Review of Trends and Challenges in Digital Payment Systems

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Abstract

The development of digital payment systems has revolutionized the process of conducting business in terms of technological advancements and changing consumer behavior. This literature review focuses on new trends such as mobile wallets, contactless payments, real-time processing, embedded finance, biometric authentication, and Central Bank Digital Currency (CBDC). Moreover, other emerging trends include the impact of Artificial Intelligence on personalized services and the application of Blockchain technology in digital payment systems. Other topics discussed in the paper include cybersecurity, the demand for interoperability, costly transaction costs, regulation, financial inclusion, and fraud. An analysis of both global and regional perspectives on digital payment systems, especially concerning countries such as India with payment platforms such as the Unified Payment Interface (UPI), has been included with regard to the influence of COVID-19 on digital payments.

Keywords: Digital Payments, Mobile Wallets, Contactless Payments, Cybersecurity, Interoperability, UPI, Blockchain, Financial Inclusion, Real-Time Payments, Regulatory Challenges.

1. Introduction

Digital payment systems have become an important component of the modern financial ecosystem, transforming the way individuals, businesses, and institutions conduct financial transactions. The increasing availability of smartphones, internet connectivity, mobile banking applications, digital wallets, and real-time payment platforms has accelerated the transition

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from cash-based transactions to electronic payment methods. These systems offer several advantages, including transaction convenience, faster fund transfers, improved accessibility, and greater efficiency in financial operations. Consequently, digital payments have attracted considerable attention from researchers, financial institutions, technology providers, and policymakers [5, 6, 12].

The development of digital payment systems has also created opportunities for financial inclusion and economic participation. Mobile payment applications and interoperable payment infrastructure have provided users with the ability to transact independently of traditional bank services. The Unified Payments Interface (UPI) is one of the biggest components of the digital payment infrastructure in India, where it provides account-to-account transfers and merchant payments using interoperable apps and QR code-based interfaces. As per the Annual Report 2024-25 of the Reserve Bank of India, the number of UPI transactions has risen from around 8,371.44 crore transactions in FY 2022-23 to 18,586.60 crore transactions in FY 2024-25. At the same time, the corresponding amount of these transactions rose from ₹139.1 lakh crore to ₹260.6 lakh crore [10].

However, despite these improvements, a number of issues related to technology, operation, economics and regulation. Cyber threats, phishing scams, fraud, identity theft, confidentiality issues, and service disruptions can jeopardize the security of electronic payment systems. In addition, varying degrees of digital literacy, internet access, device ownership, and financial knowledge can limit the ability of some populations to participate effectively [8, 11, 13]. The presence of digital payment facilities does not automatically guarantee that users are aware of security considerations, transaction procedures, and methods for addressing payment failures and financial conflicts. Thus, user trust can be maintained through a combination of technological security, consumer protection, accessibility, and conflict resolution [7, 14].

Factors that have been analyzed in the context of research on digital payment adoption include perceived usefulness, ease of use, trust, perceived risk, social influence, facilitating conditions, and user experience. The systematic reviews mention these as some of the important factors to be considered in the context of digital payment adoption literature, while emphasizing the importance of studying differences in various contexts and among different users [5, 6]. Emerging technologies such as artificial intelligence, big-data analytics, biometric authentication, and behavioral analysis can provide ways to enhance fraud detection and

improve payment security [13]. However, their success is dependent upon appropriate implementation and evaluation, along with proper data protection from future risks.

Whereas digital payment system usage has been the subject of much scholarly research, the constant developments associated with this innovation necessitate the analysis of technology development, user behavior, cybersecurity issues, financial inclusion, governance, and reliability of operations. High transaction volumes in themselves cannot serve as a measure of payment system performance because of the need to consider transaction success, vulnerability to fraud, availability of services, consumer protection, and accessibility issues. Indeed, existing economic research stresses the importance of considering the impact of digital payments on the activities of individuals, companies, financial institutions, and the government [12].

This paper evaluates the various trends and issues related to digital payment systems based on research literature, payment system statistics, and Global Findex data. This paper will cover the main forms of digital payments, factors affecting adoption, developments of payment systems in India, financial inclusion, cybersecurity and privacy threats, grievance redressal, and regulation. Furthermore, the strengths and weaknesses of studies related to this topic have been evaluated, and future research directions have been recommended.

1.1 Background of Digital Payment Systems

Shisode [18] gives a comprehensive overview of digital payment systems, especially in India. The authors explain that digital payments refer to electronic payment systems that do not involve any form of physical exchange of currency. The importance of technology like smartphones, the internet, and banks is explained in the context of digital payment systems.

Bandura [17] provides their views on digital payment systems from a global perspective. Digital payment systems are seen as a method for creating a digitally inclusive finance system. The study explains the importance of digital payment systems as a tool for financial inclusion and their importance to developing countries.

1.2 Objectives of the Review

The key objective of this review is to examine the current trends and problems with respect to digital payment systems. The major objective of this research paper is to integrate available information in order to understand the developments and problems in this technology.

The other objective of this review paper is to recognize the research gaps in this domain and propose areas for future research. The development of digital economy involves a shift in perspective from a social to a technological point of view, which can be clearly seen in recent research. Gohil [24] provides a multi-disciplinary foundation for examining behavioral and regulatory issues related to digitalization and their implications for consumer trust through e-WOM, digital taxation, and peer-to-peer lending.

1.3 Review Approach and Analytical Scope

Reserve Bank of India (RBI) Annual Report 2024-25 and World Bank Global Findex 2025 workbook. The literature includes technology adoption models, consumer trust and grievances redressal, financial inclusion, regulations, cybersecurity, and research mapping. The RBI report has been used for current indicators of Indian payment systems, current indicators, while the Global Findex workbook provides insights into digital payment usage by adults and their payment activity choices.

2. Digital Payment Ecosystem and Transaction Modes

A digital payment system represents the transmission of financial value through digital means without the need for physical exchange of cash. These systems consist of customers, merchants, banks, non-bank payment institutions, payment aggregators, card schemes, account-to-account transfers, telecom and internet, and regulations. Various types of digital payment systems have been discussed in the given literature: account-to- transfers, mobile payments, digital wallets, debit/credit cards, internet banking, POS terminals, QR codes, biometric payments, and online merchant payments [1, 6-9, 11, 13, 14].

These various modes differ in their means of payment, mode of settlement, interface, and acceptance network, as depicted in Table 1. UPI stands for the Indian account-based interoperable payment interface; wallets can carry stored value or give access to a linked means of funding; card payments depend on card networks and acceptance devices; NEFT and RTGS enable bank transfers based on their different purposes; and finally, Aadhaar enabled payment systems facilitate particular banking payments in assisted mode. A single customer may use several modes of payment, hence making system development a process that is not a replacement but rather an expansion.

Table 1. Comparison of major digital payment modes [1, 6–9, 11, 13, 14].

Mode	Typical use	Strengths	Key limitations / risks
UPI / account-to-account mobile payments	Person-to-person transfers, merchant QR payments, bills	Fast transfers, broad app choice, low-friction acceptance	Social engineering, mistaken transfers, outages, dependence on phone/network
Mobile wallets / prepaid instruments	App-based retail payments and selected transfers	Convenient interface; can support stored value and promotions	Provider dependence, wallet-specific rules, account takeover and privacy concerns
Debit / credit cards and POS	In-store and online purchases	Established acceptance and dispute processes; credit functionality for eligible users	Card-not-present fraud, skimming, data compromise, merchant acceptance costs
Internet / mobile banking, NEFT and RTGS	Bank transfers, bills, higher-value or scheduled payments	Direct bank channel; suitable for a range of transfer needs	Credential theft, phishing, interface complexity, bank/system availability
AePS / assisted biometric channels	Basic banking and cash-in/cash-out services through agents	Can extend access to users with limited branch access	Biometric/agent risks, authentication failures, connectivity and oversight issues
Online merchant gateways	E-commerce and digital service purchases	Supports remote commerce and integrated checkout	Merchant fraud, data exposure, chargeback disputes and cross-border compliance

3. Recent Trends in Digital Payments in India

According to the RBI Annual Report 2024–25, India continued its growth in payment and settlement systems. The total transaction volume across all payment and settlement systems was 34.8% in 2024–25, following a 44% growth in the previous year. As far as retail payments are concerned, transaction volume and value grew by 41.7% and 30.3%, respectively, in 2024–

25. UPI's share of the total retail payment volume is 84%. As of March 31, 2025, there were 65.8 crore UPI QR codes and approximately 1.1 crore POS terminals [10].

Table 2 presents RBI-provided UPI volumes for three financial years. The transaction volume, presented in lakh in the source, has been converted to crore by dividing 100. Figures are presented in ₹ lakh crore.

Table 2. UPI transaction volume and value, FY 2022–23 to FY 2024–25

Financial year	Transaction volume (crore; converted from RBI lakh)	Transaction value (₹ lakh crore)
2022–23	8,371.44	139.1
2023–24	13,112.95	200.0
2024–25	18,586.60	260.6

Source: RBI Annual Report 2024–25, Table 2. Conversion: 100 lakh transactions = 1 crore transactions. [10]

4. Adoption Drivers: Usefulness, Effort, Trust and Social Context

Convenience alone is never enough to predict continued usage, according to adoption literature. A UTAUT study conducted in Oman involving 436 people found performance expectancy to be the best predictor of intention to use mobile payments, followed by social influence, effort expectancy, trust, cost, and self-efficacy; perceived risk did not have any statistical significance in this particular study [1]. Another study in India involving 491 consumers also found performance expectancy and grievance redressal to be positive predictors of usage behavior, with attitude, social influence, and facilitating conditions predicting intention to use [7]. These results must be taken within their specific contexts and not as universal.

In a recent study carried out in North India, positive associations were discovered between effort expectancy, performance expectancy, and grievance redressal, and the use behaviour of the participants. However, trust did not show any significant direct relation to use behaviour, but showed a relationship to other variables and being moderated by the experience of cybercrime and perception of cybersecurity risk [4]. From these studies, it can be observed that usefulness, usability, infrastructure, user confidence and support systems are all interrelated.

Social influence may affect awareness and willingness to try new payment methods, particularly where merchants, family members or peers demonstrate how to use them. The supplied social-network review discusses influential nodes and information diffusion in online networks [3]. This source is not a digital-payment adoption study, so it is best treated as indirect conceptual background rather than direct evidence of payment behaviour.

5. Financial Inclusion and Unequal Access

Electronic payment systems have the potential to minimize transaction costs arising from the spatial and temporal constraints of accessing financial services and to facilitate transactions. Cross-country research using 2021 Global Findex data indicated a positive association between formal financial inclusion, education, labor market participation, income, mobile phone ownership, and internet connectivity with the adoption of electronic payments during the coronavirus pandemic. However, the relationships varied by country and consumption context [11]. The economic literature further recognizes the importance of heterogeneity in effects across households, firms, financial institutions, and governments [12].

Data for the Global Findex 2025 Workbook for selected indicators in India in 2017, 2021, and 2024 are provided in the attached file. With regard to the “all adults India” row, the percentage of those reporting that they had made or received a digital payment grew from approximately 28.7% in 2017 to 34.9% in 2021 and to 48.5% in 2024. The percentage of those using a phone or the internet to make bill payments grew from 2.7% in 2017 to 9.9% in 2021 and to 15.2% in 2024. Indicators for online purchases via a phone or the internet were not provided for 2017; they are 8.3% for 2021 and 16.2% for 2024.

While the measures do demonstrate positive changes, improvement in the aggregate does not necessarily mean that gaps are closed. Access may remain limited due to restrictions on connectivity, equipment ownership, computer skills, languages, disability access, documentation, affordability, and gender and income disparities. Therefore, adoption programs need to assess who is not using the technology and why rather than just looking at overall transaction numbers.

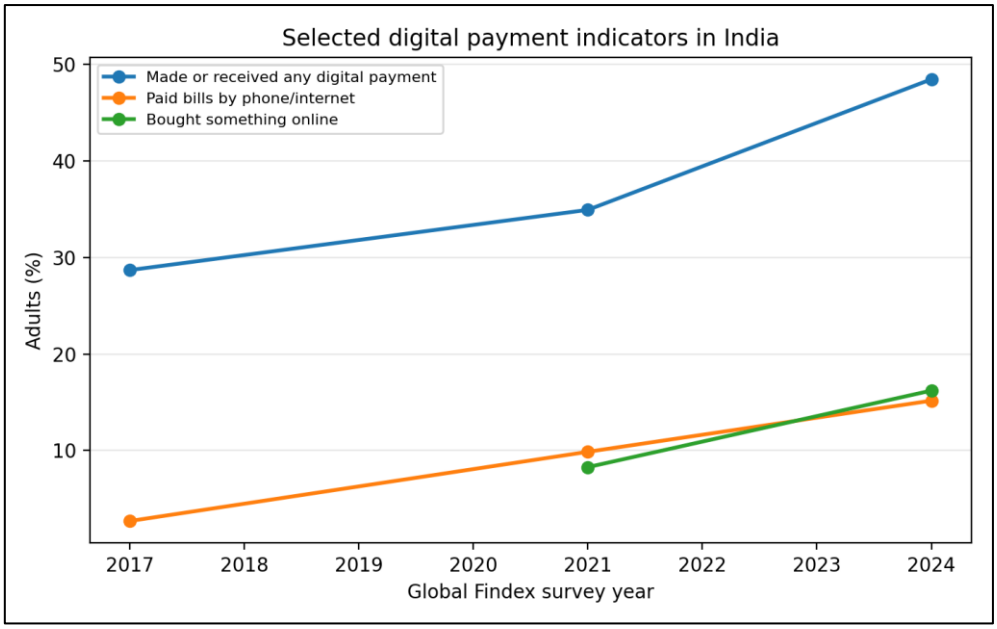


Figure 1. Selected global findex indicators for india, 2017, 2021 and 2024. Percentages are calculated from the supplied workbook's all-adult India row; unavailable values are omitted rather than treated as zero [10].

6. Cybersecurity, Fraud and Privacy Challenges

The risks associated with digital payments can be security risks in terms of devices, applications, credentials, networks, merchant systems, and end-user decisions. According to the provided policy review, cybersecurity risks, fraud, identity theft, data breaches, interoperability issues, and regulatory complications are among the challenges that persist in the growing digital payments industry [8]. The paper on Indian cybersecurity highlights the areas of artificial intelligence-assisted fraud detection, behavioral and biometric authentication, big data analytics, zero trust and social engineering [13]. The technology claims made in the paper should be taken as suggestions.

Multiple layers of controls should be used for detecting fraud. Possible controls include risk-based authentication, detection of device and transaction anomalies, limits on payment velocity, payee validation, secure management of credentials, surveillance of mule accounts, notifications, red team testing, and incident response procedures. Machine learning algorithms used for fraud detection might detect anomalies that rule-based approaches miss but they may also generate false positives, fail to evolve in line with new fraud patterns, or be biased against real customers due to biased training sets.

Equally important is privacy, payment information may provide patterns in relation to locations, purchasing habits, social networks and lifestyle. Collection should be conducted for justifiable purposes, access should be restricted, storage periods should be specified, and users should be informed in an understandable way regarding data sharing. Security measures should be proportional and accessible: two-factor authentication should not automatically deny access to users with old devices and limited internet connection.

Table 3. Major challenges and practical responses [2, 7, 8, 11, 13, 14].

Challenge	Possible Consequences	Response Priorities
Phishing, fake QR codes and social engineering	Unauthorised transfers, account compromise, loss of confidence	In-app warnings, payee verification, clear reporting routes, recurring awareness campaigns
Account takeover and credential theft	Fraudulent payments and identity misuse	Risk-based authentication, device binding, secure recovery and anomaly monitoring
System outages and network instability	Failed or delayed transactions; merchant disruption	Resilience testing, redundancy, transparent status messages and reliable reconciliation
Privacy and data misuse	Profiling, exposure of sensitive transaction histories	Data minimisation, access controls, purpose limitation and auditable governance
Low digital literacy and accessibility barriers	Exclusion, dependence on intermediaries, errors	Local-language design, accessible interfaces, assisted support and practical training
Slow or unclear grievance handling	Unresolved losses and reduced trust	Case tracking, defined service levels, escalation routes and transparent outcomes
Interoperability and fragmented rules	User friction, inconsistent experiences, higher integration costs	Common standards, consistent dispute procedures and cross-provider coordination
Regulatory gaps and cross-border complexity	Unclear liability, compliance burdens and consumer harm	Technology-neutral rules, supervisory coordination and clear liability frameworks

7. Grievance Redressal, Liability and Legal Governance

A successful payment system must not only entail the successful processing of transactions but also provide its users with a clear way to resolve cases of failed transactions, duplicated debits, unauthorized transactions, and disputes between customers and merchants. The Indian literature provided clearly shows low knowledge about formal complaints and stresses the importance of educating consumers about the complaint lodging process, transparency in this process, and digital literacy [14]. Mobile payment adoption in India is also noted to be positively influenced by grievance redressal [7], while a study conducted in North India found a positive relationship between grievance redressal and use behavior [4].

Authorization of payment systems, consumer protection, information processing, reaction to cybercrime, and responsibility distribution between banks, payment systems, merchants, and consumers are all influenced by legal and regulatory regimes. A comparative study of electronic payment systems' legislation asserts that legal norms can originate from different branches of law – civil and commercial law, financial regulation, criminal law and personal data protection [2]. In regard to users, the process should include indications on reporting problems, collecting and keeping evidence, response times, money returns, and further complaint escalation.

According to the RBI Annual Report 2024-25, focus has been placed on cyber resilience, secure payment systems, fraud prevention, consumer awareness and the globalization of the UPI and RuPay payment systems [10]. While globalization may enhance convenience, it also poses problems such as cross-border settlements, currency conversions, dispute resolution, and legal issues. It is thus important for interoperability to encompass both connectivity and safeguards.

8. Comparative Synthesis of the Supplied Evidence

The studies address different research questions and use different methods. Table 4 summarizes their contributions and limitations for the present article.

Table 4. Contributions and limitations of the review

Approach	Contribution Relevant to this Article	Interpretation / Limitation
Extended UTAUT meta-analysis and Oman survey [1]	Performance expectancy, social influence, effort expectancy, trust, cost and self-efficacy are relevant adoption constructs	Sample and national context limit generalization
Indian Meta-UTAUT study [7]	Links use behaviour with performance expectancy and grievance redressal	Study-specific model and sample; intention and actual use should be distinguished
Systematic review using ADO framework [5]	Maps adoption antecedents, decisions and outcomes; highlights usefulness, ease, trust and risk	Literature synthesis rather than new causal evidence
Bibliometric review of 346 papers [6]	Identifies research growth and prominent themes such as mobile payments and electronic money	Bibliometric counts indicate scholarly attention, not effectiveness of a payment system
Emerging-economy policy review [8]	Connects adoption with infrastructure, risk mitigation and regulation	Broad policy synthesis; local implementation conditions differ
Financial-inclusion analysis across 123 economies [11]	Shows association between financial inclusion, connectivity and payment uptake during COVID-19	Cross-sectional and crisis-period evidence; associations are not necessarily causal
RBI Annual Report 2024–25 [10]	Provides current Indian system volumes, values and acceptance infrastructure	Administrative/system totals; not a direct measure of individual adoption or trust
Global Findex 2025 workbook [15]	Provides India adult-level indicators across 2017, 2021 and 2024	Survey-based self-report; indicators and sample coverage vary by year
Cybersecurity and grievance literature [4, 13, 14]	Highlights cybersecurity risk, trust, complaint handling and awareness	Some supplied claims need stronger empirical validation before being treated as established effects
Social-network influence review [3]	Provides background on influence and information diffusion	Indirect relevance; not a digital-payment-specific study

9. Emerging Trends and Research Directions

A number of trends requires further scrutiny. First, while the use of AI-driven fraud analysis can be useful to detect anomalous payment patterns, assessments must rely on temporally disjointed datasets and account for false positive cost, explainability, drift and performance against well-established baselines. Second, biometric and behavioral identification may improve the identification process, but studies must consider spoofing resilience, privacy consequences, accessibility and remediation options. Third, interoperable and cross-border payment mechanisms offer the chance of faster payments, which raises the need for harmonized standards, consumer liability regulations and dispute resolution mechanisms [2, 8, 10, 13].

Fourth, digital public infrastructure and payment facilitation systems may serve customers poorly served by traditional banking, but inclusion needs to be measured based on use, performance, cost and benefits for consumers. Fifth, the adoption literature requires longitudinal studies differentiating between trial, repeat use and dropout of systems, rural-urban comparisons, and breakdowns by age, gender, income and digital skill level [1, 4, 5, 7, 11, 12]. Sixth, future research needs to bridge statistics at the system level and statistics at the user level (e.g., how often users face failed payments, fraud, time to resolution, perceived fairness and merchant costs).

2.3 Research Gaps

In spite of the rapid development and widespread application of digital payments, it is quite clear that there are major gaps in the current state of literature. The research mostly concentrates on particular kinds of digital payments (mobile wallets, credit cards, cryptocurrencies), providing no general overview of this system. In addition, although important aspects of the problem (security issues, privacy concerns, lack of trust, regulation difficulties) are often addressed, no comparative analysis is provided.

Table 5. Research gaps and future directions

Ref.	Dimension	Existing Focus in Literature	Identified Research Gap	Future Research Direction
[1, 5, 7]	User adoption and behaviour	Studies examine perceived usefulness, ease of use, trust, perceived	The combined influence of behavioural, technological, and	Develop and validate integrated adoption models across different

		risk, and facilitating conditions influencing digital payment adoption.	contextual factors requires further investigation across diverse user groups.	demographic groups and geographical settings.
[5, 6, 12]	Research synthesis and theoretical development	Reviews and bibliometric studies identify major themes, publication trends, and theoretical approaches in digital payment research.	The relationship between adoption research, economic outcomes, security, and regulatory developments is not fully integrated.	Conduct updated interdisciplinary reviews connecting technology adoption, economic effects, security, and governance.
[8, 10, 13]	Cybersecurity and fraud prevention	Existing studies discuss cybersecurity threats, user trust, fraud risks, and emerging security technologies.	Comparative empirical evidence on fraud detection effectiveness, evolving attack patterns, and security trade-offs remains important.	Evaluate AI-based fraud detection using real-world or appropriately anonymised transaction data, with attention to false positives and detection latency.
[2, 10, 14]	Regulation and consumer protection	Research examines legal frameworks, payment-system governance, security requirements, and grievance redressal.	The effectiveness and consistency of complaint resolution, liability allocation, and consumer protection across payment channels require further assessment.	Compare dispute-resolution outcomes, complaint-handling time, refund delays, and consumer protection practices across payment systems.
[11, 12]	Financial inclusion	Studies investigate the relationship between digital payments, financial access, and participation in the formal financial ecosystem.	Increased payment usage does not necessarily establish equitable access or sustained financial benefits for underserved groups.	Examine differences in adoption, usage continuity, affordability, and financial outcomes among rural, low-income, elderly, and digitally inexperienced users.
[7, 8, 14]	Trust, perceived risk, and grievance redressal	Literature considers trust, fraud concerns, service quality, and support mechanisms as factors influencing	The relationship between users' trust, actual security incidents, and satisfaction with grievance redressal	Conduct longitudinal and cross-sectional studies linking user perceptions with documented service and complaint-resolution outcomes.

		adoption and continued use.	needs stronger longitudinal evidence.	
[10, 12, 13]	Operational reliability and scalability	Research and official reports document digital payment expansion and technological development.	High transaction volume alone does not establish reliability during peak demand, outages, failed transactions, or infrastructure disruptions.	Evaluate transaction success rates, system availability, latency, recovery time, and performance under peak-load conditions.
[2, 8, 13]	Emerging technologies and privacy	Studies discuss AI, big-data analytics, biometric authentication, and other technological developments in digital payments.	The balance between security improvements, privacy protection, data governance, and implementation costs requires further evaluation.	Compare emerging security technologies using measurable performance, privacy, fairness, cost, and regulatory-compliance indicators.
[10, 11, 12]	Economic and social impact	Literature explores financial inclusion, payment-system growth, and the broader economic implications of digital payments.	The long-term effects on transaction costs, small-business performance, consumer welfare, and cash dependence are not fully established across contexts.	Use longitudinal, comparative, and quasi-experimental designs where feasible to assess economic and social outcomes.
[5, 6, 12]	Evaluation methodology and reproducibility	Reviews synthesize adoption factors, theoretical frameworks, and research trends using different analytical approaches.	Differences in datasets, indicators, sampling methods, and evaluation protocols can limit comparability between studies.	Establish transparent reporting standards, reproducible evaluation protocols, and common indicators for adoption, security, reliability, and inclusion.

Contextual studies, especially in developing countries where socio-economic differences, digital literacy, and infrastructure problems play an important role in the adoption process. Besides, novel technologies like artificial intelligence, blockchain, and central bank digital currencies have not been researched in detail when it comes to scalability,

interoperability, and other practical issues. The problem of interoperability and smooth interaction of different payment systems still requires detailed attention.

In addition, user behavior and dynamics of trust have not received much attention, and there has been a paucity of longitudinal and empirical research that investigates the psychological and socio-cultural factors influencing adoption. While digital payments are considered to enhance financial inclusion, there has been a paucity of empirical research examining the socio-economic impacts of digital payments over a longer period, particularly for marginalized communities. Another important gap pertains to the absence of any framework for evaluating system performance, security, and sustainability, which limits the comparability between different research studies on the topic. The issue of regulations and policies needs further exploration, especially as it pertains to emerging FinTech technologies and digital payment systems.

10. Conclusion

Digital payment systems experienced a great number of changes because of innovations and evolving user needs, which resulted in the creation of a new global financial system. This review deals with innovations in mobile wallets, contactless payments, instant payment systems, embedded finance, biometrics, and Central Bank Digital Currencies and their influence on the financial system and transactions. Besides, the successful operation of platforms like the Unified Payments Interface demonstrates the effectiveness of scalable and inclusive digital infrastructure for adoption and usage, including in developing countries. Despite certain achievements in this field, some issues should still be solved to ensure sustainable development. In addition, financial inclusion is not consistent enough, as people who belong to disadvantaged groups face difficulties due to a lack of digital literacy and poor digital infrastructure.

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