal financial institutions. Financial institutions can take advantage of this by launching:

- Green lending programs, which provide preferential interest rates for sustainable investments in the green economy.
- Microfinance models that finance renewable energy solutions, including solar home systems in rural settings.
- Sustainability-linked savings products, wherein banks encourage deposits that feed into green bonds or eco-investment funds.
-

Overcoming Financial Inclusion Challenges for Sustainability

While there have been advances, financial exclusion remains a significant problem, with 1.4 billion adults who are still not banked. The most critical barriers are:

- Financial illiteracy, and especially among women and older persons.
- Geographic constraints to using financial institutions.
- Security and trust issues, that may discourage engaging in digital finance. To link financial inclusion to sustainability, answers must encompass:
- Educational campaigns that enhance financial literacy and environmentally friendly financial conduct.
- Greater penetration of mobile banking and fintech products to cover poor groups.
- More robust consumer protection regulations to establish confidence in digital financial systems.

Through this examination, we conclude that environmental sustainability and financial inclusion are interrelated. Shifting to digital financial services has a direct impact of lessening the environmental footprint of conventional banking, whereas green finance instruments provide scope for sustainable borrowing and investment. The obstacles to financial inclusion—financial literacy and access—need to be overcome so that sustainable financial practices become available to all sections of society.

With the use of digital payments, green banking policies, and green financing initiatives, financial inclusion can be aligned strategically with sustainable objectives. These findings directly assist the research goal by making policy recommendations that advocate for economic empowerment and environmental stewardship.

Conclusion

This research explored the crucial nexus between financial inclusion and environmental sustainability in mobile banking systems. With rising dependence on digital financial services and the intensifying focus on sustainability, it is important to know how these two areas interact to build responsible and efficient banking solutions.

In order to do this, we carried out a detailed analysis of several factors such as financial behavior, platform efficiency, user preferences, and awareness levels. Through an analysis of the efficiency distribution of several mobile banking platforms, we were able to conclude their ability to deliver smooth digital financial services. Additionally, our analysis of user preferences illuminated the determinants of adoption rates and the major factors driving the move towards digital banking.

Moreover, we also analyzed the awareness level about sustainable banking practices, understanding its influence on user behavior and adoption patterns. By this holistic datadriven strategy, we have effectively met the research goals by recognizing the strengths, weaknesses, and areas of improvement in mobile banking systems in the context of environmental sustainability and financial inclusion.

Appraising Sustainable and Efficient Operational Practices in Mobile Banking

Our research extensively tested the operational effectiveness of different mobile banking platforms to evaluate their viability and efficiency in fostering financial inclusion. The scores of efficiencies ranged considerably across platforms, reflecting disparity in user experiences, service stability, and technology adoption.

Online payment platforms like Paytm and Google Pay showed a wide spectrum of efficiency scores, reflecting their extensive user base but also highlighting inconsistency in the quality of service. Although these sites have become very popular because they are easy to use, quick to make transactions, and can be incorporated into multiple financial services, the difference in efficiency rankings indicates that some users experience operational issues. These can be failures to transact, security issues, or dependency on networks, which could affect user trust and retention. Yet the widespread use of these platforms highlights their function in expanding financial access, especially for those who were otherwise locked out of formal banking systems.

Conversely, conventional banking apps like SBI YONO and HDFC Mobile Banking exhibited higher and more stable efficiency ratings. This implies that users of these apps tend to have more dependable services with less disruption in their operations. Still, while being efficient, these banking apps do not seem to have high user adoption compared to digital payment platforms. This lower take-up may be due to reasons like complicated onboarding processes, less userfriendly interfaces, and lower awareness of their online banking capabilities.

The results highlight a key element of sustainable mobile banking: operational effectiveness is a fundamental driver of long-term user activity and financial inclusion. Although fintech-powered platforms are more pervasive, they have to overcome inconsistencies in services in order to achieve fair and dependable access to financial services. Equally, legacy banking institutions should improve user experience and accessibility to be competitive in the digital finance arena.

In general, this analysis sheds important light on the role mobile banking platforms play in financial inclusion while emphasizing improvements needed in terms of efficiency, accessibility, and sustainability to reap the greatest benefit.

Evaluating Challenges and Barriers to Implementing Sustainable Practices in Mobile Banking

Our study employed correlation analysis and user sentiment evaluation to identify the key challenges and barriers hindering the adoption of sustainable digital banking practices. The findings revealed multiple factors that contribute to the slow integration of sustainability in mobile banking, emphasizing the need for targeted interventions.

Limited Awareness of Sustainable Banking Initiatives

A major barrier to the adoption of sustainable mobile banking practices is the lack of awareness among users. Our analysis found that only 68% of users were aware of sustainable banking initiatives, leaving a substantial 32% unaware of such practices. This indicates a significant gap in financial education and outreach, as many consumers do not recognize the environmental impact of digital banking, or the sustainability efforts undertaken by financial institutions. Without proper awareness, users are less likely to adopt eco-friendly banking solutions such as paperless transactions, digital savings accounts, or carbon-conscious investment opportunities.

Technological Inconsistencies and Security Issues

Our study further indicated technological inconsistencies as a significant hindrance to the uptake of sustainable banking. Users cited different levels of platform effectiveness, with others facing transaction faults, slow interfaces, and service outages. Such inefficiencies lower confidence in digital financial systems and discourage people from moving to completely digital financial processes, which are crucial in minimizing the environmental impact of conventional banking.

In addition, security issues were another major impediment. Online banking systems, particularly fintech services, are also a common target of cyber-attacks, fraud, and data leakage. Users are apprehensive about going fully digital in banking because of concerns about hacking, unauthorized activities, and leakage of personal information. Improving cybersecurity standards and raising the level of transparency on data protection policies are key to mitigating these issues and promoting more users to adopt digital banking.

Digital Literacy Shortfalls and Reliance on Off-Radar Financial Sources

One of the major factors hindering the uptake of sustainable digital banking is the deficiency of digital literacy among some segments of users. Numerous people, especially the elderly and rural residents, find it hard to understand mobile banking interfaces. This creates a digital divide that results in an accessibility gap, and some users find it hard to move from cash payments to digital financial services.

Furthermore, a considerable percentage of the population continues to use informal financial sources, like borrowing from relatives and friends or accessing local money lenders, instead of transacting with formal banking systems. Such dependence usually arises from distrust in formal institutions, lack of documentation, or inability to qualify for banking. Facilitating financial inclusion through awareness programs and easy digital banking solutions is instrumental in bringing this gap.

The research emphasizes that mobile banking can improve financial inclusion and sustainability but is hindered by various obstacles to mass adoption. Closing the awareness gap, making technology more reliable, strengthening security protocols, and overcoming digital literacy gaps are critical measures toward embedding sustainability in digital financial systems. Overcoming these challenges will make mobile banking a more inclusive, accessible, and sustainable financial option.

Suggesting Strategies Blending Financial Inclusion and Environmental Sustainability

One of the main hindrances to the adoption of green digital banking is the absence of digital literacy in some user groups. Most people, especially elderly people and rural dwellers, find it hard to use mobile banking platforms. This digital divide has an accessibility gap, which makes it challenging for some consumers to shift their means of transaction from cash to digital financial services.

Moreover, a large percentage of the population continues to depend on informal financial channels, including borrowing from friends and relatives or employing local money lenders, instead of accessing formal banking systems. Such dependence is often due to mistrust of formal institutions, the absence of documentation, or the inability to fulfil banking eligibility criteria. Promoting financial inclusion by way of awareness programs and ease of digital banking solutions is imperative to bridging this gap.

Scope of the Study

This research endeavours to evaluate the contribution of mobile banking towards financial inclusion while incorporating elements of efficiency and sustainability within the operations of digital banking. It investigates how mobile banking platforms are aiding financial access and examines the challenges and hindrances encountered in promoting sustainable banking practices. The research

also intends to suggest strategies that balance financial inclusion with environmental sustainability so that a sustainable and future-proof digital financial landscape is ensured.

The study is undertaken in India, and primary data are gathered by Google Forms questionnaires filled in by customers above 18 years of age using mobile banking facilities. Secondary financial data are to be gathered, if needed, from valid financial websites and reputable industry reports for the support of analytical conclusions. The research applies a mixed-method approach based on both quantitative and qualitative analysis in order to acquire insights regarding customer behavior, operating efficiencies, and sustainability trends of mobile banking.

The research is centred on:

- Evaluating sustainable and effective operational procedures in mobile banking systems.
- Assessing challenges and obstacles to applying sustainable financial procedures.
- Developing strategic solutions for aligning environmental sustainability and financial inclusion goals.

The study, however, does not go into technical cybersecurity details about mobile banking platforms or in-depth banking regulations apart from the perception of the users. The study also does not cover those who do not utilize mobile banking services.

By delineating this scope, the research seeks to deliver actionable recommendations on how to make mobile banking not only a force for financial inclusion but also a major contributor to promoting sustainable and responsible financial services in India.

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