

Adoption of Digital Payments in Emerging Economies: Drivers, Challenges and Future Directions

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Abstract

The rapid evolution of digital technologies has transformed the global financial landscape, making digital payment systems an essential component of modern economies. Emerging economies, in particular, have witnessed remarkable growth in the adoption of digital payment solutions due to increasing smartphone penetration, expanding internet connectivity, supportive government policies, and the rapid development of financial technology (FinTech) ecosystems. Despite this progress, the adoption of digital payments remains uneven across regions because of challenges related to digital infrastructure, cybersecurity, financial literacy, regulatory complexities, and consumer trust. This survey paper provides a comprehensive review of the current state of digital payment adoption in emerging economies by synthesizing recent academic research, industry reports, and policy initiatives. The study examines the evolution of digital payment systems, major payment technologies, and the key stakeholders involved in the digital payment ecosystem. Furthermore, it analyses the technological, economic, social, and regulatory factors that drive adoption while highlighting significant barriers that limit widespread acceptance. Particular attention is given to security and privacy concerns, including phishing attacks, identity theft, payment fraud, data breaches, and emerging cyber threats, together with the mitigation strategies adopted by financial institutions and payment service providers. The survey also compares digital payment adoption across selected emerging economies to identify common trends, country-specific practices, and successful policy interventions that promote financial inclusion and digital transformation. In addition, the paper reviews widely adopted theoretical models for technology acceptance and identifies existing research gaps that require further investigation. Finally, it discusses emerging technologies such as artificial intelligence, blockchain, biometric authentication, central bank digital currencies, and cross-border real-time payment systems that are expected to shape the future of digital finance. By integrating findings from diverse research domains, this survey offers a comprehensive reference for researchers, policymakers, financial institutions, and technology developers seeking to understand the evolving landscape of digital payment adoption in emerging economies and to support the development of secure, inclusive, and sustainable digital financial ecosystems.

Keywords: Digital Payments, Emerging Economies, Financial Technology (FinTech), Mobile Wallets, Unified Payments Interface (UPI), Financial Inclusion, Consumer Adoption, Cybersecurity, Digital Banking, Cashless Economy.

1. Introduction

The rapid advancement of digital technologies has fundamentally transformed the global financial ecosystem, changing the way individuals, businesses, and governments conduct financial transactions. Over the past two decades, digital payment systems have evolved from basic electronic fund transfers to sophisticated, real-time payment platforms that offer speed, convenience, security, and accessibility [1]. The widespread availability of smartphones, affordable internet services, and innovative financial technologies (FinTech) has accelerated this transition, enabling digital payments to become an essential component of modern economies. As societies increasingly embrace digitalization, payment systems have shifted from being merely transactional tools to strategic enablers of economic growth, financial inclusion, and digital innovation.[2]

Emerging economies have experienced particularly rapid growth in digital payment adoption due to a combination of technological progress, supportive government policies, expanding digital infrastructure, and increasing consumer awareness. Countries such as India, Brazil, Indonesia, Kenya, Nigeria, and Vietnam have introduced various initiatives to promote cashless transactions and strengthen digital financial ecosystems.[5] Government-led programs, real-time payment infrastructures, digital identity systems, and regulatory reforms have encouraged both consumers and businesses to adopt digital payment solutions. In addition, the rapid expansion of e-commerce platforms, mobile banking applications, and digital wallets has significantly altered consumer payment behaviour, making digital transactions more convenient and widely accessible than ever before.

Digital payment systems encompass a broad range of technologies and services, including internet banking, mobile wallets, Quick Response (QR) code payments, contactless card transactions, Unified Payments Interface (UPI), Near Field Communication (NFC), biometric authentication, and blockchain-enabled payment solutions. These technologies facilitate secure and efficient financial transactions while reducing dependence on physical cash[3]. Compared with conventional payment methods, digital payments offer numerous advantages, including faster transaction processing, lower operational costs, improved financial transparency, enhanced customer convenience, and greater accessibility to financial services.

Despite these significant advancements, the adoption of digital payment systems in emerging economies remains uneven. Several socioeconomic, technological, and institutional challenges continue to affect the widespread acceptance and sustainable use of digital financial services. Limited digital infrastructure in rural regions, inadequate internet connectivity, varying levels of financial and digital literacy, cybersecurity concerns, privacy risks, regulatory inconsistencies, and economic disparities present considerable obstacles to digital payment adoption[11]. Furthermore, consumer trust remains a critical factor influencing the willingness to adopt electronic payment methods. Incidents involving phishing attacks, identity theft, fraudulent mobile applications, payment scams, data breaches, and unauthorized transactions have increased public concern regarding the security and reliability of digital financial platforms.

The COVID-19 pandemic further accelerated the global transition toward contactless and remote payment methods. During periods of restricted physical movement, digital payment platforms enabled businesses

to continue operations while allowing consumers to purchase goods and services without direct physical interaction. This unprecedented situation highlighted the resilience and flexibility of digital financial systems and reinforced the importance of developing secure, scalable, and inclusive payment infrastructures. The increased reliance on digital transactions also encouraged financial institutions and technology providers to invest in advanced security mechanisms such as multi-factor authentication, tokenization, biometric verification, artificial intelligence-based fraud detection, and real-time transaction monitoring[5,6,7].

Recent technological innovations continue to reshape the future of digital payments. Artificial intelligence and machine learning are increasingly employed to detect fraudulent activities, personalize financial services, and improve customer experience. Blockchain technology offers decentralized transaction processing with enhanced transparency and security, while cloud computing enables scalable payment infrastructures capable of supporting millions of concurrent transactions. Emerging technologies such as the Internet of Things (IoT), wearable payment devices, central bank digital currencies (CBDCs), and cross-border instant payment systems are expected to further transform the digital payment landscape over the coming years.

This survey paper addresses this need by presenting a comprehensive review of digital payment adoption in emerging economies. It examines the evolution of digital payment technologies, explores the major drivers influencing consumer and business adoption, discusses key implementation challenges and security concerns, compares experiences across selected emerging economies, and highlights emerging technologies that are expected to shape the future of digital finance. Furthermore, the paper identifies existing research gaps and proposes future research directions that can support the continued development of secure, efficient, and inclusive digital payment systems[30]. By integrating insights from recent academic literature, industry developments, and policy initiatives, this survey aims to provide a valuable reference for scholars, practitioners, policymakers, and financial service providers working toward the advancement of digital financial ecosystems in emerging economies.

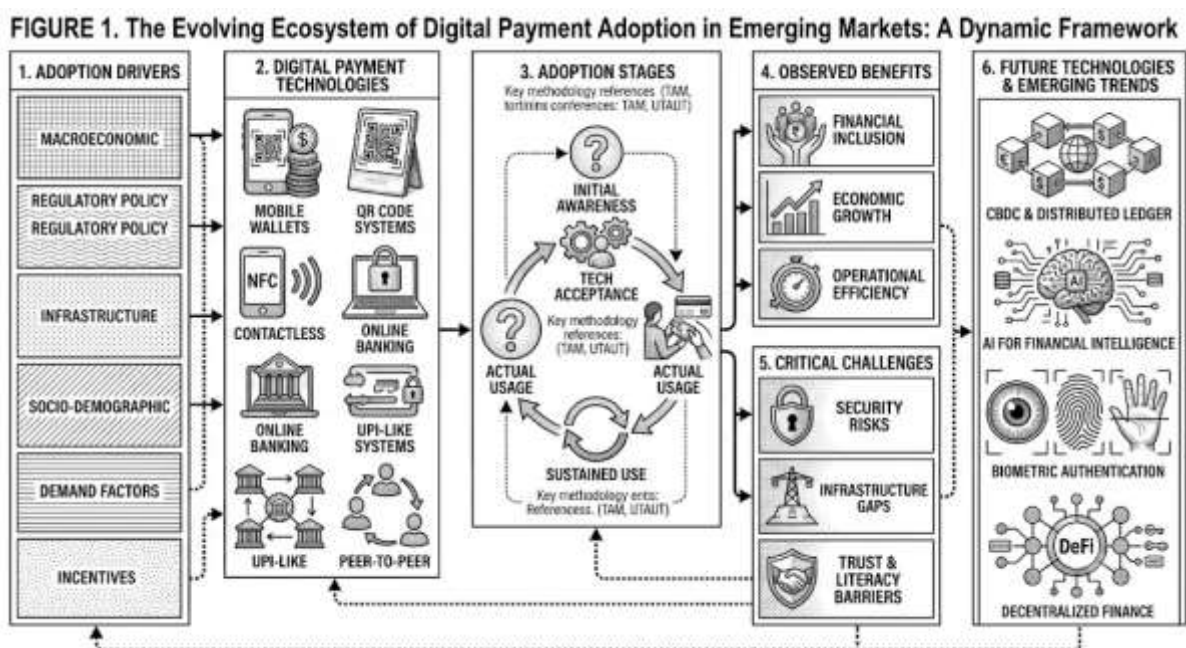


Figure 1. Overview of Digital Payment Adoption in Emerging Economies

2. Evolution of Digital Payment Systems

The evolution of digital payment systems represents one of the most significant transformations in the financial sector. Payment methods have progressed from traditional cash-based transactions to highly sophisticated digital platforms that enable secure, real-time, and borderless financial exchanges. This transformation has been driven by technological advancements, increasing internet accessibility, widespread smartphone adoption, innovations in financial technology (FinTech), and supportive government policies. As economies become increasingly digital, payment systems continue to evolve to meet the growing demand for speed, convenience, security, and financial inclusion. Understanding this evolution provides valuable insight into how modern digital payment ecosystems have developed and highlights the technological innovations shaping their future.

2.1 Cash Economy

For centuries, cash served as the primary medium of exchange for individuals, businesses, and governments. Transactions involving physical currency were simple and universally accepted, requiring no technological infrastructure or intermediary institutions. Cash-based economies offered anonymity and immediate settlement, making them suitable for everyday commercial activities.

Despite these advantages, cash transactions also presented several limitations. Managing physical currency involved significant costs related to printing, transportation, storage, and security. Cash transactions were difficult to trace, increasing the risk of tax evasion, corruption, and illegal financial activities. Additionally, individuals living in remote areas often had limited access to formal banking services, restricting their participation in the broader financial system.

The expansion of banking services and advancements in communication technologies gradually encouraged the transition from cash-based transactions toward electronic payment methods. Governments and financial institutions also recognized that reducing dependence on cash could improve economic transparency, enhance financial inclusion, and strengthen monetary policy implementation.

2.2 Card Payments

The introduction of payment cards marked the first major step toward electronic financial transactions. Debit cards, credit cards, and prepaid cards enabled consumers to make purchases without carrying large amounts of cash. Financial institutions introduced electronic authorization systems that verified transactions instantly, improving both efficiency and security.

Credit cards allowed customers to access short-term credit while offering reward programs and purchase protection, making them increasingly attractive for retail transactions. Debit cards, directly linked to bank accounts, provided consumers with immediate access to their deposited funds. Automated Teller Machines (ATMs) further enhanced banking convenience by allowing customers to withdraw cash and perform basic banking operations at any time.

Card payment networks significantly expanded domestic and international commerce by enabling electronic payments across different merchants and financial institutions. However, card-based transactions also faced challenges, including transaction fees, card skimming, counterfeit cards, and fraud resulting from stolen payment credentials. These limitations encouraged continuous improvements in payment security through technologies such as EMV chip cards, tokenization, and two-factor authentication.

2.3 Internet Banking

The rapid expansion of the internet during the late twentieth century introduced a new era of banking services. Internet banking enabled customers to access their accounts remotely through secure web portals,

eliminating the need to visit physical bank branches for routine financial activities.

Through internet banking platforms, users could transfer funds, pay utility bills, manage investments, apply for financial products, and monitor account balances at any time. This digital accessibility significantly improved customer convenience while reducing operational costs for financial institutions.

The growth of electronic commerce further accelerated internet banking adoption, as consumers increasingly preferred online shopping and electronic bill payments. Banks continuously enhanced online banking platforms by incorporating encryption technologies, secure authentication mechanisms, and transaction monitoring systems to protect customer information. Nevertheless, cyber threats such as phishing attacks, malware infections, and credential theft highlighted the importance of developing stronger cybersecurity frameworks within digital banking environments.

2.4 Mobile Banking

The widespread adoption of smartphones transformed internet banking into mobile banking by enabling financial services through dedicated mobile applications. Mobile banking provides customers with instant access to banking services regardless of location, making financial management more flexible and convenient.

Modern mobile banking applications allow users to transfer funds, pay bills, deposit checks, manage investments, apply for loans, and receive real-time transaction notifications using mobile devices. Biometric authentication methods, including fingerprint recognition and facial recognition, have further improved both user convenience and account security.

In emerging economies, mobile banking has played a crucial role in expanding financial inclusion. Individuals living in underserved regions can now access essential banking services through smartphones without relying on traditional banking infrastructure. Mobile banking has also supported the rapid growth of digital commerce by integrating payment services with retail platforms, transportation services, healthcare applications, and government welfare programs.

2.5 QR Payments

Quick Response (QR) code payments have become one of the fastest-growing digital payment methods, particularly in emerging economies. QR technology enables customers to complete transactions by scanning a merchant-generated code using a smartphone application, eliminating the need for physical payment cards or specialized hardware.

QR payments are inexpensive to implement, making them highly attractive for small businesses and local merchants. Unlike traditional point-of-sale terminals, QR codes require minimal infrastructure and can be deployed quickly across urban and rural markets. This affordability has significantly increased merchant participation in digital payment ecosystems.

Governments and payment service providers have actively promoted standardized QR payment systems to improve interoperability between banks and mobile wallet providers. The convenience, speed, and low implementation cost of QR payments have contributed substantially to their widespread adoption across retail stores, restaurants, transportation services, healthcare facilities, and public utility payments.

2.6 Contactless Payments

Contactless payment technology enables consumers to complete transactions by simply tapping a payment card, smartphone, smartwatch, or other wearable device near a compatible payment terminal. These systems typically rely on Near Field Communication (NFC) or Radio Frequency Identification (RFID) technologies to transmit payment information securely.

Compared with traditional card insertion methods, contactless payments reduce transaction time and improve customer convenience. The technology became particularly important during the COVID-19 pandemic, as consumers and merchants sought payment methods that minimized physical contact.

Financial institutions have strengthened contactless payment security through encryption, dynamic transaction authentication, tokenization, and spending limits for low-value transactions. As wearable technologies continue to evolve, contactless payments are expected to become increasingly integrated into everyday consumer experiences.

2.7 Unified Payments Interface (UPI)

The Unified Payments Interface (UPI) represents one of the most significant innovations in real-time digital payment infrastructure. UPI enables users to transfer funds instantly between bank accounts using mobile applications without requiring detailed bank account information. Instead, transactions are initiated through a Virtual Payment Address (VPA), mobile number, or QR code.

UPI provides interoperability among multiple banks and payment service providers, allowing users to perform peer-to-peer (P2P) and peer-to-merchant (P2M) transactions seamlessly. The platform supports 24-hour real-time payments, bill payments, merchant settlements, recurring payments, and integration with numerous financial services.

The rapid adoption of UPI demonstrates how government support, robust digital infrastructure, and collaboration between banks and FinTech companies can accelerate financial innovation. Its success has inspired several countries to explore similar real-time payment systems as part of their national digital transformation strategies.

2.8 Blockchain Payments

Blockchain technology represents the latest stage in the evolution of digital payment systems by introducing decentralized transaction processing without requiring a central intermediary. Transactions are verified through distributed consensus mechanisms and permanently recorded on tamper-resistant digital ledgers, enhancing transparency and reducing the risk of data manipulation.

Blockchain-based payment systems offer several advantages, including faster cross-border transactions, reduced settlement times, lower transaction costs, improved traceability, and enhanced security through cryptographic techniques. Smart contracts further automate payment execution when predefined conditions are satisfied, reducing administrative complexity and operational delays.

Despite these benefits, blockchain payment systems continue to face challenges related to regulatory uncertainty, scalability, energy consumption, interoperability, and varying legal frameworks across countries. Central banks worldwide are also exploring Central Bank Digital Currencies (CBDCs), which combine many advantages of blockchain-inspired technologies with the stability of government-issued currencies. As blockchain technologies continue to mature, they are expected to play an increasingly important role in the future development of secure, transparent, and globally interconnected digital payment ecosystems.

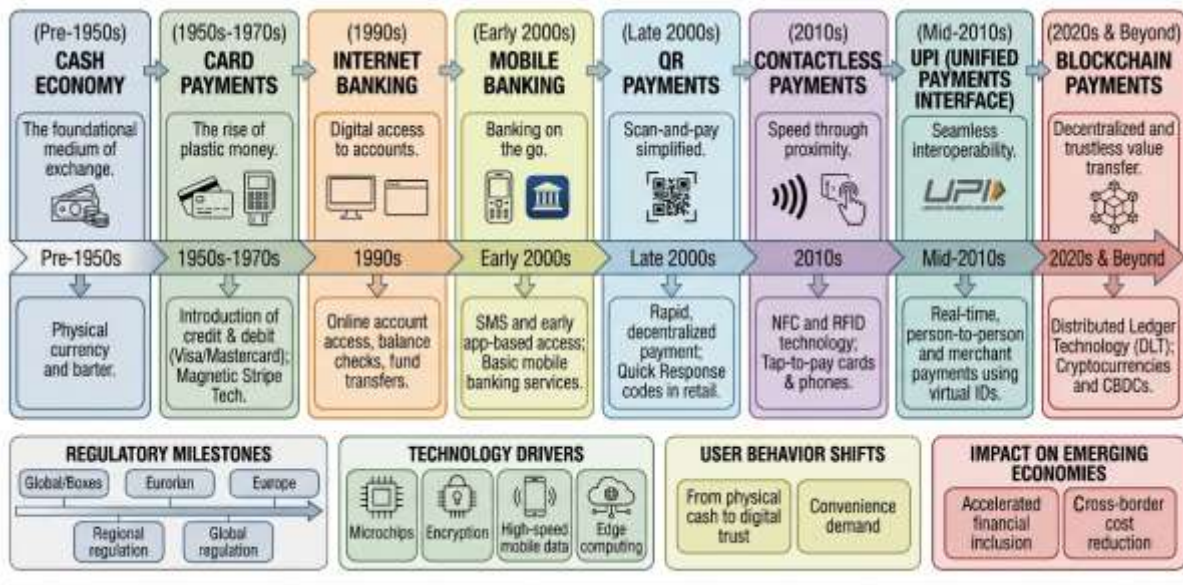


Figure 2. Evolution of Digital Payment Systems

3. Digital Payment Ecosystem

A digital payment ecosystem is an interconnected network of stakeholders, technologies, and financial institutions that collectively enable secure, efficient, and real-time electronic transactions. It facilitates the seamless movement of funds between consumers and merchants through digital platforms while ensuring transaction security, regulatory compliance, and operational reliability. The ecosystem relies on collaboration among banks, payment service providers, FinTech companies, government agencies, telecommunication networks, and regulatory authorities to deliver accessible and trustworthy payment services. Each stakeholder performs a specific function that contributes to the successful execution of digital financial transactions.

3.1 Customers

Customers are the primary users of digital payment systems. They initiate transactions using digital payment methods such as mobile wallets, internet banking, debit cards, credit cards, UPI applications, and QR code payments. Customers expect payment services to be secure, convenient, fast, and available at any time. Their willingness to adopt digital payments is influenced by factors such as ease of use, trust, transaction costs, digital literacy, and perceived security.

3.2 Merchants

Merchants are businesses or service providers that accept digital payments from customers for goods and services. They integrate payment solutions such as QR codes, Point-of-Sale (POS) terminals, payment gateways, and mobile payment applications into their business operations. Digital payments help merchants reduce cash handling costs, improve transaction efficiency, maintain accurate financial records, and expand their customer base through online and offline sales channels.

3.3 Banks

Banks form the backbone of the digital payment ecosystem by providing financial accounts, transaction processing, payment settlement, and fund transfer services. They authenticate customer identities, manage account balances, issue payment cards, and ensure secure movement of funds between different financial institutions. Banks also implement advanced security measures, including encryption, fraud detection systems, and multi-factor authentication, to protect customer information and financial assets.

3.4 Payment Gateways

Payment gateways act as intermediaries between customers, merchants, and financial institutions during online transactions. They securely collect payment information, encrypt sensitive data, verify transaction details, communicate with banks for authorization, and facilitate payment completion. Payment gateways support multiple payment methods, including cards, internet banking, UPI, and digital wallets, ensuring smooth and secure online payment experiences for both businesses and consumers.

3.5 FinTech Companies

Financial Technology (FinTech) companies develop innovative digital financial solutions that improve payment accessibility, efficiency, and customer experience. They provide services such as mobile wallets, digital lending platforms, peer-to-peer payment applications, fraud detection systems, and AI-driven financial services. FinTech firms continuously introduce new technologies that simplify payment processes while promoting financial inclusion and digital transformation across emerging economies.

3.6 Government

Governments play a crucial role in promoting digital payment adoption by developing national digital strategies, investing in digital infrastructure, encouraging financial inclusion, and implementing policies that support cashless transactions. Many governments provide incentives for digital payments, establish digital identity systems, and promote secure payment infrastructures to accelerate economic growth and improve transparency in financial transactions.

3.7 Regulators

Regulatory authorities establish the legal and operational frameworks governing digital payment systems. They formulate policies related to payment security, consumer protection, data privacy, anti-money laundering (AML), and Know Your Customer (KYC) compliance. Regulators also monitor financial institutions and payment service providers to ensure stability, fairness, and compliance with national financial regulations while protecting the interests of consumers.

3.8 Telecom Providers

Telecommunication providers supply the communication infrastructure required for digital payment services. Reliable internet connectivity, mobile networks, and broadband services enable real-time transaction processing through smartphones, mobile banking applications, and digital wallets. The expansion of 4G, 5G, and broadband networks has significantly improved digital payment accessibility, particularly in rural and underserved regions, supporting the continued growth of digital financial ecosystems.

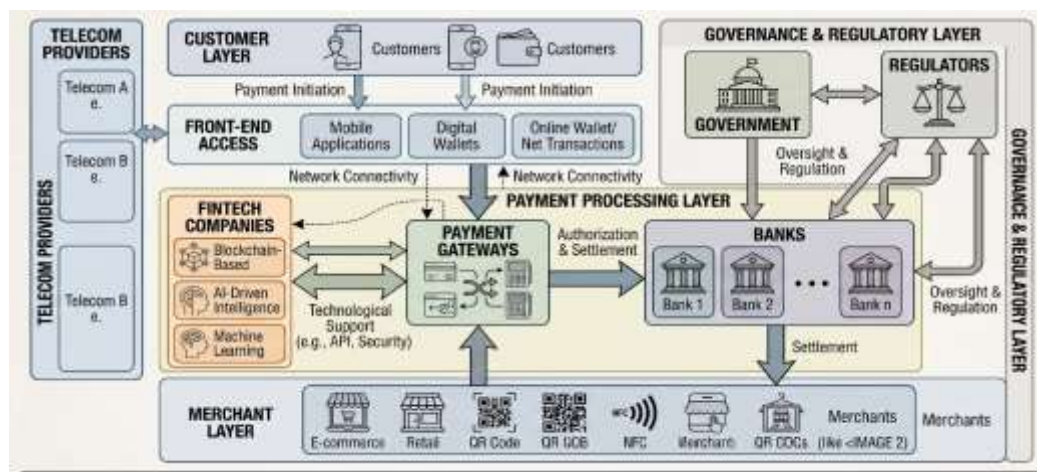


Figure 3. Digital Payment Ecosystem Architecture

4. Technologies Behind Digital Payments

Digital payment systems are built upon a combination of advanced information and communication technologies that enable secure, reliable, and efficient financial transactions. These technologies work together to ensure seamless payment processing, fraud prevention, data protection, and real-time transaction management. As digital payment ecosystems continue to evolve, innovations such as cloud computing, artificial intelligence, blockchain, and biometric authentication have become fundamental components of modern financial services. This section discusses the major technologies that support digital payment systems and their contributions to improving transaction speed, security, scalability, and user experience.

4.1 Cloud Computing

Cloud computing provides the computing infrastructure required to store, process, and manage digital payment transactions over the internet. Instead of relying on local servers, financial institutions and payment service providers use cloud platforms to host applications, databases, and payment processing systems. Cloud computing offers scalability, allowing payment systems to handle millions of transactions during peak periods without performance degradation. It also reduces infrastructure costs, improves disaster recovery, and enables continuous service availability. Furthermore, cloud platforms support rapid software updates and facilitate integration with other financial technologies, making them essential for modern digital payment ecosystems.

4.2 Artificial Intelligence (AI)

Artificial Intelligence (AI) has become an essential technology in digital payment systems by enabling intelligent decision-making and automation. AI algorithms analyze transaction data to detect suspicious activities, identify fraudulent behavior, and improve risk management. AI-powered virtual assistants and chatbots provide customer support by answering payment-related queries and assisting users with financial services. Financial institutions also utilize AI to personalize customer experiences by recommending suitable financial products based on spending patterns and transaction history. As digital transactions continue to increase, AI plays a crucial role in enhancing payment security, operational efficiency, and customer satisfaction.

4.3 Machine Learning (ML)

Machine Learning is a branch of Artificial Intelligence that enables computer systems to learn from historical transaction data and improve their performance without explicit programming. In digital payment systems, machine learning models continuously analyze payment patterns to identify anomalies that may indicate fraudulent transactions. These models adapt to evolving fraud techniques by learning from new data, thereby improving detection accuracy over time. Machine learning is also used for customer behaviour analysis, credit scoring, transaction categorization, and predictive analytics. By automating complex analytical tasks, machine learning significantly enhances the efficiency and reliability of digital payment services.

4.4 Blockchain

Blockchain is a decentralized distributed ledger technology that records transactions across multiple computers in a secure and transparent manner. Each transaction is verified through cryptographic techniques and permanently stored in blocks linked together chronologically. Unlike traditional centralized payment systems, blockchain eliminates the need for intermediaries by enabling peer-to-peer financial transactions. This technology offers improved transparency, reduced transaction costs, faster cross-border payments, and enhanced resistance to data tampering. Blockchain also supports smart

contracts, which automatically execute payment agreements when predefined conditions are satisfied. Although blockchain presents enormous potential, challenges such as scalability, energy consumption, and regulatory uncertainty continue to influence its widespread adoption.

4.5 Big Data Analytics

Big Data Analytics involves collecting, processing, and analysing massive volumes of structured and unstructured financial data to generate meaningful insights. Digital payment platforms generate enormous amounts of transaction data every second, making big data technologies essential for extracting valuable business intelligence. Financial institutions use big data analytics to monitor customer spending behaviour, detect fraudulent activities, evaluate creditworthiness, optimize marketing strategies, and improve operational efficiency. Real-time data analysis enables organizations to make informed decisions while enhancing customer experiences and strengthening payment security.

4.6 Internet of Things (IoT)

The Internet of Things (IoT) refers to a network of interconnected smart devices capable of communicating and exchanging data through the internet. In digital payment systems, IoT enables payments through connected devices such as smartwatches, wearable fitness trackers, smart vehicles, vending machines, and home automation systems. Consumers can perform transactions without using traditional payment cards or smartphones, improving convenience and accessibility. IoT-based payment systems also support automated billing and subscription services. However, ensuring the security of interconnected devices remains a significant challenge, requiring strong encryption, authentication mechanisms, and continuous network monitoring.

4.7 Near Field Communication (NFC)

Near Field Communication (NFC) is a short-range wireless communication technology that enables contactless financial transactions between compatible devices. Using NFC, customers can simply tap their smartphones, smartwatches, or contactless payment cards near a payment terminal to complete a transaction. NFC technology significantly reduces transaction time while improving customer convenience and reducing physical contact. To ensure secure transactions, NFC payments employ encryption, tokenization, and dynamic authentication techniques. The growing popularity of contactless payment systems in retail stores, transportation services, and restaurants has made NFC one of the most widely adopted technologies in modern digital payments.

4.8 QR Codes

Quick Response (QR) codes have become one of the most affordable and widely accepted digital payment technologies, especially in emerging economies. A QR code stores payment information in a machine-readable format that can be scanned using a smartphone camera. Customers simply scan the merchant's QR code through a banking or digital wallet application to initiate and authorize payments instantly. QR-based payments require minimal infrastructure and eliminate the need for expensive Point-of-Sale (POS) terminals, making them highly suitable for small businesses and street vendors. Their low implementation cost, ease of use, and interoperability have contributed significantly to their rapid adoption across various industries.

4.9 Biometric Authentication

Biometric authentication enhances digital payment security by verifying the identity of users based on unique biological characteristics such as fingerprints, facial recognition, iris patterns, or voice recognition. Unlike traditional passwords or PINs, biometric identifiers are difficult to replicate, providing stronger protection against unauthorized access. Financial institutions increasingly integrate biometric

authentication into mobile banking applications and digital wallets to improve both security and user convenience. Multi-factor authentication combining biometrics with passwords or one-time passwords (OTPs) further strengthens payment security while reducing the risk of fraud and identity theft.

4.10 Tokenization

Tokenization is a security technique that replaces sensitive payment information, such as debit or credit card numbers, with randomly generated digital tokens during financial transactions. These tokens have no meaningful value outside the specific transaction, ensuring that confidential payment information is never directly transmitted or stored by merchants. Even if cybercriminals intercept a token, it cannot be used to reconstruct the original financial data. Tokenization significantly reduces the risk of payment fraud, data breaches, and unauthorized access. Today, tokenization has become a standard security feature in mobile wallets, contactless payments, online banking, and digital commerce platforms.

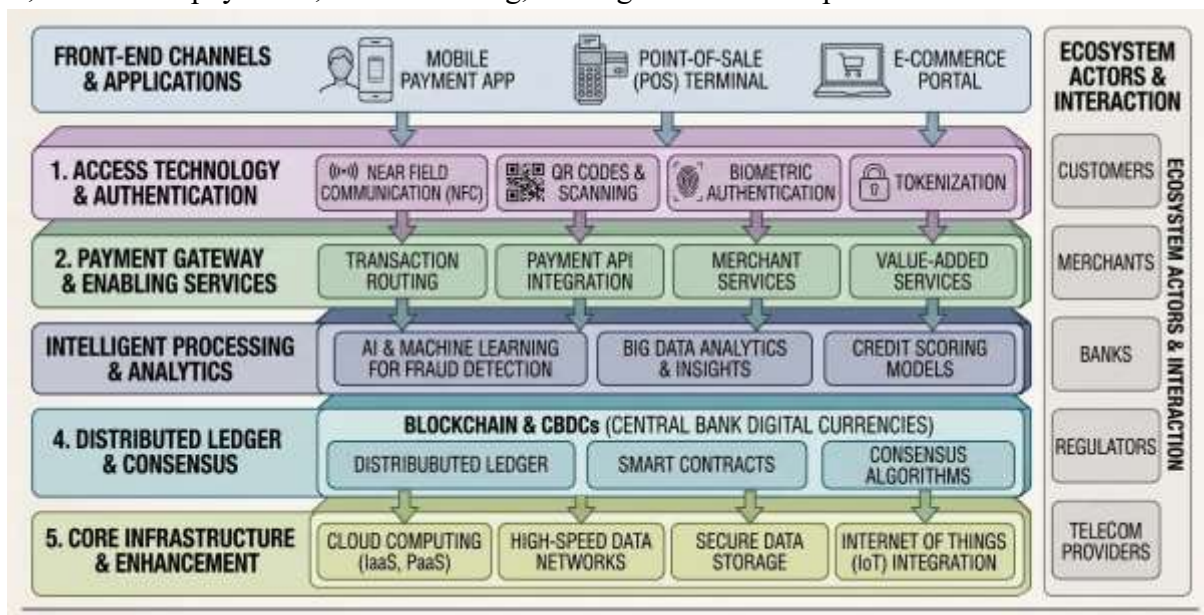


Figure 4. Technology Stack Behind Digital Payment Systems

5. Drivers of Digital Payment Adoption

The rapid adoption of digital payment systems across emerging economies has been influenced by multiple technological, economic, governmental, social, and business-related factors. These drivers have collectively transformed traditional financial transactions into fast, secure, and convenient digital experiences. Improvements in digital infrastructure, supportive government policies, increasing smartphone usage, and innovative financial services have accelerated the shift toward cashless economies. Understanding these drivers is essential for policymakers, financial institutions, businesses, and researchers seeking to enhance digital financial inclusion and develop sustainable payment ecosystems.

5.1 Technological Drivers

Technological advancements provide the foundation for digital payment systems by enabling secure, reliable, and efficient financial transactions. Continuous innovations in communication networks, smartphones, cloud computing, and digital platforms have significantly improved the accessibility and usability of digital payment services.

5.1.1 Smartphone Penetration

The increasing availability of affordable smartphones has significantly accelerated digital payment adoption. Smartphones function as portable financial devices that allow users to access mobile banking

applications, digital wallets, UPI platforms, and QR code payment systems. Features such as fingerprint sensors, facial recognition, and NFC capabilities further improve transaction security and convenience. As smartphone ownership continues to rise, digital payment services become accessible to a larger population, including users in rural and remote areas.

5.1.2 Internet Connectivity

Reliable internet connectivity is essential for real-time digital payment processing. High-speed broadband, 4G, and 5G mobile networks enable secure communication between customers, merchants, banks, and payment service providers. Improved internet infrastructure has expanded the reach of online banking, mobile wallets, and e-commerce, making digital payments faster and more dependable. Increasing internet penetration has also reduced the digital divide and promoted financial inclusion in emerging economies.

5.1.3 Cloud Services

Cloud computing enables financial institutions and FinTech companies to deliver scalable and highly available digital payment services. Cloud platforms support secure data storage, real-time transaction processing, disaster recovery, and rapid application deployment. They reduce infrastructure costs while allowing payment providers to handle millions of concurrent transactions efficiently. Integration with AI and big data technologies further enhances fraud detection, customer service, and operational efficiency.

5.2 Economic Drivers

Economic benefits encourage both consumers and businesses to adopt digital payment systems. Digital payments reduce operational costs while improving transaction speed and financial efficiency.

5.2.1 Cost Reduction

Digital payment systems significantly reduce expenses associated with printing currency, transporting cash, physical security, and manual transaction processing. Businesses benefit from automated accounting, reduced cash-handling risks, and lower operational costs. Consumers save both time and travel expenses by conducting financial transactions electronically, while banks improve efficiency through automated payment processing.

5.2.2 Faster Transactions

One of the major advantages of digital payments is the ability to complete transactions instantly or within a few seconds. Real-time payment systems improve cash flow, reduce waiting time, and enhance customer satisfaction. Faster settlements benefit businesses by improving liquidity and enabling quicker financial decision-making. Consumers also appreciate the convenience of immediate payment confirmation.

5.3 Government Drivers

Government support has played a crucial role in expanding digital payment ecosystems through policy reforms, digital infrastructure development, and financial inclusion initiatives.

5.3.1 Digital India

The Digital India initiative has promoted digital transformation by improving internet accessibility, encouraging digital literacy, and expanding electronic governance. The initiative supports digital banking, mobile payment platforms, and online government services, enabling citizens to perform financial transactions electronically. It has also encouraged innovation within the FinTech sector and strengthened India's digital economy.

5.3.2 Cashless Initiatives

Governments have introduced various cashless initiatives to reduce dependence on physical currency and encourage electronic transactions. These programs include awareness campaigns, financial incentives, digital infrastructure investments, and simplified regulations for digital payment providers. Cashless

initiatives improve transparency, reduce tax evasion, and promote efficient financial management while accelerating the adoption of digital payment systems.

5.4 Social Drivers

Social and demographic factors influence consumer acceptance of digital payment technologies by shaping attitudes toward technology adoption and financial behavior.

5.4.1 Digital Literacy

Digital literacy refers to the ability of individuals to effectively use digital technologies and online financial services. Consumers with higher digital literacy are more likely to use internet banking, mobile wallets, and electronic payment applications confidently. Educational campaigns conducted by governments and financial institutions improve awareness regarding digital payment security, fraud prevention, and responsible financial practices.

5.4.2 Youth Population

Young consumers are among the earliest adopters of digital payment technologies due to their familiarity with smartphones, mobile applications, and online services. Their increasing participation in e-commerce, online education, digital entertainment, and food delivery platforms has significantly accelerated digital payment usage. As younger generations continue to enter the workforce, they are expected to further drive digital payment adoption.

5.5 Business Drivers

Businesses, financial institutions, and payment service providers actively encourage digital payment adoption through incentives, promotional campaigns, and innovative financial services.

5.5.1 Merchant Incentives

Merchants are encouraged to adopt digital payment systems through reduced transaction fees, subsidized Point-of-Sale (POS) terminals, simplified onboarding procedures, and government support programs. Accepting digital payments improves operational efficiency, reduces cash management costs, and enhances customer convenience. Merchant participation is particularly important for expanding digital payment acceptance in small businesses and rural markets.

5.5.2 Cashback Programs

Cashback programs have become one of the most effective strategies for promoting digital payment adoption. Banks, digital wallet providers, and FinTech companies offer cashback rewards, discounts, loyalty points, referral bonuses, and promotional offers to encourage consumers to make digital transactions. These incentives improve customer satisfaction, increase transaction frequency, and promote long-term adoption of digital payment platforms.

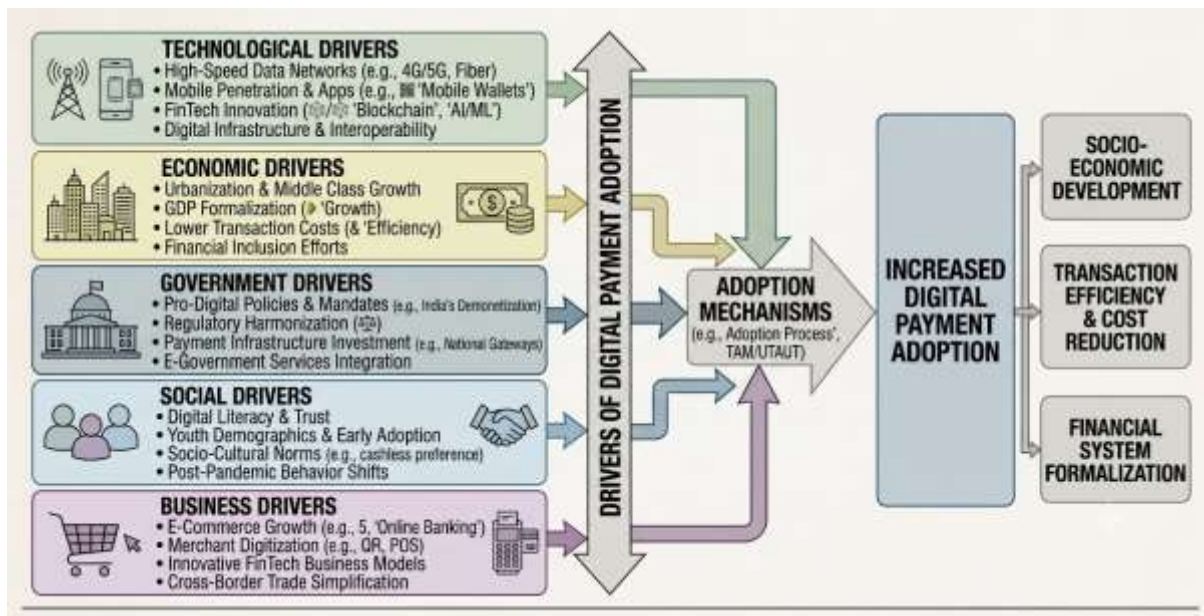


Figure 5. Drivers of Digital Payment Adoption

6. Challenges in Digital Payment Adoption

Despite the rapid expansion of digital payment systems, several challenges continue to hinder their widespread adoption, particularly in emerging economies. While technological advancements and supportive government initiatives have significantly increased the use of digital financial services, various socioeconomic, infrastructural, technological, and regulatory barriers remain. These challenges affect consumers, merchants, financial institutions, and policymakers alike. Addressing these obstacles is essential for building secure, inclusive, and sustainable digital payment ecosystems that can support long-term economic growth and financial inclusion.

6.1 Digital Divide

The digital divide refers to the gap between individuals and communities that have access to digital technologies and those that do not. In many emerging economies, significant disparities exist between urban and rural regions regarding internet availability, smartphone ownership, digital infrastructure, and access to financial services. While urban populations often benefit from advanced communication networks and modern banking facilities, rural communities frequently face limited connectivity and inadequate technological resources.

The digital divide also extends to differences in income, education, age, and socioeconomic status. Low-income households may find smartphones and internet subscriptions unaffordable, restricting their ability to participate in digital financial services. Older adults may experience difficulties adapting to new technologies due to limited digital skills. As a result, a considerable portion of the population continues to rely on cash-based transactions, limiting the overall effectiveness of digital payment initiatives. Bridging the digital divide requires investments in digital infrastructure, affordable internet services, and educational programs that promote digital inclusion across all sections of society.

6.2 Internet Issues

Reliable internet connectivity is a fundamental requirement for digital payment systems. Poor network coverage, unstable internet connections, low bandwidth, and frequent service interruptions can significantly affect the success of digital transactions. In many developing regions, mobile network

congestion and limited broadband infrastructure lead to transaction failures, delayed payment confirmations, and poor user experiences.

Power outages and natural disasters can further disrupt communication networks, preventing users from accessing banking applications or completing online transactions. Slow internet speeds may also discourage merchants from adopting digital payment systems, particularly when payment processing becomes unreliable during peak business hours. Continuous investment in broadband infrastructure, expansion of 4G and 5G networks, and improved telecommunication services are essential to ensure uninterrupted digital payment operations across both urban and rural areas.

6.3 Infrastructure

A robust technological infrastructure is essential for supporting digital payment ecosystems. Banks, payment service providers, merchants, and telecommunications companies depend on secure servers, payment gateways, cloud platforms, Point-of-Sale (POS) terminals, and high-speed communication networks to process digital transactions efficiently.

Many emerging economies continue to face infrastructure-related challenges, including limited banking facilities, insufficient payment terminals, inadequate electricity supply, and outdated information technology systems. Small businesses, particularly those located in rural regions, often lack access to modern payment technologies due to financial constraints and limited technical support. Inadequate infrastructure increases transaction failures, reduces customer confidence, and slows the adoption of digital payment services. Strengthening national digital infrastructure through public and private investments is therefore critical for expanding digital financial inclusion.

6.4 Trust Deficit

Consumer trust is one of the most important factors influencing digital payment adoption. Many individuals remain hesitant to use digital financial services because they fear financial fraud, identity theft, unauthorized account access, and misuse of personal information. High-profile cybersecurity incidents and online scams have further reduced public confidence in electronic payment platforms.

Consumers may also question the reliability of payment applications, particularly when transactions fail or technical errors occur during payment processing. A lack of transparency regarding data privacy policies and dispute resolution mechanisms can further discourage adoption. Financial institutions must strengthen customer trust by implementing advanced security technologies, providing transparent communication, offering reliable customer support, and educating users about safe digital payment practices. Building consumer confidence remains essential for achieving sustainable growth in digital payment usage.

6.5 High Transaction Costs

Although digital payments generally reduce operational expenses compared with cash handling, certain transaction-related costs continue to discourage adoption among both consumers and merchants. Payment processing fees, merchant discount rates, service charges, and cross-border transaction costs can be particularly burdensome for small businesses operating with limited profit margins.

Merchants may hesitate to adopt digital payment systems if transaction fees significantly reduce their earnings. Similarly, consumers may avoid certain digital payment methods if additional convenience charges or transfer fees are imposed. High costs associated with installing Point-of-Sale (POS) terminals, upgrading payment infrastructure, and maintaining payment software can further limit merchant participation. Governments and financial institutions can encourage wider adoption by reducing transaction fees, offering financial incentives, and promoting affordable digital payment solutions.

6.6 Device Availability

Access to compatible digital devices plays a crucial role in determining an individual's ability to participate in digital payment ecosystems. Smartphones, computers, tablets, and internet-enabled devices are necessary for accessing mobile banking applications, digital wallets, internet banking platforms, and QR code payment systems.

In many emerging economies, a significant proportion of the population still lacks access to affordable smartphones or modern computing devices. Economic disparities often prevent low-income households from purchasing internet-enabled devices capable of supporting advanced digital payment applications. Furthermore, older mobile devices may not support recent software updates or enhanced security features, increasing cybersecurity risks. Expanding access to affordable digital devices through government initiatives and private sector partnerships can significantly improve digital payment adoption.

6.7 Financial Literacy

Financial literacy refers to an individual's understanding of financial concepts, banking services, budgeting, and responsible money management. Digital payment adoption depends not only on technological skills but also on consumers' ability to understand financial products and services. Individuals with limited financial literacy may hesitate to use digital banking applications because they are unfamiliar with transaction procedures, account management, digital security practices, or online fraud prevention.

Insufficient awareness regarding digital payment benefits can also contribute to continued reliance on cash transactions. Financial education programs conducted by governments, educational institutions, banks, and non-governmental organizations play a crucial role in improving public understanding of digital financial services. Increasing financial literacy enhances consumer confidence, promotes responsible financial behavior, and supports long-term financial inclusion.

6.8 Merchant Acceptance

Merchant participation is a critical component of any successful digital payment ecosystem. Consumers are more likely to adopt digital payments when merchants widely accept electronic transaction methods. However, many small and medium-sized enterprises continue to rely on cash because of infrastructure costs, limited technical knowledge, and concerns regarding transaction fees.

Some merchants may perceive digital payment systems as complex or expensive to implement, particularly if they require specialized hardware such as Point-of-Sale (POS) terminals. Others may be reluctant to adopt electronic payments because they are unfamiliar with digital accounting systems or fear cybersecurity risks. Encouraging merchant acceptance requires affordable payment technologies, simplified registration procedures, financial incentives, technical training, and reliable customer support. Widespread merchant participation ultimately increases customer confidence and expands the overall digital payment ecosystem.

6.9 Regulatory Challenges

The regulatory environment significantly influences the growth and stability of digital payment systems. Governments and regulatory authorities must develop policies that promote innovation while ensuring financial stability, consumer protection, and cybersecurity. However, rapidly evolving digital technologies often create regulatory challenges because existing financial laws may not adequately address new payment models, digital assets, or cross-border financial transactions.

Differences in regulations across countries can create interoperability issues and complicate international payment services. Compliance requirements related to Know Your Customer (KYC), Anti-Money

Laundering (AML), data privacy, taxation, and cybersecurity may also increase operational complexity for financial institutions and FinTech companies. Excessive regulatory burdens can discourage innovation, while weak regulations may expose consumers to fraud and financial crimes. Therefore, policymakers must establish balanced regulatory frameworks that encourage technological innovation while protecting consumers and maintaining financial system integrity.

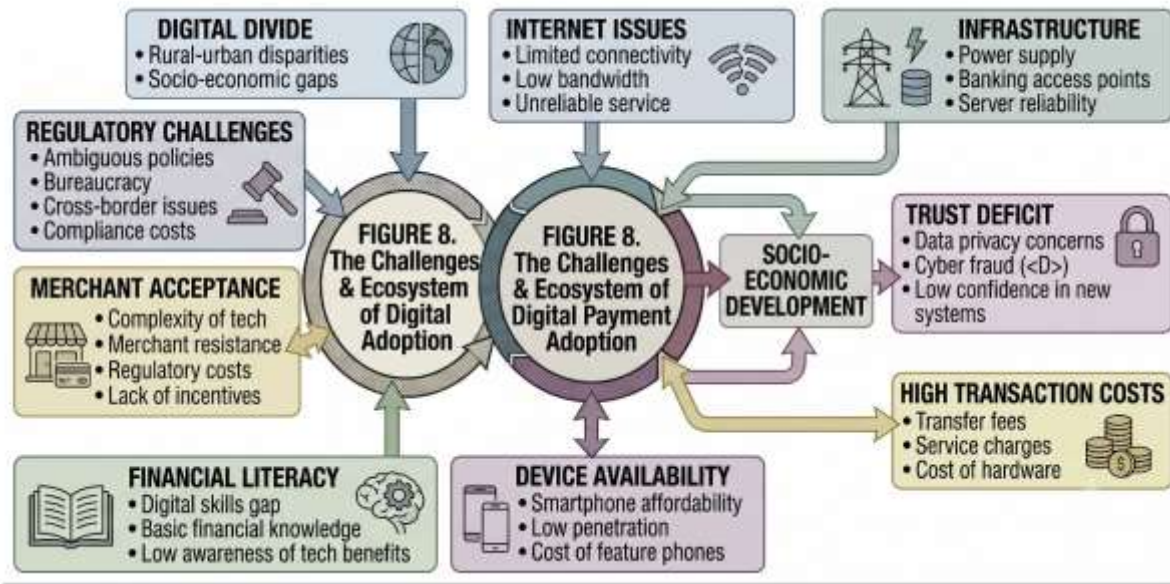


Figure 6. Challenges in Digital Payment Adoption

7. Comparative Analysis of Emerging Economies

Digital payment adoption varies considerably across emerging economies due to differences in technological infrastructure, government policies, financial inclusion, digital literacy, and economic development. While some countries have successfully established advanced digital payment ecosystems, others continue to face challenges related to infrastructure, regulatory frameworks, and public awareness. A comparative analysis of major emerging economies helps identify best practices, common barriers, and successful policy initiatives that can guide future digital payment strategies. This section compares six leading emerging economies India, China, Brazil, Indonesia, Kenya, and Nigeria based on smartphone usage, internet access, government support, financial inclusion, digital payment growth, and existing challenges.

Table 1 Comparative Analysis of Digital Payment Adoption in Emerging Economies

Country	Smartphone Usage	Internet Access	Government Support	Financial Inclusion	Digital Payment Growth	Major Challenges
India	Very High	High	Strong	High	Very Rapid	Cybersecurity, digital literacy, rural connectivity
China	Very High	Very High	Very Strong	Very High	Very Rapid	Data privacy, regulatory concerns
Brazil	High	High	Strong	Moderate to High	Rapid	Regional inequality, cybersecurity

Indonesia	High	Moderate to High	Strong	Improving	Rapid	Geographic diversity, internet coverage
Kenya	Moderate	Moderate	Strong	High	Rapid	Infrastructure, smartphone affordability
Nigeria	Moderate	Moderate	Moderate to Strong	Improving	Moderate to Rapid	Electricity, internet access, fraud

Comparative Analysis Based on Key Parameters

The following parameters provide a comparative overview of digital payment adoption across selected emerging economies.

7.7.1 Smartphone Usage

Smartphone penetration is a primary driver of digital payment adoption. China and India have the largest smartphone user bases, enabling widespread use of mobile banking and digital wallets. Brazil and Indonesia also demonstrate high smartphone adoption, while Kenya and Nigeria continue to experience steady growth due to increasing affordability of mobile devices.

7.7.2 Internet Access

Reliable internet connectivity directly influences the success of digital payment systems. China offers highly developed digital infrastructure with extensive broadband coverage. India, Brazil, and Indonesia have significantly improved internet accessibility over recent years, although rural connectivity gaps remain. Kenya and Nigeria continue expanding mobile internet infrastructure but still experience connectivity challenges in remote regions.

7.7.3 Government Support

Government policies have played a crucial role in promoting digital payment adoption. India has implemented large-scale digital transformation initiatives through Digital India and UPI. China has invested heavily in digital financial infrastructure and innovation. Brazil and Indonesia have introduced supportive financial regulations and real-time payment systems, while Kenya and Nigeria have focused on improving financial inclusion through mobile payment initiatives and cashless economy programs.

7.7.4 Financial Inclusion

Digital payments have significantly improved access to financial services across all six countries. India has expanded banking access through digital identity and financial inclusion programs. Kenya has successfully extended financial services to rural populations through mobile money. Brazil, Indonesia, Nigeria, and China have also improved banking accessibility, although disparities remain among lower-income and geographically isolated communities.

7.7.5 Digital Payment Growth

India currently records one of the highest growth rates in real-time digital payments due to the success of UPI. China continues to lead in transaction volume and mobile payment usage. Brazil has experienced rapid expansion following modernization of its payment infrastructure. Indonesia's digital economy continues to grow rapidly alongside e-commerce development, while Kenya and Nigeria have demonstrated consistent growth through mobile payment innovations.

7.7.6 Challenges

Although digital payment adoption has expanded considerably, several common challenges remain across

emerging economies. These include cybersecurity threats, internet connectivity limitations, digital literacy gaps, infrastructure deficiencies, regulatory complexities, financial fraud, and unequal access to digital technologies. Addressing these challenges requires coordinated efforts among governments, financial institutions, technology providers, and regulatory authorities.

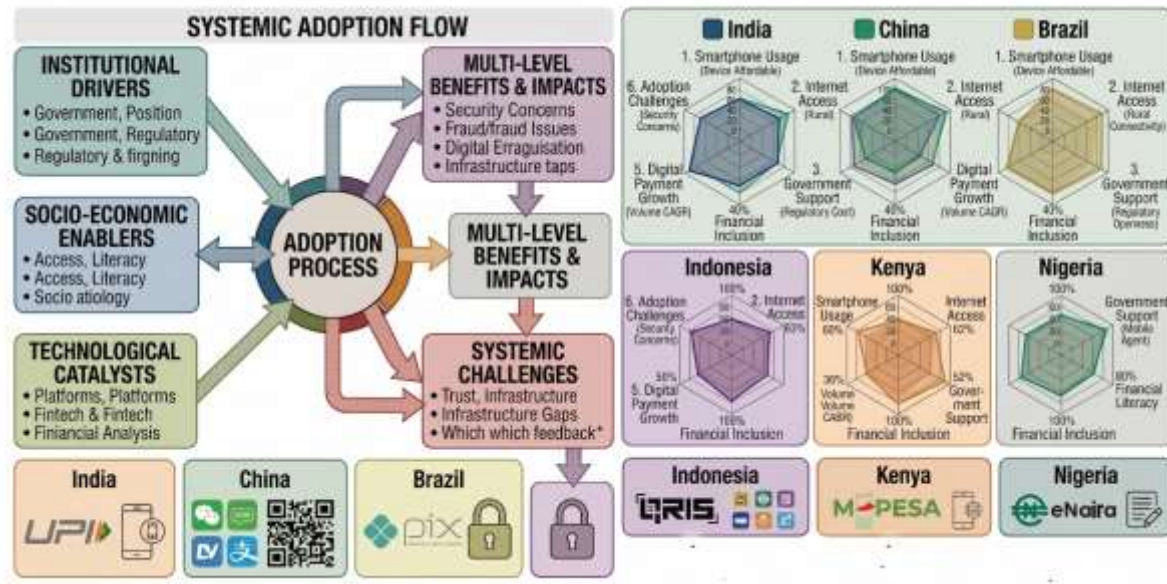


Figure 7. Comparative Analysis of Digital Payment Adoption in Emerging Economies

8. Literature Review

S. No.	Author(s)	Year	Country / Region	Methodology	Dataset Sample /	Key Findings	Limitations
1	Faten Aisyah Ahmad Ramli et al.	2020	Emerging Economies	Systematic Literature Review	Published research articles	Identified major factors affecting e-wallet adoption in emerging economies.	Limited empirical validation. (SLOT GACOR 2026 TERBARU)
2	Muftawu Dzang Alhassan & Martin Butler	2021	Ghana	Conceptual Framework	Mobile payment users	Digital resilience influences continued use after fraud incidents.	Framework requires empirical testing. (arXiv)
3	Jain & Jain	2024	Global	Bibliometric Analysis + SLR (PRISMA)	1,052 publications (57 reviewed)	Identified major research themes and future directions in	Focused on published literature only. (Sage Journals)

						digital payment adoption.	
4	Chauhan & Sharma	2024	Global	Systematic Literature Review	Scopus, WoS, Elsevier, EBSCO	Summarized emerging digital payment technologies and research gaps.	Did not perform empirical analysis. (Sage Journals)
5	Shahen & Sharaf	2025	Global	Systematic Literature Review	Empirical studies on digital payments	Demonstrated the role of digital payments in improving financial inclusion.	Mostly qualitative synthesis. (MDPI)
6	Saida Hajjaji	2026	97 Countries	Logistic Regression + Explainable ML	Global Findex 2025 (5,189 adults)	Connectivity and digital ecosystems strongly influence payment adoption.	Uses secondary survey data only. (IDEAS/RePEc)
7	Mohammad Nasir Uddin	2026	139 Economies	Multilevel Logistic Regression	Global Findex 2021 (143,887 respondents)	Institutional quality significantly affects digital payment adoption.	Limited to Global Findex variables. (SSRN)
8	Emini, Budić & Volarević	2026	Emerging Markets	Structural Equation Modelling (SEM)	500 respondents	Trust, perceived usefulness, and facilitating conditions drive adoption.	Limited sample size. (Hrčak)
9	Authors (MDPI Review)	2026	Global	PRISMA + Bibliometric Analysis	Literature (2020–2025)	COVID-19 accelerated digital payment	Based on secondary literature. (MDPI)

						adoption and financial inclusion.	
10	Joann Jasiak et al.	2023	Canada	Statistical Analysis	Canadian Internet Use Survey	Digital divide significantly affects online banking and digital payment usage.	Focused on one country. (arXiv)

The existing literature demonstrates that digital payment adoption has increased rapidly since 2020 due to advancements in mobile technology, improved internet accessibility, government-led digitalization initiatives, and the expansion of FinTech services. Across different countries, researchers consistently identify perceived usefulness, ease of use, trust, security, financial literacy, smartphone penetration, internet connectivity, and government support as the primary determinants of adoption. Recent studies have increasingly employed advanced analytical techniques such as machine learning, explainable AI, multilevel regression, structural equation modelling, bibliometric analysis, and systematic literature reviews to better understand user behaviour and adoption patterns. Despite substantial progress, important research gaps remain in areas such as cybersecurity, cross-country comparative analysis, interoperability, rural digital inclusion, and the integration of emerging technologies including blockchain, artificial intelligence, and central bank digital currencies

9 Research Gap Summary

The existing body of literature demonstrates substantial progress in understanding digital payment adoption; however, several important research gaps remain that require further investigation. Most studies focus on individual countries or specific digital payment technologies, resulting in limited cross-country comparative analyses that can provide broader insights into adoption patterns across emerging economies. In addition, the majority of existing research is based on cross-sectional data, offering only a snapshot of user behavior without examining how digital payment adoption evolves over time.

There is also a need for more studies focusing on rural and underserved communities, where inadequate digital infrastructure, limited internet connectivity, low smartphone penetration, and insufficient digital literacy continue to hinder financial inclusion. Furthermore, although technologies such as Artificial Intelligence (AI), Blockchain, the Internet of Things (IoT), Big Data Analytics, and cloud computing have individually demonstrated significant potential, limited research has explored their integrated application in developing intelligent, secure, and scalable digital payment ecosystems.

Cybersecurity and data privacy remain critical concerns as digital transactions continue to increase, highlighting the need for advanced fraud detection mechanisms, privacy-preserving technologies, and stronger authentication methods. Existing literature also provides limited understanding of how consumer trust develops over time and how behavioral, psychological, and cultural factors influence long-term adoption of digital payment systems. Financial literacy remains another underexplored area, particularly

regarding the effectiveness of digital education programs in increasing awareness and encouraging responsible use of digital financial services.

Moreover, rapidly evolving payment technologies have created new regulatory challenges, requiring adaptive legal frameworks that balance innovation with consumer protection and financial stability. Research examining the adoption of digital payment systems among small and medium-sized enterprises (SMEs) is also relatively limited, despite their significant contribution to national economies. Finally, environmental sustainability has received comparatively little attention, creating opportunities for future studies on energy-efficient payment infrastructures, sustainable cloud computing, and environmentally friendly blockchain technologies.

Addressing these research gaps will contribute to the development of secure, inclusive, resilient, and intelligent digital payment ecosystems that support long-term economic growth, technological innovation, and financial inclusion across emerging economies.

10. Future Research Directions

The rapid evolution of digital payment technologies presents numerous opportunities for future research. As emerging economies continue to embrace digital financial services, researchers, policymakers, financial institutions, and technology providers must address existing limitations while exploring innovative solutions that enhance security, efficiency, accessibility, and sustainability. Advances in artificial intelligence, blockchain, cloud computing, and communication technologies are expected to redefine the future of digital payment ecosystems. The following research directions represent some of the most promising areas for future investigation.

10.1 AI-Driven Payment Systems

Artificial Intelligence (AI) is expected to play a transformative role in the future of digital payments by enabling intelligent automation, predictive analytics, and personalized financial services. Future research should investigate AI-powered fraud detection systems capable of identifying suspicious transactions in real time with higher accuracy and lower false-positive rates. Researchers can also explore AI-based customer support through intelligent virtual assistants, personalized financial recommendations, automated credit assessment, and dynamic risk management. In addition, explainable AI models should be developed to improve transparency, accountability, and user trust in automated financial decision-making systems.

10.2 Central Bank Digital Currencies (CBDCs)

Central Bank Digital Currencies (CBDCs) have emerged as one of the most significant innovations in modern financial systems. Unlike cryptocurrencies, CBDCs are issued and regulated by central banks, providing the advantages of digital transactions while maintaining monetary stability. Future research should focus on the design, implementation, scalability, interoperability, and security of CBDCs. Researchers should also investigate their impact on financial inclusion, commercial banking, monetary policy, cross-border transactions, and consumer adoption across both developed and emerging economies.

10.3 Blockchain-Based Payment Ecosystems

Blockchain technology offers decentralized, transparent, and highly secure payment processing without relying on traditional financial intermediaries. Future studies should investigate scalable blockchain architectures capable of supporting large transaction volumes while minimizing energy consumption and transaction latency. Research should also focus on smart contracts, decentralized finance (DeFi), blockchain interoperability, regulatory compliance, and integration with existing banking systems. Such

advancements can improve transparency, reduce transaction costs, and strengthen global payment infrastructures.

10.4 Quantum-Resistant Cryptography

The emergence of quantum computing presents potential risks to current cryptographic algorithms that protect digital payment systems. Powerful quantum computers could eventually compromise existing encryption standards, threatening financial security and data privacy. Future research should focus on developing quantum-resistant cryptographic algorithms, secure key management techniques, and migration strategies that protect digital payment infrastructures against future quantum attacks. Preparing financial systems for the post-quantum era is becoming increasingly important.

10.5 Offline Digital Payments

Internet connectivity remains limited in many rural and remote regions, creating barriers to digital payment adoption. Future research should investigate secure offline digital payment mechanisms that allow financial transactions to be completed without continuous internet access. Technologies such as Near Field Communication (NFC), Bluetooth Low Energy (BLE), secure hardware modules, and delayed transaction synchronization can enable reliable offline payment systems. These innovations will significantly improve financial inclusion in underserved communities.

10.6 Voice-Enabled Payments

Voice recognition technology has created opportunities for hands-free digital financial transactions. Future research should examine secure voice-enabled payment systems that allow users to authorize financial transactions through smartphones, smart speakers, and virtual assistants. Researchers should address issues related to speaker authentication, multilingual speech recognition, privacy protection, and resistance to voice spoofing attacks. Voice-enabled payment technologies can also improve accessibility for elderly users and individuals with physical disabilities.

10.7 Wearable Payment Technologies

Wearable devices such as smartwatches, fitness bands, smart rings, and connected accessories are increasingly supporting contactless financial transactions. Future research should investigate secure authentication mechanisms, biometric verification, energy-efficient communication protocols, and interoperability between wearable devices and banking systems. Studies should also evaluate user acceptance, usability, privacy concerns, and healthcare-related payment applications supported by wearable technologies.

10.8 Cross-Border Instant Payments

Global trade and international financial transactions require payment systems that are faster, less expensive, and more secure. Current cross-border payment methods often involve multiple intermediaries, increasing processing time and transaction costs. Future research should investigate interoperable payment infrastructures capable of supporting real-time international fund transfers across different banking systems and currencies. Blockchain technology, standardized payment protocols, digital identity verification, and international regulatory cooperation are expected to play important roles in achieving efficient cross-border payment systems.

10.9 Green and Sustainable Payment Infrastructure

As digital payment transactions continue to increase, the environmental impact of supporting technologies such as cloud computing, blockchain networks, and data centers has become an important research concern. Future studies should investigate environmentally sustainable digital payment infrastructures that minimize energy consumption while maintaining high levels of security and performance. Research

opportunities include energy-efficient blockchain consensus mechanisms, renewable energy-powered data centers, sustainable cloud computing architectures, and environmentally friendly financial technologies. Green digital payment systems will contribute to both technological advancement and global sustainability goals.

11. Conclusion

Digital payment systems have become one of the most significant innovations in the global financial sector, transforming the way individuals, businesses, and governments conduct financial transactions. The transition from traditional cash-based economies to digitally enabled financial ecosystems has been driven by rapid technological advancements, increasing internet accessibility, widespread smartphone adoption, supportive government policies, and continuous innovation within the Financial Technology (FinTech) industry. Emerging economies have witnessed remarkable growth in digital payment adoption due to the expansion of mobile banking, digital wallets, QR code payments, contactless payment technologies, and real-time payment platforms. These developments have not only improved transaction efficiency and convenience but have also played a vital role in promoting financial inclusion and accelerating digital economic growth.

This survey paper presented a comprehensive review of digital payment adoption in emerging economies by examining the evolution of digital payment systems, major payment methods, underlying technologies, drivers of adoption, implementation challenges, and comparative developments across selected countries, including India, China, Brazil, Indonesia, Kenya, and Nigeria. The review demonstrated that technological innovations such as cloud computing, artificial intelligence, machine learning, blockchain, big data analytics, biometric authentication, Near Field Communication (NFC), and tokenization have significantly enhanced the efficiency, scalability, and security of modern payment infrastructures. These technologies continue to reshape financial services by enabling faster transactions, intelligent fraud detection, personalized customer experiences, and secure digital authentication mechanisms.

The study also highlighted several important factors driving digital payment adoption, including increasing smartphone penetration, improved internet connectivity, government initiatives promoting cashless economies, enhanced digital literacy, growing merchant participation, and attractive business incentives such as cashback and reward programs. Collectively, these drivers have encouraged millions of consumers and businesses to transition from traditional payment methods to digital financial services. At the same time, the survey identified persistent challenges that continue to hinder widespread adoption, including the digital divide, inadequate technological infrastructure, unreliable internet connectivity, cybersecurity threats, consumer trust issues, financial literacy gaps, regulatory complexities, and limited merchant acceptance in certain regions. Addressing these barriers remains essential for ensuring equitable access to digital financial services across diverse populations.

The comparative analysis of emerging economies revealed that although countries differ in technological maturity, regulatory environments, and financial inclusion levels, they share common objectives of expanding digital financial services and reducing dependence on cash. Successful initiatives implemented in different countries provide valuable lessons that can assist policymakers and financial institutions in developing more inclusive, secure, and interoperable payment ecosystems. Furthermore, the literature review demonstrated that while considerable research has been conducted on digital payment adoption, important gaps remain in areas such as cross-country comparative studies, long-term adoption behavior,

cybersecurity, privacy protection, rural financial inclusion, sustainable payment infrastructure, and the integration of emerging technologies.

Based on these identified research gaps, the paper proposed several future research directions, including Artificial Intelligence-driven payment systems, Central Bank Digital Currencies (CBDCs), blockchain-based payment ecosystems, quantum-resistant cryptographic techniques, offline digital payment solutions, voice-enabled transactions, wearable payment technologies, cross-border instant payment networks, and environmentally sustainable digital payment infrastructures. These emerging technologies have the potential to redefine the future of digital financial services by improving transaction security, operational efficiency, accessibility, interoperability, and environmental sustainability.

In conclusion, digital payment systems will continue to serve as a fundamental pillar of digital transformation and economic development in emerging economies. Their successful implementation requires strong collaboration among governments, financial institutions, technology providers, regulatory authorities, businesses, and consumers to establish secure, reliable, and inclusive financial ecosystems. Continued investment in digital infrastructure, cybersecurity, financial literacy, technological innovation, and supportive regulatory frameworks will be essential for maximizing the benefits of digital payments while minimizing associated risks. It is expected that future advancements in intelligent financial technologies and secure digital infrastructures will further accelerate the transition toward globally connected, resilient, and inclusive cashless economies, ultimately contributing to sustainable economic growth and improved quality of life.

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