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AI Integration in Electronic Payment Systems

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AI integration in Electronic Payment Systems

Executive Summary

India's payment system has undergone huge transformation over the past 35 years, moving from paper -based transactions to advance digital solutions. The paper explores how Artificial Intelligence (AI)is reshaping the way we pay and receive money. While the new technologies like Unified Payment Interface (UPI), and Immediate Payment Service (IMPS) have made payments faster and convenient. The paper examines how AI is helping to detect fraud, improve customer service, and make systems more efficient. The paper also looks at these changes affect different group of peoples – from those who operate these payment systems to those who might be left behind due to lack of internet access or technical knowledge. By looking at both the benefits and risks of AI in payment systems we can understand how to build payment systems that can work for everyone, also balancing innovation with inclusion.

Sector and Sectoral Application:

Payment systems mainly involve money transfer and settling transactions involving buying and selling goods and services. Historically, evolving from the ages of the barter system, the concept, in general, has evolved from money constituting precious metals like gold and silver to governments issuing coins and paper currency that has been the norm now for centuries. With the evolution of banking systems, people preferred keeping their money with these institutions as they are considered safer and remunerative. For a long time, cheques have been used as payment instruments instructing banks to undertake transactions. The cheque-based system included intermediaries such as drawee bank, the drawer bank and the

cheque clearing houses. The system was characterised by heavy dependence on manpower, larger processing time, more prone to forgery and scams, etc. (Gandhi, 2016). These systems have gone through the greatest transformation in India in the past 35 years and have never been looked at from the lens of a revolution, but indeed are a "silent revolution" in the Indian payment landscape (Gandhi, 2016). With the Reserve Bank of India (RBI) at the helm of this revolution, in the initial years as a developer and now taking up the role of a catalyst and a facilitator.

Today, India boasts advanced payment systems, including Unified Payments Interface (UPI), Immediate Payment Service (IMPS), and National Automated Clearing House (NACH), underpinned by technological advancements driven by RBI's initiatives (Gupta, 2024; Siddiqui & Goyal, 2023). We will be looking at electronic payment systems (EPS), there are various options available for the users depending on their need and criticality, such as National Electronic Funds Transfer (NEFT), Immediate Payment Service (IMPS), Aadhaar Enabled Payment System (AEPS) and Unified Payments Interface (UPI) (Gandhi, 2016; Siddiqui & Goyal, 2023). The digital payments landscape recorded a 58% growth in FY 2022-2023 compared to the previous FY, within this growth mandate, UPI led the charge accounting for over 75% of the country's retail digital payments (Sarkar, et al., 2023). For all these changes and innovations RBI has been at the helm of these, by way of constituting various committees such as Rangarajan Committee I & II, Saraf Committee, Patil Committee, Burwan Working Group, etc. (Gandhi, 2016). They have explored integrating ICT solutions for banking and payment solutions. These committees introduced technological innovations and laid the foundation for a huge shift in payment systems. From Magnetic Ink Character Recognition (MICR) for automating cheque processing in the 1980s to the Cheque Truncation System (CTS) in 2008, which enabled T+1 settlements, the transformation is not short of a revolution still way ahead of

many countries.

With advancements in technology, the challenges associated with large-scale adoption for online service delivery have increased. With more and more reliance on virtual platforms, issues such as cyber security threats, social engineering, and phishing scams have become more prevalent, exploiting customers into sharing their sensitive information. In addition to the above, the growing complexity of the systems with the inclusion of third-party service providers (TSPs) adds new layers of risks in terms of delays to consumer redressal.

Learning from past experiences, measures such as two-factor authentication and the mandatory use of one-time passwords (OTP) for online transactions have been implemented to enhance security. These are examples of steps that have been taken with the evolving ecosystem to mitigate emerging risks.

Potential for AI in the sector:

AI's integration into payment systems offers great potential. AI models can analyse transaction patterns, identify suspicious behaviour, and block fraudulent transactions in real life, helping financial institutions manage their liquidity needs to maintain liquidity buffers (Shamugasamy, 2024). Furthermore, according to Shamugasamy, there are other benefits too, such as better optimisation and quick working of cross-border payments, that can be achieved by automating compliance checks, predictive clearing and settlement and reducing intermediaries in the loop by combining blockchain and smart contracts in the system. Generative AI not only enhances predictive accuracy but also provocatively helps with a better understanding of fraud scenarios that help in strengthening the system defences (Shamugasamy, 2024). These systems integrate rule-based checks and behavioural pattern recognition, significantly reducing false positives and enhancing user trust. For example, a Nordic-Baltic banking group has been able to

implement a generative adversarial network (GAN) model to detect fraudulent transactions, resulting in a significant reduction in false positives and improved operational efficiency.

Furthermore, by effectively managing large numbers of queries, chatbots and virtual assistants driven by sophisticated natural language processing (NLP) have transformed customer service. Kotak Mahindra Bank and State Bank of India have used AI-powered chatbots to improve customer experience in India (R. Chaya and Salman 2024). The chatbots help consumers with personalized responses and streamline banking processes.

AI can also be employed for advanced analytics, as these models can extract useful insights from large volumes of transactional and behavioural data is another application (R. Chaya and Salman 2024). GenAI's transformative skills allow for the production of brief and customized FAQs based on user behaviour and previous interactions (Kumar and Dharukar 2024). Additionally, banks and FinTech organisations can optimise pricing in real-time based on supply and demand by enabling dynamic pricing strategies through the analysis of market dynamics, consumer behaviour, and inventory data. The use of AI can automate pricing models, especially in loans where interest rates are constantly modified in response to real-time risk assessments (R. Chaya and Salman 2024). These uses demonstrate how AI can revolutionize the development of data-driven, customer-focused financial ecosystems.

According to a PWC report, these systems facilitate regulatory compliance, showcasing AI's function in automating adherence to Know Your Customer (KYC) and Anti-Money Laundering (AML) laws. There are issues with AI's "explainability," "fairness," and "transparency," which require attention from a legal and regulatory perspective. A Responsible AI (RAI) framework emphasizing ethics, justice, and accountability is crucial to reducing them. Global adoption of these principles is shown in the EU's AI Act, which places stringent constraints on high-risk AI systems to safeguard consumers and maintain system integrity.

Utilizing these frameworks may aid in achieving the optimal AI application.

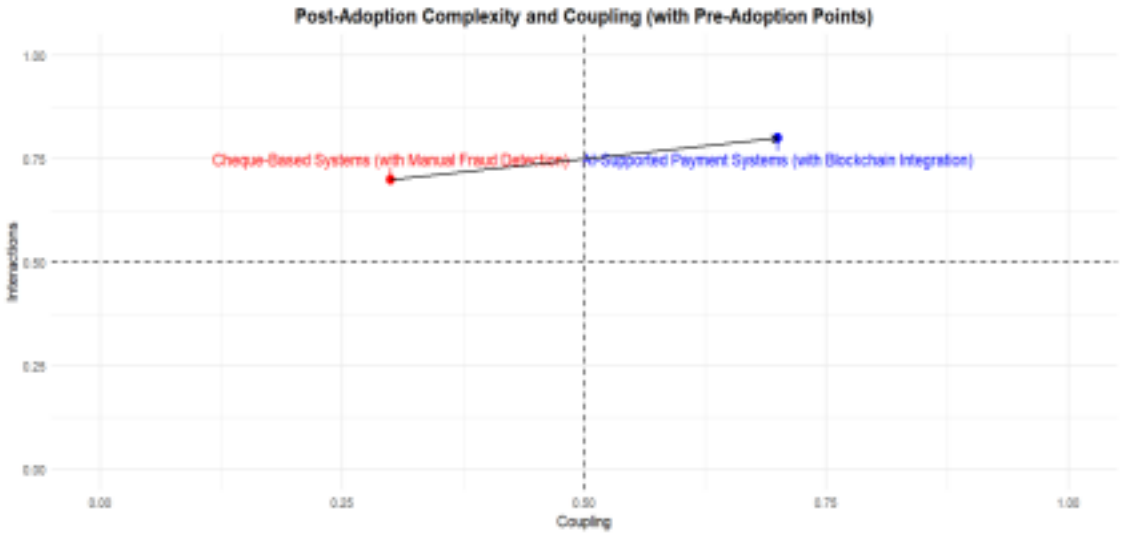
Systems Perspective: Change in Complexity and Coupling:

AI systems transform payments by increasing their complexity and coupling (Perrow, 2011).

Pre-adoption complexity and coupling can be understood in traditional payment systems as having linear interactions in which entities are observed to function in linear predictable patterns and are not coupled. Integration between the systems is typically somewhat weak and therefore while it is highly adaptive and flexible, implementation often lacks a high level of real-time performance. For example, cheque-based transactions, are performed by the multiple layers of operations that are connected with physical delivery to the clearing house, manual verification and reconciliation, all these steps consume time and, thus, can be delayed or contain errors. Normally, when it comes to fraud detection and compliance checks, some organizations employ manual processes in such system environments and this greatly leads to a lot of uncoordinated processes hence compromising their efficiency as well as increasing operational costs.

Source: By Author

Post-adoption complexity and Coupling can be understood with the adoption of AI-driven systems introducing unanticipated interactions between components, creating complex, non-linear dynamics. Feedback loops, real-time analytics, and integrated decision-making enhance operational efficiency but also heighten the risks of cascading 8 failures. For example, electronic payment mode like UPI or IMPS incorporates real-time fraud detection and blockchain to ensure security for transactions. These systems facilitate the running of data in real time hence improving the speed and accuracy of transactions. Of course, this tight coupling also increases exposure – because failure in one component, say the blockchain node, brings down the whole network. This means that adequate measures have to be taken within the governance frameworks and the design to merit the necessary error tolerance for counteracting risky problems.



Source: By Author

Impact Groups of AI application:

Understanding the impact groups affected by technological systems requires examining their complexity and risks. As Perrow (2011), explains in "Normal Accidents: Living with High-Risk Technologies," the inherent complexity and tight coupling in modern systems can lead to unforeseen consequences for diverse stakeholders.

First-party victims – This group involves the operators of the technology, so in the case of the application of AI in payment systems, operators of digital payment systems may face significant challenges as AI tools become increasingly complex. There may be a need to upskill to manage the AI-drive workflow effectively. For instance, operating real-time fraud detection systems or ensuring the proper functioning of blockchain nodes demands technical expertise and adaptability.

Second-party victims – The group involves system users, including consumers and merchants, encountering concerns over data privacy breaches and biases in algorithmic decision-making. For example, consumers might face wrongful transaction rejections due to inaccurate risk profiling, while merchants may struggle with inconsistencies in payment processing. From personal experience, once I was undertaking a transaction from my credit card and it did not go through because of the high value of the transaction, it was cited as a transaction undertaken by an unknown source.

Third-party victims are individuals or groups who are excluded from the financial system also known as **innocent bystanders**, such people or groups may suffer such social or economic losses. This also focuses on individuals in areas with low or no internet connection and physical infrastructure or those who have no ability to adhere to the technicality involved in operating with advanced payment methods.

Fourth-party victims are future generations who may suffer from systemic risks such as biases that may arise in Artificial Intelligence infrastructure. The long-term effects of these decisions may raise ethical questions or chronic cybersecurity problems for future generations.

Impacts of Technology Interventions on Impact Groups:

AI-powered solutions can fill the gaps for underbanked populations, but they can also at the same time lead to the exclusion of individuals or groups due to the technical capabilities of the system or the physical accessibility of the service. These systems also enhance efficiency and reduce cost which could improve the economic value, nevertheless, overdependence on such systems would create system risks which affect stability in the longer run.

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