

Financial Inclusion Through Digital Payment Innovations

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Abstract- Various advancements in digital payment options have been developed as tools for transforming financially excluded communities across the globe. This work analyses the role those digital payments have played in extending financial services provision in developing countries, through a detailed evaluation of adoption factors, challenges faced and outcomes. Based on the empirical experience within the digital payment's environment in India with respect to the use of Unified Payment Interface and RuPay cards, the study adopts an integrative quantitative and qualitative research strategy by analysing both transaction data and various stakeholder assessments. Results of the study show that there was almost 11 times increase in the adoption of digital payments in the period 2021-2025, especially as far as transaction volumes using UPI are concerned, accounting for almost 80% of total digital payments. Ease of use, trust, security, and digital financial literacy were found to be significant determinants of the use of these innovations.

Keywords— Financial Inclusion, Digital Payments, UPI, FinTech Innovation, Digital Financial Literacy, Payment Systems, Financial Technology

I. INTRODUCTION

Financial inclusion, defined as the provision and equal opportunities to gain access to finance, is currently considered as one of the pillars of sustainable development dialogue [1][2][10]. According to World Bank reports, there are about 1.4 billion adults who still do not have bank accounts and are thus deprived of an access to financial services that are crucial for their socio-economic development [1][2][10]. Traditional banks have found it difficult to establish themselves among poor people who inhabit rural areas, because the costs associated with construction of infrastructure are extremely high and, thus, are not economically efficient for opening small-scale accounts [1][2][10]. Therefore, governments of different countries and various institutions have been searching for new

technologies that will help to close financial access gap [1][2][10].

Digital payment technology represents a viable solution to enhance financial inclusion as it uses mobile phone, internet infrastructure and digital identification systems [1][2][6]. In comparison with traditional bricks and mortar bank operations, which require establishment of many branches that will provide services, digital payment platforms do not demand construction of physical infrastructure, which helps to deliver financial services to remote places with much lower costs [1][2][6]. Moreover, during the current pandemic, when the need for contactless transactions arose, such kind of payment systems became crucial to maintain economic activities and, consequently, people's lives [1][2][6].

Apart from being used for conducting transactions, there is significant value addition in terms of digital payment data that would help in accessing credit, insurance, and savings products among previously unreached communities [1][6][7]. Digital transaction history serves as an alternative way of evaluating creditworthiness of customers without collateral security [1][6][7]. Such a digital system holds the promise of democratizing access to financial services with a possibility for micro-businesses and poor households to get involved into formal economic activities through financial intermediation [1][6][7].

The Indian experience offers a rich ground to understand the dynamics between innovations in digital payment systems and financial inclusion [3][5][7]. The JAM Trinity, comprising Jan Dhan Bank Accounts, Aadhaar digital ID, and mobile phones, has provided a robust foundation of a digital public infrastructure for using digital payments [3][5][7]. In addition, the launch of Unified Payments Interface (UPI), introduced by the National Payments Corporation of India, has changed completely the face of P2P and merchant payments as now people could make quick and affordable inter-bank and cross-bank transactions [3][5][7]. Incentive schemes for RuPay debit card and low transaction value UPI transactions have contributed greatly to increased adoption of digital payment systems [7].

Even as such innovation takes place, however, there is still considerable need to address the challenge of making such developments lead to financial inclusion among all members of society [3][5][8]. Studies have shown that such technological innovation in financial transactions has been mostly beneficial to wealthy people and those in urban centers while poor people and those living in rural areas are still less benefited [3][5][8]. Gaps in infrastructure, low literacy levels about digitization and the mistrust of digitization systems have all led to such difficulties being faced by the marginalized sections of society [3][5][8]. It therefore becomes critical to learn more about these difficulties and how they can be solved [3][5][8].

In this way, the current study will make a contribution to the existing literature about digital payments and

financial inclusion by focusing on digital payments in India using a theoretical framework [1][3][5][7]. The main research questions which the present study hopes to answer are the following:

- What are the driving and restraining forces behind the digital payments adoption by underserved people? [2][4][8]
- How do innovations in digital payments affect financial inclusion results quantitatively? [1][6][7]
- What policy interventions would effectively address these binding constraints to inclusive digital finance? [5][7][8]

II. LITERATURE SURVEY

Academic and policy-related research on the subject of digital payment technologies in the context of financial inclusion has grown considerably during the last decade, recognizing the role those digital technologies have in promoting financial access [1][2][10]. Shahan and Sharaf (2025) performed a systematic literature review of how digital payment technologies enhance financial inclusion worldwide and found out that such digital payments have assisted in alleviating financial exclusion, especially in the countries developing their economy, by increasing availability of essential financial services to marginalized populations [1]. The review demonstrates demographic differences in the usage of technology with higher adoption rates among younger people and women, indicating the potential to use digital payment technologies to solve long-standing gender problems in the sphere of financial access [1]. Moreover, such innovations as blockchain technology, artificial intelligence, cloud computing, and biometric authentication increase the efficiency, safety, and accessibility of digital payment systems [1].

A variety of theories can be used to explain the process of adoption of such payments and technology access in general [2][4]. Putri, Wiguna, and Anaage (2026) performed a systematic literature review based on PRISMA methodology of trends and determinants of digital payment adoption and discovered that more than 61.5% of works used quantitative approaches to studying the subject and used TAM, UTAUT, and PMT as theories in the

process [2]. The results indicate that perceived ease of use, perceived usefulness, trust, and social influence serve as the most important determinants of digital payment adoption [2]. In addition, the authors note the necessity of financial digital literacy as a requirement of proper usage of digital payments [2].

In another study on fintech innovation, Sandhu, Dayanandan, and Kuntluru (2025) conducted a quantitative survey-based study on financial inclusion in India [3]. They found that user experience, motivation, security, trust, transparency, and customer support affect perceived ease of use and usefulness [3]. These mediate financial inclusion [3]. In doing this, this study disproves the beliefs that cultural values influence the adoption of fintech [3]. There was a lack of any significant influence of cultural values on financial inclusion through perceived ease of use and usefulness [3]. The authors have identified CBDC as the potential means of achieving financial inclusion based on security, trust, transparency, and customer support within fintech innovation [3].

In their study, Kaur, Khan, and Sujood (2025) studied the role of digital financial literacy integrated with the Technology Acceptance Model for predicting consumers' intention towards using fintech payments products for financial inclusion purposes [4]. They conducted a Structural Equation Modeling on 499 survey results [4]. As a result, they proved that TAM factors have a considerable impact on the consumers' decisions to use fintech payments for digital financial inclusion purposes [4]. As a conclusion, the authors state that industry stakeholders and policymakers should pay special attention to digital financial literacy among all promotion strategies [4].

According to Harihareswara and Miller (2021), the authors use a decision tree methodology to evaluate some binding constraints on digital financial inclusion in India and find that an unbalanced playing field that is tilted towards state banks is a constraint on innovation and competition [5]. In the course of analyzing such a situation, the authors conclude that some institutional problems are the

cause of an inflexible model dominated by banks without proper incentives and ability to provide digital payments services to poor citizens [5]. Under current market conditions, many segments of the society, especially low-income people and women, have no reason to use such services since they do not satisfy their needs well enough, thus forming an underperforming market equilibrium characterized by insufficient benefits and distrust [5].

The World Bank Group (2026) reports about the macroeconomic effects of fast payments, stressing that digital fast payments systems available in 137 countries allow making transactions more affordable, cheaper and convenient for the users [6]. In particular, according to the findings of the authors, there are two main mechanisms for influencing the macroeconomy in question, namely, liquidity acceleration that allows reducing a demand for precautionary balances and releasing working capital to micro and small companies, and information acceleration that is used for creating transaction history of users and allowing gaining access to finance for firms and individuals without traditional means of collateral [6]. The results indicate that Thailand's PromptPay will yield the additional GDP worth of 2% while the UPI will be worth 1.4% [6].

According to Kaur and Chakraborty (2026), there were various difficulties associated with transitioning to the adoption of cashless economy, infrastructure gaps, digital illiteracy, and financial constraints being the primary barriers that hindered the adoption of cashless technology by the marginalized groups [8]. The authors pointed out the preference for cash transactions by consumers on account of security considerations, personal preferences, and lack of infrastructure as reasons for slow adoption of technology [8]. It is necessary that policy solutions be provided in order to bridge the gap and address consumer preferences regarding cash transactions and security [8].

The Indian government's Department of Financial Services (2026) conducted a socio-economic impact evaluation of the incentive scheme for RuPay debit cards and UPI transactions [7]. It provided an

empirical basis for digital payment adoption trends [7]. A study was conducted using a primary survey of 10,378 respondents from 15 states of India [7]. It indicated that UPI is the preferred transaction mechanism among 57% of respondents with 38% having preferences for cash transactions [7]. As far as the adoption of UPI among merchants is concerned, the rate is high at 94% of small merchants having adopted UPI [7]. There is an impressive development in the adoption and usage of digital payments [7]. Digital transactions have increased by nearly 11 times and the number of UPI QR deployment increased from 9.3 crore to 65.8 crore between 2021-2025 [7].

III. PROPOSED METHODOLOGY

This study uses the mixed-method technique that brings together analysis of transactions through a quantitative analysis and stakeholder interviews through a qualitative approach in evaluating the impact that digital payment innovations have on financial inclusion. The mixed-method technique will bring about an integration of the use of economic models and interviews in assessing transactions with digital payments. The purpose of the mixed-method technique used is to overcome the limitation of single-method techniques whose outcomes may lack either statistical evidence of the trend or the reasons for adoption.

Research Design

This research will use a mixed methods strategy of a concurrent triangulation convergent design that uses quantitative and qualitative data simultaneously. With this research methodology, data is gathered at once before being analyzed independently and eventually compared as well as combined for interpretation. Quantitative research will look at transaction numbers and value data provided by the National Payments Corporation of India for analyzing the development of UPI and RuPay transactions from 2021-2025. The qualitative data will be drawn from the socio-economic impact survey conducted by the government and involving responses of 6,167 end-users, 2,199 merchants, and 2,012 service providers.

Data Sources

The sources of secondary data used in the research are varied and reputable. Information about transaction volume and its value on UPI and RuPay on a monthly basis is obtained from the primary source - National Payments Corporation of India (NPCI) - for the period from January 2021 to December 2025. The Financial Inclusion Index, published by the Reserve Bank of India, combines the results of financial inclusion on the three parameters – access, usage and quality, and the FI-Index has been increasing steadily, having reached the level of 64.2 in March 2024 and risen to 67.0 in March 2025. Socio-economic impact analysis is based on the data of the Department of Financial Services that includes information about 10,378 respondents in 15 states across five geographic zones.

Analytical Framework

The analytic framework consists of three parts that are interconnected: descriptive analysis to find out trends and patterns of adoption of electronic payments; econometric analysis to reveal relationships among variables of adoption drivers and results; and qualitative thematic analysis to understand contextual issues influencing adoption choices.

Econometric Modeling

The factors that will be considered to investigate the effects of digital payment determinants on financial inclusion will include multiple regression analysis using fixed effects model specification which is as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \alpha_i + \epsilon_{it}$$

Where Y_{it} is an outcome of financial inclusion (through FI-Index variables or transaction adoption). X denotes different variables which are factors affecting adoption like perceptions of ease of use, perceptions of trust, digital financial literacy, infrastructure access and control variables. α_i represent the fixed effects while ϵ_{it} is the error term.

Research Instruments

The main method used for the study is a semi-structured interview guide to engage stakeholders, and the main areas explored through interviews include technology usage experience, factors hindering or facilitating adoption, sense of security and trustworthiness, as well as ideas about how to make the digital financial inclusion better. Quantitative analysis utilizes information gathered on transactions collected by NPCI. This source includes data for all UPI and RuPay transactions throughout India.

Since de-identified secondary data will be used for research purposes, there will be no human subjects involved in the study. All data analysis will strictly follow the concepts of ethical data management and the privacy issues relating to the financial transactions data.

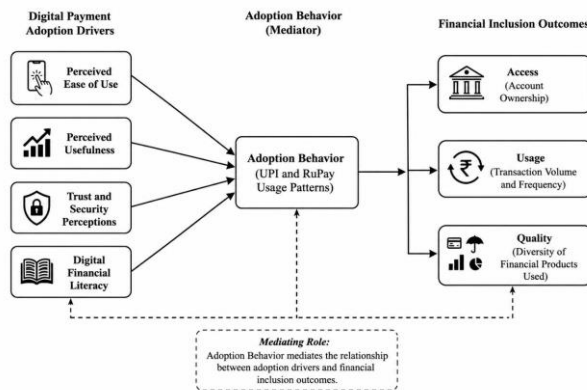


Figure 1: Conceptual Framework for Digital Payment Adoption and Financial Inclusion

This conceptual model depicts the routes through which the drivers of digital payment adoption affect financial inclusion outcomes. The four major drivers of adoption such as the perception of ease of use, the perception of usefulness, perceptions regarding trust and security, and digital financial literacy are posited to affect adoption behavior (as measured by usage of UPI and RuPay). Adoption behavior is, in turn, anticipated to positively affect financial inclusion outcomes in three ways: access (having an account), usage (amount and frequency of transactions), and quality (variety of products used).

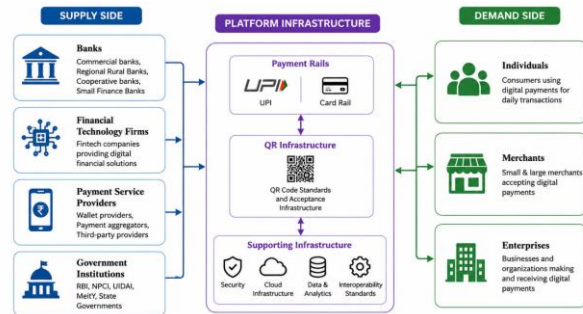


Figure 2: Integrated Digital Payment Ecosystem Stakeholder Model

This stakeholder map describes the integrated digital payment ecosystem and shows how different stakeholders on the supply side and on the demand side and the platform infrastructure are connected. The stakeholders from the supply side include banks, financial technology firms, payment service providers, and government institutions, whereas payment rails (UPI, card rail), and QR infrastructure represent the infrastructure technology. On the demand side are individuals, merchants, and enterprises.

IV. ANALYSIS

Quantitative Analysis

Based on the digital transactions analysis for the years 2021-2025, the usage of digital payment methods has greatly increased in India. There has been an increase in the volume of digital transactions nearly eleven times during this period with the market share of UPI increasing up to around 80% of the total number of digital transactions in 2025. Thus, the exponential increase in digital transaction analysis highlights how digital payment technology has been embraced quickly. The deployment of UPI QR has increased from 9.3 crore in 2021 to 65.8 crore in 2025 with the surveying of around 94% of small merchants showing that they have adopted UPI.

Transaction frequency analysis has shown that digital transactions have become common in everyday life with almost 65% of UPI users having multiple digital transactions each day. Digital payments are especially popular among younger people aged between 18 and 25 with UPI being adopted by 66%

of people in this age group, thus showing how young people change their behavior towards digital money management. Cashback was shown to be a reason for adoption of digital payments in 52% of users while speed of payment was given as a reason by 74% of people.

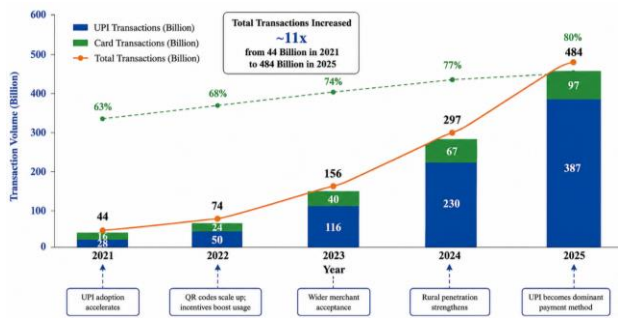


Figure 3: Digital Payment Transaction Growth 2021-2025

UPI became the leading method for payment in terms of volume with approximately 80% share of overall transactions by 2025. The exponential nature of the graph shows the increasing pace of adoption especially as QR codes have grown and incentives were provided.

The analysis of satisfaction of stakeholders shows positive attitudes towards digital payments systems. As per the survey among the users of digital payments in India, 90% showed an increase in their confidence due to UPI and RuPay card payment while there was a significant decrease in their cash transaction and ATM transactions. Among the surveyed merchants 72% were satisfied with digital payment owing to easy transactions and better record-keeping while 57% have shown an increase in sales due to digitization.

Figure 3 shows the trend of digital payment transactions in India between 2021 and 2025. Total transactions of digital payment rose by approximately 11 times during this time period. Transactions made through UPI have increased at a quicker pace than card transactions. The result is that

Comparative Analysis

Table 1: Comparative Analysis of Digital Payment Systems for Financial Inclusion

Dimension	UPI (India)	PromptPay (Thailand)	Pix (Brazil)	M-Pesa (Kenya)
Launch Year	2016	2017	2020	2007
Primary Payment Type	P2P & P2M	P2P & P2M	P2P & P2M	P2P & Merchant
Interoperability	High	Medium	High	Low
Transaction Cost	Very Low	Low	Zero	Medium
QR Code Support	Yes	Yes	Yes	Limited
GDP Impact Estimate	1.4%	2.0%	\$49.9B (by 2028)	~1.0%
Reach (2025)	~70% adults	~75% adults	~80% adults	~85% adults

Dimension	UPI (India)	PromptPay (Thailand)	Pix (Brazil)	M-Pesa (Kenya)
Digital Inclusion Impact	High	High	Very High	Very High
Primary Access Mode	Mobile Apps	Mobile Apps	Mobile Apps	USSD/Mobile

Comparison of four digital payment systems that are widely used in different countries with respect to their characteristics and implications for financial inclusion. India's UPI was introduced in 2016 and provides peer-to-peer and peer-to-merchant payments at a very low rate of fees via very high-interoperable platforms. The GDP impact is assessed as 1.4%. The 2017 introduction of Thailand's PromptPay includes about 75% of adults with GDP impact of 2%. Brazil's Pix was the latest digital payment system (launched in 2020) and includes zero-cost transactions. It will generate additional GDP of \$49.9 billion up to 2028. The innovative digital payment system is Kenya's M-Pesa (the pioneer in mobile money payments, launched in 2007).

Discussion

There are multiple important insights drawn from the analysis about the correlation between innovation in digital payment mechanisms and financial inclusion. First, there is an observed rapid increase in the diffusion of digital payments once the required infrastructure threshold is passed. The introduction of additional QR codes of UPI from 9.3 crore to 65.8 crore allowed for increased acceptance by the merchants which in their turn led to greater adoption by users through increased utility of the mechanism in routine payments. There is a positive cycle here with higher utility driving adoption in a network effect fashion.

Second, it is possible to conclude that the implementation of such an innovation in the process of financial inclusion requires the introduction of supportive measures. The scheme introduced by the government to incentivize people for the use of RuPay cards and UPI transactions was instrumental

in lowering the cost barrier for users and making them feel secure using digital payments. For instance, cash-back incentives made 52% of users adopt the system and incentive mechanism allowed acquiring banks to bring more merchants on board. Finally, from the analysis, one can say that the diffusion of the innovations occurs differently in respect to different groups. There is a clear difference in adoption rates between younger users (at the age between 18 and 25) and elderly users with younger age group having 66% adoption rate. Moreover, even though 94% of merchants use digital payment options, the quality of such adoption could be lower with merchants using such mechanism in limited scenarios.

Fourth, there are very many macroeconomic consequences associated with digital payment innovations. For example, the fact that adoption of UPI is expected to lead to GDP increase by 1.4% means that the economy will derive some benefits like better working capital management for the micro and small businesses, better taxation and economic activity formalization. The GDP increase also implies that digital payment innovations are not simply convenient but essential economic infrastructure.

Finally, some of the persistent problems are lack of digital literacy, issues of privacy and lack of infrastructure for the marginalized communities. The binding constraint analysis highlights deficiencies in the institutional infrastructure in the banking system and poor perception of benefits for the low-income groups as some of the key problems.

V. CONCLUSION

This research has looked at how new technologies for digital payments are helping promote financial inclusion by studying how digital payment adoption worked in India. The results of this analysis suggest that there is great potential for expansion of financial access through digital payment technologies provided that appropriate policies, infrastructure development, and digital literacy efforts accompany these technologies. The explosive growth of the number of transactions through UPI and RuPay platforms, which accounted for 80% of digital payment transactions made during 2021-2025, shows great potential of well-developed digital payment systems for promoting inclusive finance.

A number of findings can be formulated based on this research. Digital payment adoption is influenced by multiple factors: technological, economical, and social. Ease of use, trust in the system, digital financial literacy, and usefulness of technology are crucial determinants of adoption. All of these elements influence each other in complicated ways, but one could argue that trust and literacy are crucial prerequisites for sustainable adoption for those who lack any familiarity with the formal financial system before. It is shown that 90% of digital payment adopters have gained more confidence in the system after using it.

Furthermore, the success of the use of digital payments for the purpose of financial inclusion is contingent on the overall environment within which it exists. Availability of the infrastructure, acceptance by the merchants, policy initiatives and frameworks, and regulations influence the outcomes of its adoption. The success of India's initiative to develop a digital payments ecosystem through coordinated efforts of the government, financial institutions, and technology providers is evidenced by the adoption of the UPI QR technology to 65.8 crore codes and onboarding of 94% of small merchants to accept digital payments.

Finally, the economic impact of the use of digital payments is significant and can be assessed and measured. The contribution of the UPI in terms of

GDP is estimated to be 1.4%. The use of digital payments contributes to the economy beyond its role of improving financial inclusion in a positive way through improving liquidity management for corporations, lowering transaction costs, increasing tax collection, and formalizing informal economic activity. Thus, the positive relation of the adoption of the digital payments and economic growth justifies considering digital payments not merely as convenient technology, but as infrastructure.

Moreover, many difficulties exist in making digital financial services universally available. Infrastructure deficiencies, especially in remote areas, pose problems for the adoption of digital payment services. The insufficient digital literacy prevents many consumers from fully utilizing new digital payment technologies, and privacy concerns discourage people from adopting digital payment methods. The finding that 38% of transactions are still made with cash implies that some segments of the population cannot use digital payments because of some reasons, such as privacy concerns, habit, or unavailability of necessary devices. In order to solve this problem, more investments in digital infrastructure are needed, and more financial literacy programs should be implemented.

It should be noted that the study reveals some institutional barriers to the development and distribution of digital payment innovations. For instance, there is an overrepresentation of state-owned banking enterprises in the financial market, and there is little competition. This creates barriers in innovativeness and outreach to marginalized populations.

From the results of the study, several key policy suggestions come to light. In the first place, further investments in digital technology infrastructure will facilitate the penetration of the technology into areas where there is currently insufficient access to digital payments. Second, programs aimed at improving the digital literacy of potential users need to be combined with campaigns promoting digital payments. Third, the regulatory framework for digital payments should strive to combine the support of innovation with the protection of consumers'

interests. Finally, mechanisms for encouraging merchants to accept payments and use digital technologies should be implemented.

As regards future research, one needs to focus on the impact of the adoption of the technology on economic indicators and how digital payments are linked to the economic participation of individuals. One can conduct longitudinal studies to track changes and trace the relationship between using the technology and economic participation. One may also try out comparative analysis to find similarities and differences in the effectiveness of the technology implementation in different countries.

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