International Journal of Core Engineering & Management

Volume-8, Issue-02, 2025 ISSN No: 2348-9510

THE FUTURE OF CARDLESS TRANSACTIONS: ADDRESSING THE EVOLVING FRAUD RISKS IN MOBILE AND DIGITAL PAYMENTS

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Abstract

The cardless payment systems through mobile wallets, contactless payments, and real-time payment systems are proliferating globally and are developing replacement ecosystems for conventional payment methods. While these innovative payment systems provide unprecedented levels of comfort, speed, and inclusion, they also introduce new and complex forms of fraud. This research paper unveils critical evidence of the emergent fraud schemes of synthetic identity theft, AI-based deepfake fraud, APP fraud, SIM swapping, and RFID skimming and state-of-the-art detection and prevention technologies of AI, ML, GNN, and GAN, along with existing regulations and industry efforts to fight the respective fraud threats. This paper endeavors to evaluate and collate notable trends, technology, and regulatory aspects to pave the future of safeguarding cardless payments and delivers actionable evidence and recommendations for the respective parties.

Main conclusions: the study reveals that an adaptive security framework, cross-industry partnerships, and compliance with existing regulations is paramount to overcoming emerging fraud threats. Investments in artificial intelligence-enabled detection and consumer education are vital for building secure, sustainable digital payment ecosystems.

Keywords: Cardless transactions, Mobile payments, Digital payments, Payment fraud, Synthetic identity fraud, AI fraud detection, Deepfakes, Authorized Push Payment (APP) scams, SIM swap fraud, Contactless payments, Real-time payments, Machine learning, Graph neural networks, Payment security, Regulatory frameworks.

I. INTRODUCTION

Abrupt digitization of worldwide economies and increasing smartphone penetration is changing the traditional modes of financial transactions for customers and businesses. The cardless payment solutions - mobile wallets (Apple Pay and Google Pay), contactless NFC payments, real-time payment systems (India's UPI and US's FedNow) are on the verge to replace card-based payment modes. The cardless payment solutions are promising unique levels of convenience, speed, and user experience.

On the contrary, Digital Evolution has multiplied the attack space for cybercriminals.

Fraudsters are utilizing the technology gaps, social engineering, new attack vectors, and exploiting loopholes in the systems which is becoming a headache for financial systems, regulators, and end-users alike. The payment landscape demands enhanced fraud detection, prevention, and response measures as it keeps growing.

This paper intends to explore the trends and the scope of developments in the area of cardless transactions, the trends for the fraud emerging, and scope of opportunities related to development, and progress of technologies for fraud recognition and avoidance. And thereafter, the paper will review responses from the regulators and the industry. Recommendations will be made for future-proofing the digital economy. Additionally, it will consider the implications of these trends on consumer behavior and industry practices.

1.1 Mobile Wallets and Contactless Payments

Mobile wallets are digital wallets which help customers make payments for purchases digitally using smart phones or wearable devices to store card information as encrypted data and communicate the payment value via Near Field Communication (NFC) technology. The mobile wallet has received global acceptance and as at 2022 reported users were estimated at 782 million and expected to exceed 1 billion by 2024. Most mobile wallets include biometric credentials (either fingerprint or facial recognition) as their default security mechanism, which while it can be spoofed by advanced attacks techniques, provides some level of additional security against mobile wallet breaches.

The wireless payments market experience a surge in popularity due to contactless payments. These payments have become ubiquitous, particularly during the COVID-19 pandemic where users sought for hands-free options in light of health and hygiene issues. Contactless payments require no more than a simple tap of a smartphone or card on a reader. It is faster than other forms of payment and allows for contactless transactions, making it desirable in the retail and transport sectors. Unfortunately, the ease and convenience offered by the contactless payment also have their disadvantages as it further opens up more avenues for fraudsters to exploit the vulnerabilities of the devices through wireless communication protocols or careless user negligence.

Example: A few fraudulent cases were reported in 2023 across various cities in Europe, where fraudsters made use of portable NFC readers in over-crowded public transport systems to steal data from commuters' wallets/pockets.

1.2 Real-Time Payment Systems

The real-time payment (RTP) system allows users both individuals and businesses to immediately transfer funds from one bank account to another, increasing the liquidity and user experience. India's UPI (Unified Payments Interface) and the US's FedNow are leading RTP systems and UPI had over 8 billion monthly transactions in inflation-adjusted terms until late 2023. As users increasingly treasure speed and efficiency in payments, RTP systems worldwide are expected to grow rapidly.

At the same time, the same speed that makes RTP systems appealing creates serious threats.

Instant fund transfers leave window too short for conventional fraud prevention solutions to act. RTP attackers benefit from such scenarios, which require instant response, for example, authorized push payment (APP) scams, where the user is persuaded to transfer funds to the scammer's account. RTP providers are using behavioral analytics, real-time monitoring, and sophisticated authentication solutions to mitigate threats.

Example: In the UK, the growing adoption of RTP is leading to a 30% rise in APP scams, leading Banks to upgrade their fraud detection systems and partnerships with the police.

II. EMERGING FRAUD RISKS IN CARDLESS TRANSACTIONS

2.1 Synthetic Identity Fraud

Synthetic identity fraud is characterized by the creation of new identities where criminals employ a mix of authentic and fraudulent data (for instance, they might use an actual social security number but combine it with a fake name and date of birth). In the case of this threat actor, identity of multiple parties is not compromised, but rather a new 'person' is introduced to the financial ecosystem, making it difficult to identify this case via commonplace Know Your Customer (KYC) compliance procedures , as this new identity does not seem dubious to anyone.

Synthetic identity fraud is on the rise, especially in unsecured lending and new accounts. It is estimated to have resulted in USD 6 billion in losses in 2022 in the US . Criminals take advantage of KYC deficiencies and the lethargic information exchange between entities.

Mitigation: FINs currently use multi-layered identity verification system which include biometrics, behavioural analysis and cross-financial institutions data sharing for the detection and prevention of synthetic identity theft.

2.2 AI-Driven Deepfakes and Social Engineering

The rise of artificial intelligence (AI) technologies allowed criminals to produce flawless deepfakes—synthetic video, audio, or images that create convincing likenesses of actual individuals. Criminals exploit deepfakes to circumvent biometric security measures, impersonate corporate leaders to commit business email compromise (BEC) fraud, or trick customer service agents . The Federal Bureau of Investigation (FBI) estimated a 30% increase in complaints related to AI-enabled fraud from 2021 to 2023.

Deepfakes therefore pose a major threat to organisations as they can be produced rapidly and on mass which poses a challenge to an organizations cyber security system to remain alert to all possible threats. Deepfake detection also needs specialized tools, like GANs that helps identify deepfake by spotting minute irregularities in audio-visual .

Example: In 2023, a European bank lost over €2 million after fraudsters used a deepfake video call to impersonate a company CEO and authorize a large transfer.

2.3 Authorized Push Payment (APP) Scams

APP scams, or Authorised Push Payment scams, are a type of fraud in which the victim is manipulated into willingly making a payment to the scammer's account. These scams are primarily carried out through social engineering methods, including phishing emails, bogus invoices, or urgent telephone calls. Understanding APP scams as different from card fraud is crucial: whereas a card fraud victim may often recover their funds -- since the transaction was not authorized by them -- in an APP scam there lacks the possibility of remediation, as the victim has "authorized" a payment.

APP scams losses in the UK hit £86 million in 2023, a rise of 12% relative to 2022 . Regulatory authorities are acting to make banks refund authenticated victims and demanded better customer education and authentication.

Example: A common APP scam involves fraudsters posing as utility companies and convincing customers to pay "overdue" bills to a fraudulent account.

2.4 SIM Swap and RFID Skimming

The most prominent exploit involves the SIM swapping technique. Attackers request the victim's mobile carrier to transfer their phone number to a new SIM card that is controlled by the attacker. The attacker can then receive SMS messages containing two-factor authentication (2FA) codes and use them to access the victim's accounts.

RFID skimming is the process of using concealed scanners to read information from contactless cards or other devices. Security measures have increased, however the fact RFID technology is proximity-based makes it susceptible to attacks.

Example: In 2024, a coordinated SIM swap attack in Australia compromised the accounts of dozens of high-net-worth individuals, leading to millions in losses before carriers and banks could respond.

III. TECHNOLOGICAL ADVANCEMENTS IN FRAUD DETECTION

3.1 Artificial Intelligence and Machine Learning

Modern fraud detection practices are increasingly reliant on AI and machine learning (ML) algorithms. These techniques process large volumes of transaction data to uncover fraudulent traces through complex stipulations or anomalies. Supervised (i.e., based on tailoring ML on labeled samples) and unsupervised (i.e., finding new relationships based on the provided dataset) ML models are employed in the detection of potentially fraudulent transactions and their subsequent marking.

Unlike current static rule-based systems, AI-enabled fraud detection solutions utilize machine learning algorithms that can learn from fresh data, understand different vulnerabilities, and automate the controls. Thus, novel fraud detection and prevention systems can be more responsive to new needs in a dynamic digital environment. This adaptability allows organizations to stay ahead of rapidly evolving fraudulent tactics and methodologies. Ultimately, this means that businesses can significantly reduce their risk exposure and improve overall security.

Example: JPMorgan Chase reported a 20% reduction in fraud losses after deploying an AI-based transaction monitoring system that uses neural networks to analyze customer behavior.

3.2 Graph Neural Networks (GNNs)

Graph Neural Networks (GNNs) can effectively capture and model the interactions among the complex entities within a given financial network (accounts, transactions, devices, etc) . GNNs have the capacity to depict the underlying relationship in fraud cases aiming to extract collusions, mule schemes, and other types of intricate fraud that other models may overlook.
Such as detectGNN framework which boosts fraud detection rates by 18% on credit card data over traditional ML methods. GNNs are also highly suitable for detecting collusive and money laundering activities.
Example: A major European bank used GNNs to identify a network of mule accounts involved in a cross-border money laundering operation, leading to multiple arrests.

3.3 Generative Adversarial Networks (GANs)

GANs are a type of AI, where two neural networks compete—a generator to make synthetic data, and a discriminator to identify it . For fraud detection, GANs can generate synthetic fraudulent transactions for training models, or they can be used to identify deepfakes in fraud authentication. This unique capability enhances the robustness of fraud detection systems, allowing them to adapt to emerging threats effectively.
In the fight against payment fraud, GAN-based deepfake detection models help identifies the forged videos with more than 95% accuracy. GANs help security systems to evolve and adapt to the latest fraud schemes.
Example: Payment platforms are now using GANs to simulate new types of fraud, allowing their detection systems to “learn” from attacks before they occur in the real world.

IV. REGULATORY AND INDUSTRY RESPONSES

4.1 Enhanced Reimbursement Policies

APP scams continue to be a significant concern as there has been a trend for regulators to expect greater responsibility from financial service providers to mitigate fraud loss, with APP scams constituting the bulk of this fraud loss . In the UK, there is the Contingent Reimbursement Model Scheme (CRMS) which mandates most banks to reimburse victims of APP fraud, with each claim having the maximum limit of £415,000. With this mandate in place, banks are encouraged to have effective fraud prevention mechanisms in place for their customers . Similarly, the EU has the Payment Services Directive 2 (PSD2) which is legislation that stipulates Strong Customer Authentication (SCA) for electronic payment transactions with the aim of increasing security while reducing the incidence of fraud . This has prompted banks to invest in advanced technologies and better customer education initiatives to enhance their fraud prevention strategies.
Example: After the introduction of CRMS, UK banks invested heavily in real-time fraud monitoring and customer education, resulting in a measurable decline in APP scam losses.

4.2 Collaborative Efforts and Technological Investments

Finally, advanced and sophisticated fraud can be countered with collaboration between telecom operators, banks, and technology providers, both within platforms and public agencies, to develop ID verification and monitoring processes and tools. For instance, banks and telecoms in Australia are working together to improve ID verification and monitoring practices, and have made great strides in decreasing SIM swap financial fraud. Meanwhile, banks are also investing in advanced technologies and consumer awareness initiatives; Commonwealth Bank and Westpac have blocked a record $640 million in financial scams in 2024 thanks upgraded and improved technology processes and awareness campaigns . These collaborative efforts highlight the critical role of innovation and communication in safeguarding consumer trust and financial integrity. As they continue to adapt to the ever-evolving landscape of digital threats.

Example: The Australian Cyber Security Centre coordinates information sharing between banks, telecoms, and law enforcement to respond rapidly to emerging threats.

4.3 Regulatory Actions Against Non-Compliance

A robust approach is being taken by Regulators against the institutions that are not able to adopt the robust fraud controls. Australian Securities and Investments Commission (ASIC) brought actions against HSBC for not being able to thwart scams , as such institutions are being forced to comply with the regulatory standards so breaches in law would not be entertained. Globally, similar actions are being adopted which result in mainstreaming of Anti-Fraud controls development or heavy fines.

Example: In 2023, several US banks faced fines for failing to implement effective anti-fraud systems, prompting industry-wide reviews of fraud prevention protocols.

V. FUTURE OUTLOOK AND RECOMMENDATIONS

5.1 Integration of Advanced Authentication Methods

To ensure the highest security standards for cardless payment methods, future innovations will use the principles of multi-factor authentication (MFA), which combines the use of biometrics (fingerprint, facial recognition), device fingerprinting, and user behavioral analytics. More advanced continuous authentication techniques (analysis of typing patterns or user gait, etc.) will help protect users of cardless payment methods by allowing verification of user ownership of the account throughout the entire session (not only when logging in) .

Example: Some mobile banking apps now use behavioral biometrics to detect unusual user interactions, flagging potential account takeovers in real-time.

5.2 Continuous Monitoring and Real-Time Analysis

Real-time analytics and automated alert systems are essential for detecting and stopping fraud as it happens. Blockchain technology, with its transparent and tamper-resistant ledger, offers additional security for high-value transactions and cross-border payments .

Example: Blockchain-based payment platforms can instantly flag and halt suspicious transactions, reducing the risk of large-scale fraud.

5.3 Consumer Education and Awareness

Consumers remain the first line of defense against fraud. Effective education campaigns on phishing, social engineering, and safe payment practices can significantly reduce the success rate of scams. User-friendly security features, such as transaction alerts and easy reporting mechanisms, empower consumers to act quickly when something seems amiss.
Example: Norton's "Stop. Think. Connect." campaign has helped millions of users recognize and avoid online scams.

5.4 Global Collaboration and Information Sharing

Fraud is a global problem that requires international cooperation. Organizations such as the Financial Action Task Force (FATF) provide platforms for information exchange, standards development, and coordinated response efforts. Cross-border data sharing and joint investigations are critical for tracking and disrupting transnational fraud networks.
Example: FATF's global network has facilitated the dismantling of several international fraud rings by enabling real-time intelligence sharing between member countries.

VI. CONCLUSION

1. Cardless transaction modes are rapidly becoming the global norm due to their unmatched convenience, speed, and accessibility.
2. Digital evolution introduces complex and evolving fraud risks such as synthetic identity fraud, AI-driven deepfakes, APP scams, SIM swapping, and RFID skimming.
3. Traditional static rule-based detection methods are insufficient; adaptive security frameworks using AI, ML, GNNs, and GANs are essential for effective fraud prevention.
4. Regulatory authorities are responding with stronger authentication standards, reimbursement schemes, and sector-wide cooperation to address emerging threats.
5. Industry investments in technology and consumer awareness demonstrate the importance of a secure payments environment and the need for proactive defense.
6. Balancing user convenience with security will remain a challenge, as social engineering risks cannot be fully eliminated.
7. The future of cardless payment security depends on holistic strategies: real-time intelligence, global collaboration, consumer empowerment, and continuous innovation.
8. Proactive, multidimensional approaches are crucial for instilling trust and reliability in digital payments, ensuring a safe and inclusive financial network for all.

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