

Evolution of Payment Systems in the Digital Era: A Comprehensive Analysis of Mobile Payments, Contactless Technology and the Disruptive Potential of Cryptocurrencies on Traditional Payment Systems

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ABSTRACT

Payment systems have seen a rapid change in the digital age, transforming how people and organizations perform financial transactions. An in-depth examination of the major advancements in payment systems in the digital age is provided in this research paper, with a particular emphasis on mobile payments, contactless technologies, and the prospective effects of cryptocurrencies on conventional payment methods. The study examines existing studies, new technological developments, and the implications for consumers and financial institutions. This article seeks to shed light on the potential future of digital payments by exploring the advantages and difficulties of these new payment systems

INTRODUCTION

The digital transformation has revolutionized the financial landscape, reshaping traditional payment systems to meet the demands of a digitally savvy consumer base. Rapid technological improvements have marked the evolution of payment systems in the digital era, changing how money is transacted. The major innovations that have shaped the payment system landscape have been the subject of several studies and works of literature over the years. Researchers have looked into the rise of mobile payments, the spread of contactless technologies, and the possible disruption that cryptocurrencies could bring about to established payment systems. Financial institutions, politicians, and companies looking to adjust to changing customer requirements and preferences must fully comprehend these changes and their ramifications. Through a review of the literature and a discussion of the relevance of these transformational patterns, this research study attempts to provide a thorough overview of the development of payment systems.

Significance of Understanding the Evolution of Payment Systems

In the current digital world, it is crucial to comprehend how payment methods have evolved. Payment systems are the backbone of financial transactions, and as technology develops, they go through significant changes that affect a variety of stakeholders, such as customers, companies, and financial institutions. The ability to harness technological breakthroughs, promote financial inclusion, ensure security, and boost overall economic growth is made possible by understanding this transition for firms, politicians, and consumers. For all parties involved in the financial services business, staying up to date on the most recent advances is essential as payment technologies continue to improve.

Understanding the various effects of technical improvements on financial transactions requires an understanding of the evolution of payment systems. By offering an integrated examination of the effects of mobile payments, contactless technology, and cryptocurrencies on conventional payment systems, this research article aims to build on these earlier studies. This study seeks to provide useful insights into the likely future landscape of digital payments and aid stakeholders in navigating the shifting financial ecosystem by combining the findings from diverse research sources.

Research Objectives

1. To explore the evolution of payment systems
2. To analyze the significance of mobile payments, contactless technology, and the disruptive potential of cryptocurrencies on traditional payment methods.

LITERATURE REVIEW

The Emergence of Mobile Payments

Money has an interesting and lengthy history that dates back thousands of years. Its influence on the way our society operates has been significant since the beginning of bartering, through the introduction of metal coins, and ultimately the introduction of paper money. Changes in the history of money are closely related to advancements in finance and money. Currency has evolved into many

different forms over time. Its journey has taken it from barter to precious metal coins composed of copper and bronze, which then changed to include silver and gold. Somewhere along the line, individuals got creative and began using claims on things, or a bill of exchange, in place of actual goods for barter. However, the function of money has remained constant over time; in general, it serves as a reliable store of value and allows commerce in commodities and services even though opinions regarding the origin and forms of ancient money have continued to diverge throughout recorded history.

Money either possesses intrinsic worth or signifies ownership of items with intrinsic value or ownership of other debt instruments. Currency is a type of money that is issued only by the sovereign (or a central bank acting as its representative) and is considered legal tender in modern countries. Paper money is a good example of money because it is fundamentally a debt instrument. It is both an asset and a liability of the issuing central bank (and sovereign).

Systems for making payments are evolving quickly. Users now demand quicker, simpler payments whenever they want and wherever they are, reflecting the digitalization and convenience of other elements of life (Bech et al., 2017). Systems that enable very quick retail payments between individuals are spreading throughout the world. In the field of payment and settlement systems, India has always been a nation that has encouraged innovation and growth. Numerous payment methods have developed over the past few decades, all for the benefit of the average person. Since the middle of the 1980s, the Reserve Bank of India has undertaken several attempts to introduce technology-based banking system solutions. The chart below shows the developments in detail.

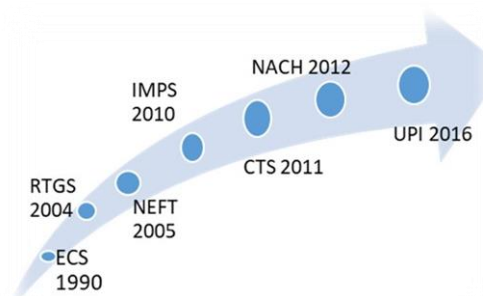


Figure 1. The Emergence of Mobile Payments

Source: RBI

In today's world, large payments must be made quickly across great distances with the least amount of transaction costs. It appears that payment systems are being digitalized worldwide to meet these demands. But money is still an essential component of the transaction. As a result, the debate over the modern payment system centers on cash vs. digital transactions.

Rise of mobile payments

Mobile payments have emerged as a prominent aspect of the digital age as mobile gadgets, including cellphones, PDAs, wireless tablets, and laptop computers, have started transmitting all different sorts of data in recent years. With the advent of mobile payments (or "m-payments"), these devices can now

also be used to make payments for goods and services through data transmission (Liébana-Cabanillas et al.,2017) revolutionizing how individuals and businesses engage in financial transactions. An m-payment is any wireless method used to start, activate, or finalize a transaction (Geva, 2012). Otherwise, any personal or professional activity employing an electronic device connected to a mobile network to execute an economic transaction can also be deemed an m-payment (Liébana-Cabanillas,2012).

Within India's financial landscape, mobile payments have risen as a powerful force, reshaping transaction methods and promoting financial inclusivity. Over the past decade, mobile payments in India have experienced substantial growth, attributed to various factors such as the widespread adoption of smartphones, improved network infrastructure, and government initiatives like Digital India and the Pradhan Mantri Jan Dhan Yojana. The ambitious initiatives of the government and the quick uptake of smartphones are the sources of India's mobile payment revolution. A turning point came with the introduction of the Unified Payments Interface (UPI) in 2016. UPI provides a favorable environment for mobile payments to thrive, especially in light of the increase in budget-friendly smartphones and the rise in mobile internet users.

Many factors have fueled the rise of mobile payments. One such factor is the increasing rate of smartphone usage in India, providing a gateway for widespread acceptance. Researchers have conducted numerous investigations into the determinants influencing consumer adoption of mobile payments. For example, the convenience, perceived utility, and security of mobile payment technology play significant roles in user acceptance (Chen et al., 2019). Government-led initiatives have also played a pivotal role in promoting mobile payments, exemplified by the Digital India campaign, which has heightened awareness and developed the infrastructure for online transactions (Gupta and Arora, 2020). Mobile payments have also made significant strides in advancing financial inclusion in India, particularly in rural areas, by enabling marginalized groups to access formal financial services (Reddy and Mishra, 2018). Furthermore, the adoption of mobile payments hinges on consumer trust and willingness (Jain and Sharma, 2017).

METHODOLOGY

Contactless Technology and its Implications

A quick and secure way to conduct transactions without having to make physical touch between the payment device and the payment terminal is known as contactless payment technology. Customers can pay by tapping their contactless-enabled card, smartphone, or wearable device on a suitable payment terminal using radio frequency identification (RFID) or near-field communication (NFC). Due to its many advantages over conventional payment systems, this technology has recently become widely used and younger generations show a larger tendency to adopt these technologies (Granger et al.,2019).

This technology has lately grown in popularity due to its many advantages over traditional payment systems. Speed and convenience come first when discussing the benefits of contactless payment technology over conventional payment methods. Contactless payments offer significant time savings over traditional payment methods. According to a Visa study published in 2019 that looked at transaction data from several retailers, contactless payments were, on average, 10 to 15 seconds faster per transaction than conventional chip-and-PIN payments. This speed and convenience have a positive impact on retail efficiency by reducing checkout lines, customer wait times, and shop traffic. Similarly, a study stated that contactless transactions were finished in less than three seconds, in contrast to chip-and-PIN purchases, which took an average of 15 seconds to complete (Pascoe and Horvath,2018). This time-saving feature has been recognized as being essential to raising point-of-sale transaction efficiency overall and improving customer experience. This ease and quickness of contactless payment technologies have led to their mainstream acceptance (Xu et al.,2020). This is unquestionably a benefit, but it's vital to understand that in the context of a person's total shopping experience, the time saved for each transaction may be minimal. Although the effect on retail efficiency, shorter checkout lines, and shorter customer wait times are stated, research on how much these aspects influence total consumer happiness and loyalty would be useful.

The whole customer experience is considerably improved with contactless payment technology. Numerous research has focused on how consumers see contactless payments. According to a Statista (2021) study, 62% of American consumers had a favorable opinion of contactless payments because of their ease, quickness, and security. In a similar vein, eMarketer's 2022 survey found that 78% of European consumers believed contactless payments to be a safer option to cash transactions, which may have influenced their decision to use this technology. The rapid uptake of smartphones and wearables contributed to the general acceptance of contactless payment technology, which has become an essential component of the digital era and the simplicity and seamless user experience of contactless payments have been further enhanced by their incorporation into digital wallets and mobile apps, fueling their popularity among tech-savvy customers. Customers view contactless payments as a seamless and user-friendly payment option, increasing customer happiness and brand loyalty (Deloitte,2021). But it's important to recognize that not all consumers may have the same perspective. Customers' opinions of contactless payments can vary depending on their age, technological comfort level, and personal preferences. To better understand how much of this improvement is due solely to contactless payments, it would be helpful to look at the multiple outcomes of customer satisfaction and brand loyalty.

The potential of contactless payments in the digital age is revealed by studies looking into merchant acceptance, consumer views, and the influence on transaction processing times. These studies shed important light on the adoption and efficiency of contactless payment technology, assisting in the comprehension of its significance and ramifications in the contemporary payment landscape. The

adoption of contactless payment systems has become increasingly popular, driven by their reputation for security and the growing concern for public health. Contactless payments utilize encryption and tokenization to safeguard payment data, rendering it challenging for hackers to intercept and misuse private information (Garcia et al.,2019). Studies looking into contactless payment acceptance by merchants have revealed a rising tendency in recent years. 76% of merchants in a global survey surveyed by KPMG (2020) had already used contactless payment technology or were planning to do so within the next year. The study showed that retailers were interested in adopting contactless payments because they saw them as a way to increase consumer happiness and operational efficiency. Moreover, these payments often impose transaction limits, enhancing security for smaller transactions. In light of heightened hygiene concerns, especially in public areas where germs can thrive on surfaces like payment keypads, contactless payments offer a safer alternative. Contactless payments significantly reduce the need for physical touch during transactions, thereby lowering the risk of infection transmission (Williams et al.,2020). However, while contactless payments minimize physical contact, they still rely on shared payment terminals, which can potentially harbor contaminants.

Furthermore, compared to traditional payment methods, contactless payment technology is associated with lower fraud rates, Sarker and Chae (2021) attribute this to enhanced security features, including dynamic transaction tokens and biometric verification, which reduce the incidence of fraudulent transactions. In contrast to this, data from the RBI states that there has been a considerable increase in fraud transactions over the past few months. As we embrace contactless payments, it is crucial to address potential vulnerabilities and concerns within the system. Security breaches are a notable threat and there is a need for robust encryption and security protocols to safeguard transaction data from unauthorized access (Li et al.,2018). Privacy concerns are another dimension to consider, particularly with the continuous collection of transaction data (Fernandez-Aviles et al.,2019). This data can lead to customer profiling, potentially enabling companies and advertisers to target individuals with personalized ads, and raising privacy issues. The use of Near Field Communication (NFC) technology in contactless payments, allowing location tracking, has also raised concerns about potential privacy infringements (Akinyokun and Teague,2017). Furthermore, the analysis of transaction data to understand consumer behavior, has the potential for invasive marketing tactics, further underscoring the need for clear privacy policies and consumer consent (UK's Information Commissioner's Office,2020). In conclusion, the adoption of contactless payments offers security benefits and addresses health concerns but is not without its vulnerabilities. It is essential to strike a balance between convenience and security, implement robust security measures, and ensure transparent privacy policies and informed consent to protect both user data and public health effectively.

RESULT AND DISCUSSION

Technology improvements have had a big impact on how payment systems have evolved. In order to assure security and customer convenience, mobile payment apps have undergone significant development, combining cutting-edge technologies like biometric authentication and tokenization (Bouhnik and Saguy, 2018). Contactless payments now allow for faster and more secure transactions because of the inclusion of Near Field Communication (NFC) technology (Duan et al., 2019). In addition, the blockchain technology that underpins cryptocurrencies has the power to fundamentally alter many elements of financial transactions (Swan, 2015). The growth of digital transactions in the nation will be aided by recent moves taken by the government and the RBI, the expansion of FinTechs, and their partnerships with banks to introduce cutting-edge and user-friendly solutions.

India's rapid adoption of mobile payments shows not just a change in the manner financial transactions are carried out but also a change in the country's economic environment. It has aided financial inclusion, decreased reliance on cash, and encouraged digital entrepreneurship, but it has also brought to light problems with the digital divide, security, dependence on technology, privacy, and regulatory issues. In India's changing economic environment, addressing these issues is crucial to maximizing the advantages of mobile payments while limiting potential downsides. A cashless future has been made possible by a mix of governmental measures, technical developments, and the creative energy of the fintech industry. Mobile payments will become more and more important in determining India's economic future as it continues on its digital transformation journey.

The growth of digital transactions in the nation will be aided by recent moves taken by the government and the RBI, the expansion of FinTechs, and their partnerships with banks to introduce cutting-edge and user-friendly solutions. Another advantage of contactless payments is the increase in transaction volume. Contactless payments have been demonstrated to enhance transaction volumes for businesses due to their simplicity and convenience. Contactless payments encourage more impulsive purchases and enable micro-transactions, which boosts sales and profitability for businesses (MasterCard, 2020). In India, it is projected that by 2025, there will be a volume of 167 billion transactions with a total value of 238 trillion rupees in digital transactions (PwC's analysis of RBI and NPCI data). However, there is a growing trend of rejected transactions due to technical glitches. In September 2020, ten of the top 30 Indian banks reported a 3% failure rate in UPI transactions. The surge in UPI transactions is also straining the technical infrastructure of the banking industry, which is ill-prepared to handle the increased volume. Implementing a real-time resolution system for addressing consumer complaints by banks will reduce turnaround time (TAT) and streamline the entire process.

Together, these studies show how important contactless payments are becoming in the digital age, with rising merchant adoption, favorable consumer impressions, and quantifiable advantages in transaction processing times even though rapid technological advancement can also bring forth problems like the

digital divide, increasing cybersecurity risks, and a reliance on technology for financial operations. Although contactless payments provide security advantages and solve health issues, they are not without flaws. To effectively secure user data and public health, it is crucial to strike a balance between convenience and security, put in place strong security measures, and make sure informed consent is obtained and privacy rules are transparent. Contactless payment technology has many benefits over conventional payment methods, including quickness, practicality, hygiene, security, less fraud, higher transaction volumes, and improved consumer satisfaction and is set to play an ever bigger role in determining the future of payment systems as technology develops and customer preferences change. Contactless payment techniques are anticipated to transform the payment landscape and turn into a vital part of contemporary payment systems as they develop and become more widely accepted. However, it's essential to acknowledge that no payment method is entirely infallible. Despite security measures like tokenization and encryption, the possibility of security vulnerabilities or system-related issues still exists. Hence the RBI, banks, and other participants in the payment ecosystems must step up efforts to improve cyber security and alert clients to suspected fraud.

Cryptocurrencies and their Disruptive Potential

Cryptocurrencies, such as Bitcoin and Ethereum, have emerged as a disruptive force in the financial landscape. The disruptive potential of cryptocurrency has frequently come up in intellectual discourse. Nakamoto's (2008) landmark whitepaper on Bitcoin, the original cryptocurrency, laid the foundation for this disruptive potential by introducing a decentralized, peer-to-peer electronic cash system that operates without the need for intermediaries like banks. This innovative concept sparked discussion and interest in the revolutionary impact of cryptocurrency on existing financial systems.

Scholars have extensively researched the potential impact of cryptocurrencies on traditional payment systems and financial services. Cryptocurrencies have the potential to increase financial inclusion, especially in places where traditional banking services are less accessible. A study by Demirgüç-Kunt and Klapper states that blockchain technology and cryptocurrencies could improve financial inclusion by extending the use of financial services to underbanked and unbanked people. For instance, the use of Bitcoin for remittances and cross-border transactions has the potential to lower costs and enhance financial inclusion (Yermack,2017). Cryptocurrencies may provide quick, borderless, and affordable cross-border transactions, doing away with the need for expensive middlemen and drastically cutting down transaction times (Luno,2020). By giving them access to effective and accessible financial services, this upheaval of conventional remittance systems may empower people in underdeveloped nations. Although there is a chance that cryptocurrencies may increase financial inclusion, the reality is far more complicated, especially in developing countries. Many poor populations frequently lack the internet connection and technological literacy needed to use cryptocurrencies. Furthermore, it's possible that the absence of consumer protection and

governmental control in the bitcoin industry could leave vulnerable people open to fraud and scams.

Numerous studies have been conducted on the intrinsic price volatility of cryptocurrencies like Bitcoin. News stories and speculative trading have a big impact on Bitcoin's price and can cause substantial swings (Dwyer,2015). In a similar vein, Gandal et al. (2018) discovered that variables including market condition and liquidity affect the volatility of cryptocurrency prices. The extreme price volatility of cryptocurrencies makes them a less attractive option as a store of value compared to traditional assets like gold or government-issued currencies. Unpredictable price movements hinder cryptocurrencies from fulfilling the role of a stable store of value (Gaurav,2019). Due to price volatility, cryptocurrency users and investors are subject to a variety of hazards like the dangers of double-spending attacks and the possibility of network instability (Eyal and Sirer,2018) and the risks of trading on unregulated exchanges and the lack of investor protection (Cheah & Fry, 2015). Concerns about regulation are further exacerbated by price volatility. Sharp price fluctuations draw regulatory attention and affect decision-maker's views on the cryptocurrency markets (Pagliery,2018).

In the discussions of the disruptive potential of cryptocurrency, More Attention has been drawn to the idea of tokenization, which blockchain technology has made possible and which has the potential to upend numerous businesses. Real-world assets could be represented on blockchain networks by tokenization, making them easily marketable and divisible (Swan, 2015). As a result, high-value assets like real estate and fine art can now be owned in small fractions, upending old paradigms of asset ownership and investing. This may appear to be a good idea, but it ignores the legal and regulatory issues that surround tokenized assets. Existing legal frameworks may not recognize or safeguard the ownership and transfer of tokenized assets, which could result in disputes and legal problems.

Decentralized finance, or DeFi, is a recent innovation in the Bitcoin sector that threatens traditional financial intermediaries and services. The disruptive potential of DeFi includes decentralized platforms for lending, borrowing, and trading (ConsenSys,2021). These DeFi programs work independently of banks, allowing users total control over their finances and creating new opportunities for accruing interest and borrowing money. Despite the attention it has garnered, DeFi is still in its infancy and faces significant regulatory and security issues. Hacking incidences and smart contract bugs have caused considerable losses for users, underlining the risks associated with using these platforms.

The widespread use of cryptocurrencies and blockchain technology must be acknowledged as a possibility. Cryptocurrencies have the potential to revolutionize a number of industries, such as payment systems, financial inclusion, asset tokenization, and the advent of decentralized finance. These technologies will undoubtedly have a significant impact on established financial institutions and businesses as they develop and become more widely accepted, paving the way for a more decentralized and diverse global financial landscape. However, we should also consider that the broader acceptability and utilization

may be hampered by elements including regulatory scrutiny, scalability issues, and public perception.

Implications for Financial Institutions and Consumers

The evolution of digital payment systems has profound implications for financial institutions and consumers as they must now deal with the serious ramifications of the digital payment revolution. Banks are challenged to adapt their services to accommodate the changing preferences of customers and implement robust security measures (Angst and Agarwal, 2019). Consumers, on the other hand, experience changes in their financial behavior, with the potential to increase financial inclusion and alter spending patterns (Fernandez and Garces, 2018). This revolution has transformed the financial sector and individual consumers, changed old banking processes, and consumer behavior, and produced new opportunities and difficulties.

In order to compete in the shifting market financial institutions have been forced to innovate and adapt as a result of the development of digital payment technology. Banks are under pressure to improve their digital capabilities to keep up with shifting client demands for simple and convenient payment methods (McKinsey & Company, 2019). To offer a seamless customer experience, institutions are now investing in digital infrastructure, such as mobile banking apps and internet platforms. Financial institutions are integrating digital payment options into their services in order to draw in and keep consumers, banks and fintech firms are working together to create cutting-edge payment systems including peer-to-peer payment platforms and digital wallets. Through this partnership, institutions are better positioned to compete successfully in the digital payments market by utilizing the agility and innovation of startups (Capgemini's research, 2021). Financial institutions in India have been inspired by the digital payment revolution to innovate and adapt in order to meet shifting consumer expectations. Indian banks are making significant investments in digital infrastructure to provide a variety of digital payment solutions, such as mobile banking apps, UPI-based platforms, and digital wallets (Deloitte, 2021). This is a reflection of the institutions' attempts to support the government's goal for a digital economy by offering clients simple and effective payment options. The influence of the implementation of digital payments on the business models of financial institutions is highlighted in a report by the Indian Institute of Management Bangalore (IIMB) from 2020. It highlights the fact that Indian banks are putting their efforts into utilizing digital payment data to provide tailored financial goods and services, boosting client engagement and loyalty. This shift to data-driven tactics shows how digital payments have the power to completely change how financial operations are conducted. The revolution in digital payments has significantly altered consumer expectations and behavior. Consumers today seek simplicity, quickness, and security in their payment experiences and are increasingly using contactless payments and mobile wallets to speed up transactions and lessen their dependency on cash (PwC, 2020).

Indian consumers' payment habits and behaviors have changed as a result of the digital payment revolution. The convenience and ease of use that digital payment mechanisms like UPI and mobile wallets provide have accelerated their acceptance in India and these payment alternatives have become a crucial part of Indian consumers' daily lives and allowed them to conduct digital business across numerous industries (McKinsey & Company,2021). Despite the fact that cash still reigns supreme, as seen by the high currency in circulation (CIC), the digital payment environment increased rapidly in recent years. Over 72 billion digital transactions were recorded nationwide during the fiscal year 2022. Digital payments are progressively promoting financial inclusion in India and as a result formerly unbanked and underbanked populations now have access to formal financial services (RBI report,2020). The major reason behind this transformation is the ability of digital payment platforms to expand financial services to underserved people thus closing the gap between the unbanked and banking systems (McKinsey & Company,2020). This is consistent with the government programs' goals of financial inclusion and empowerment in India.

CONCLUSION

Future Outlook and Conclusion

The future of payment systems in the digital era holds promising opportunities for financial institutions and consumers. As mobile payments, contactless technology, and cryptocurrencies continue to evolve, a hybrid approach integrating traditional and digital payment methods may emerge. The adoption of Central Bank Digital Currencies (CBDCs) could also play a significant role in shaping the future landscape of digital payments (BIS, 2020). However, addressing regulatory challenges, security concerns, and scalability issues is essential to ensure the sustainable growth and mainstream acceptance of digital payment systems.

Both financial institutions and customers will be significantly impacted by the digital payment revolution in India. By putting money into digital infrastructure and using data to provide individualized services, institutions are adjusting. Because they are convenient and have the potential to increase financial inclusion, consumers are embracing digital payments. According to the government's aim of a digital economy and improved financial accessibility, these reforms are transforming India's financial landscape.

FURTHER STUDY

This research still has limitations so further research needs to be carried out regarding the topic Evolution of Payment Systems in the Digital Era: A Comprehensive Analysis of Mobile Payments, Contactless Technology, and the Disruptive Potential of Cryptocurrencies on Traditional Payment Systems in order to perfect this research and increase insight for readers.

REFERENCES

- Akinyokun, N., & Teague, V. (2017). Security and Privacy Implications of NFC-enabled Contactless Payment Systems. In Proceedings of the 12th International Conference on Availability, Reliability and Security (ARES '17) (Article 47, pp. 1-10). Association for Computing Machinery, New York, NY, USA. <https://doi.org/10.1145/3098954.3103161>
- Bech, M, Y Shimizu and P Wong (2017): "The quest for speed in payments", *BIS Quarterly Review*, March, pp 57-68.
- Cheah, E. T., & Fry, J. (2015). Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. *Economics Letters*, 130, 32-36.
- ConsenSys. (2021). Decentralized Finance (DeFi): An Emergent Disruption. Retrieved from <https://consensys.net/resources/defi-emergent-disruption/>
- Deloitte. (2021). Digital Payments in a Digital World: The Rise of Contactless Payments. Retrieved from <https://www2.deloitte.com/insights/us/en/industry/financial-services/fintech-digital-banking-contactless-payments.html>
- Deloitte. (2021). Indian Banking in the New Normal: Accelerating Digital Transformation. Retrieved from <https://www2.deloitte.com/content/dam/Deloitte/in/Documents/financial-services/in-fsi-indian-banking-in-the-new-normal-noexp.pdf>
- Demirgüç-Kunt, A., & Klapper, L. (2018). Blockchain Technology: What Is It Good For? Retrieved from <https://openknowledge.worldbank.org/handle/10986/30458>
- Dwyer, G. P. (2015). The economics of Bitcoin and similar private digital currencies. *Journal of Financial Stability*, 17, 81-91.
- eMarketer. (2022). Contactless payments - statistics & facts. Retrieved from <https://www.emarketer.com/topics/topic/contactless-payments>
- Eyal, I., & Sirer, E. G. (2018). Majority is not enough: Bitcoin mining is vulnerable. *Communications of the ACM*, 61(7), 95-102.
- Fernandez-Aviles, G., Orozco-Arroyave, J. R., Hincapie, D. H., & Nino-Mora, J. (2019). Privacy concerns in contactless payment systems. *IEEE Access*, 7, 104859-104869.
- Gandal, N., Hamrick, J. T., Moore, T., & Oberman, T. (2018). Price manipulation in the Bitcoin ecosystem. *Journal of Monetary Economics*, 95, 86-96.
- Garcia, C. E., Johnston, A. C., & Shorten, R. N. (2019). A survey of security and privacy issues in the internet of things for smart homes. *IEEE Communications Surveys & Tutorials*, 21(3), 2333-2356.
- Gaurav, S. (2019). Bitcoin as a store of value: A survey. *Journal of Applied Economics and Business Research*, 9(1), 33-44.
- Geva, B. (2012). The wireless wire: Do M-payments and UNCITRAL model law on international credit transfers match? *Banking & Finance Law Review*, 27, 249-264.

- Gupta, R., & Arora, S. (2020). Digital India: A Step towards Financial Inclusion through Mobile Payments. *Journal of Financial Services Marketing*, 25(2), 81-92.
<https://economictimes.indiatimes.com/tech/technology/surging-upi-failure-rates-worry-banks/articleshow/78779204.cms>
- Indian Institute of Management Bangalore (IIMB). (2020). India's Fintech Revolution: How to Ride the Digital Payments Wave. Retrieved from <https://www.iimb.ac.in/sites/default/files/2020-06/digital-payments.pdf>
- Information Commissioner's Office (ICO). (2020). Big data, artificial intelligence, machine learning, and data protection. Retrieved from <https://ico.org.uk/for-organisations/guide-to-data-protection/big-data-ai-ml-and-data-protection/>
- KPMG. (2020). Global Payments Innovation Survey 2020: Merchant Edition. Retrieved from <https://home.kpmg/xx/en/home/insights/2020/12/global-payments-innovation-survey-merchant-edition.html>
- Li, Q., Hu, Y., & Chen, S. (2018). Security analysis of contactless payment systems. 2018 IEEE International Conference on Communications (ICC), 1-7.
- Liébana-Cabanillas, F. (2012). El papel de los sistemas de pago en los nuevos entornos electrónicos [The role of payment systems in the new electronic environments] (Doctoral Thesis). Department of Marketing and Market Research. Universidad de Granada.
- Liébana-Cabanillas, F., Ramos de Luna, I., & Montoro-Ríos, F. (2017). Intention to use new mobile payment systems: A comparative analysis of SMS and NFC payments. *Economic Research-Ekonomska Istraživanja*, 30(1), 892-910. <https://doi.org/10.1080/1331677X.2017.1305784>
- Luno. (2020). The Future of Money: How Cryptocurrency Could Transform Payment Systems. Retrieved from <https://www.luno.com/learn/en/article/the-future-of-money-how-cryptocurrency-could-transform-payment-systems>
- Mastercard. (2020). Tapping into contactless: How is tap to pay driving the evolution of payments? Retrieved from <https://www.mastercard.us/en-us/business/issuers/insights/tap-to-pay.html>
- McKinsey & Company. (2021). Digital Payments in India: Transformative Potential on the Horizon. Retrieved from <https://www.mckinsey.com/industries/financial-services/our-insights/digital-payments-in-india-transformative-potential-on-the-horizon>
- Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. Retrieved from <https://bitcoin.org/bitcoin.pdf>
- Pagliery, J. (2018). Bitcoin's wild ride and what's ahead. *Yale Journal on Regulation*, 35(1), 33-78.
- Pascoe, R., & Horvath, D. (2018). It's in the cards: A survey of credit and debit card fraud in Australia. *Australian Institute of Criminology, Research and Public Policy Series*, 164, 1-16.

- PIB Delhi. (2023, February 8). Digital Transactions in India.
- PricewaterhouseCoopers (PwC). (2020). The Indian Payments Handbook – 2020–2025. December 2020.
- Reddy, D. N., & Mishra, A. (2018). Financial Inclusion in India: A Study of Mobile Payment Services. *Journal of Financial Services Marketing*, 23(2), 77-87.
- Reserve Bank of India (RBI). (2020). Vision 2021 for Payments and Settlement Systems in India. Retrieved from https://www.rbi.org.in/scripts/bs_viewcontent.aspx?Id=3662
- Reserve Bank of India. (2022). Concept Note on Central Bank Digital Currency. <https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=21417>
- Sarker, Z. H., & Chae, Y. (2021). Secure payment method in internet of things applications: A review. *International Journal of Advanced Computer Science and Applications*, 12(1), 207-217.
- Shree, S., Pratap, B., Saroy, R. et al. Digital payments and consumer experience in India: a survey based empirical study. *J BANK FINANC TECHNOL* 5, 1–20 (2021). <https://doi.org/10.1007/s42786-020-00024-z>
- Statista. (2021). Contactless payments - statistics & facts. Retrieved from <https://www.statista.com/topics/5247/contactless-payments/>
- Statista. (2022). Digital Payments - Statistics & Facts. Retrieved from <https://www.statista.com/topics/5247/contactless-payments/>
- Swan, M. (2015). *Blockchain: Blueprint for a New Economy*. Sebastopol, CA: O'Reilly Media.
- Visa. (2019). Visa Tap to Phone: Faster Checkout is Just a Tap Away. Retrieved from <https://usa.visa.com/dam/VCOM/global/support-legal/documents/visa-tap-to-phone-infographic-05072019.pdf>
- Williams, C., Burgess, J., Sarker, Z. H., & Chae, Y. (2020). A comparative analysis of NFC and QR code based mobile payment systems. *Journal of Computer Information Systems*, 1-12. doi: 10.1080/08874417.2020.1858629