

Role of Artificial Intelligence in making Payment Systems Smarter

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Abstract

Purpose: To understand use-cases and explore potential use-cases in which Artificial Intelligence (AI) can make Payment Systems smarter in terms of improved turn-around time, reduced costs, reduced manual intervention and robustness.

Methodology: The study was conducted by reviewing literature and interviewing the industry experts to understand payments processing, current scenario with respect to implementation of AI in payments industry and the future opportunities in AI. Based on the same, authors explore the possible areas where AI can be adopted.

Findings: The findings of study suggest that there are multiple use cases in payments industry such as compliance and fraud management, optimization of payment processing and customer service. Application of AI will not only make payment systems smarter and effective but also robust and secured than ever before.

Research Implications: As authors identify multiple potential areas in payments industry wherein AI can be adopted, scholars in payments as well as AI can cohesively work towards practical implementation of such use cases. This will also enable FinTech companies to develop innovative products for payments industry.

Originality / Value: This research paper adds use-cases of application of AI to existing implementations. Further, the paper considers various payment systems across the world giving it a global value.

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I. INTRODUCTION

Payments systems are backbone of any economy since they allow movement of money from payer to beneficiary without movement of physical cash or commodities (Diehl, 2015). Governments and banking regulators promote faster payment systems as such systems increase the velocity of money movement in the economy. Advancement of technology has given a significant boost in reducing time between payment initiation and settlement of transaction (BIS, 2016). However, as indicated in (RBI, Payment and Settlement Systems in India: Vision – 2019-2021, 2019) and (ACAMS, 2015) reports as one increases the velocity of transactions,

risks involved in the transactions such as fraud, money laundering etc. also increase, acting as deterrence to such increase in velocity of transactions. Further, manual interventions involved in the transactions processing at payment gateways, financial institutions (banks) and payment system operators create hindrance to seamless payment experience (Horowitz, 2018). A study of payment systems and applications used globally (RBI, Payment and Settlement Systems and Information Technology, 2018)(BIS(RedBook), 2011) indicates that many countries have adopted straight-through-processing (STP) through standardized e-payment models, based on messaging formats such as ISO 20022. Such STP is based on pre-defined business

rules and may not always fetch the optimum results in terms of turn-around time and cost involved in the dynamic environment.

As per Autonomous Next research(BII, 2019), the aggregate potential cost savings for banks from AI applications is estimated to be USD 447 billion by 2023 and it is also expected that there would be potential savings of 20 to 25% across IT operations, including infrastructure, maintenance and development costs (Roy, 2018).

II. METHODOLOGY

The findings of the paper are drawn from review of literature and interviews / in depth discussions held with industry experts.

The review of literature was conducted on topics below:

- Major Payment Systems across the globe such as Indian Real Time Gross Settlement System (RTGS), Immediate Payment System (IMPS), USA Clearing House Interbank Payments System (CHIPS), Canadian Large Value Transfer System (LVTS), TARGET2 in Single Euro Payment Area
- Artificial Intelligence (AI) and Machine Learning (ML) concepts
- Application of AI in payments processing
- Current scenario with respect to implementation of AI in payments industry.

Based on the findings in the literature review, 12 experts in the field of payments and related technology working with international banks and multinational companies were interviewed to understand their views and opinion on the current trends in payment industry using AI. Further, the possible use of AI using payments data was explored through in-depth interview and discussion.

Based on the same, in this paper, authors study various opportunities and use-cases applying Artificial Intelligence (AI) in the global payment industry and explore the possible areas where AI can be adopted.

III. AI FOR REGULATORY COMPLIANCE AND FRAUD MANAGEMENT

Currently, financial institutions face a high amount compliance cost across the globe. Anti-Money Laundering and Countering Financing of Terrorism (AML/CFT) are one of such regulations which are applicable across the globe. Further, financial institutions have to suffer huge financial losses due to fraudulent transactions. (Betron, 2012). AI is being adopted in these areas to comply with AML-CFT regulations and prevent and detect frauds as follows:

Identifying money laundering and terrorism financing transactions: As per recommendations of Financial Action Task Force (FATF, 2012) and applicable banking regulations, banks across the globe are required to identify money laundering (ML) and terrorism financing (TF) transactions. Such transactions are usually identified based known topologies of ML and TF, identifying unusual transactions and identifying multiple linked transactions. Further, various entities such as United Nations, Office of Foreign Asset Control (OFAC), banking regulators of a country publish list of sanctioned entities (individuals, corporates, vessels used for shipment etc.) who are involved in money laundering or terrorism financing transactions. Every financial institution is required to ensure that transactions involving such sanctioned entities are not processed. Considering the speed with which transactions get processed in current banking environment, it may be impossible to screen all the transactions manually and identify potential money laundering and terrorism financing transactions. Experts in the field of Anti-Money Laundering regulation stated that “The speed of the payment transactions across the globe has left us vulnerable to acts of money laundering and financing of terrorism. It is crucial that the financial as well as non-financial institutions take adequate measures to identify such activities. However, a manual tracking of the same is not possible and hence there is a need for institutions to monitor the transactions through the use of algorithms or neural networks.”

It is expected that the use of technology can reduce approximately 30% of time and cost as compared to

manual approach of AML investigation (Han, et al., 2015). Many banks use applications for identifying such transactions. The applications identify potential money laundering and terrorism financing transactions and highlight the same for further manual investigation. Although many of these applications depend upon pre-defined business rules, certain applications such as FICO and Pelican applications leverage upon AI capability to continuously improve results. AI allows application to build profile of customer based on historical data, peer customer data and build logical entities and identify potential threats (Deloitte, 2018). This capability allows these applications to adapt to ever changing topologies of money laundering and terrorism financing.

With respect to sanction screening, name of an entity is one of the main fields to be matched against the sanctioned entity. However, additional information (such as address) may be used to confirm the case to reduce false positives. Applications supported by Artificial Intelligence can be trained to capture relevant information from the structured payment messages as well as scanned documents and match against the sanction list. Institutions such as Pelican have deployed Natural Language Processing (NLP), Intelligent optical Character Recognition (ICR) and Machine Learning (ML) for sanctions screening which is said to have resulted in 75% reduction in false positives (Fintech Futures, 2020).

Preventing and detecting payment frauds: Online payment frauds are on the rise with the advent of newer technology. When it comes to real-time payments, every step of the transaction, including fraud detection, must be completed within seconds. Therefore, prevention and detection of such payment frauds is critical. In the view of a senior bank auditor, “Financial institutions can address the challenge of payment frauds by leveraging the machine learning and artificial intelligence (AI) technologies. Data analytics using AI can help in preventing crimes. The intervention of technology partners in this aspect becomes advantageous and helps prevent fraudulent transactions.”

Similar to anti-money laundering applications stated earlier, banks use applications to identify potential fraudulent payments. There are various studies

available on detection of fraud using various algorithms and techniques listed below (See table 1 below):

Table 1: Use of AI techniques for fraud prevention and detection

Technique	Paper
Decision trees	(Popat & Chaudhary, 2018)(Mubalaike & Adali, 2017)
Naïve Bayes	(Popat & Chaudhary, 2018)(Mubalaike & Adali, 2017)(Charleonnann, 2016)
Artificial Neural Networks	(Mubalaike & Adali, 2017)
Deep learning	(Popat & Chaudhary, 2018)
Logistic Regression	(Popat & Chaudhary, 2018)
Fuzzy logic-based system	(Popat & Chaudhary, 2018)
K Nearest Neighbor	(Popat & Chaudhary, 2018)
Deep Reinforcement Learning	(El Bouchti, Chakroun, Abbar, & Okar, 2017)

Bank fraud detection is possible with the use of data-mining techniques such as association, clustering, forecasting, and classification. These techniques can be used to analyze the customer data in order to identify the patterns and

build customer profiles. These applications build customer profile in terms of various parameters of transactions such as day of a week, timing, average value, currency, types of beneficiaries etc. In case any outliers are found, the same are flagged off as potential fraudulent transactions. Many applications generate a 'risk score' for every transaction and in case such a risk score goes beyond a threshold, the same is red flagged. The application uses AI to build profile and identify patterns. These AI based techniques are adopted by industry giants like Citi Bank and VISA (Rykun, 2020).

Mr. Shaktikanta Das, Governor of Reserve Bank of India in his speech delivered at the Mint's Annual Banking Conclave on February 24, 2020 (RBI S. D., 2020) stated that "Artificial Intelligence (AI), Machine Learning (ML) and Big Data are becoming central to financial services innovation. They can also help in fraud detection and in identifying better ways of monitoring use of funds by borrowers, track suspicious transactions, etc. by processing large datasets".

IV. AI FOR OPTIMISING PAYMENT PROCESSING

A thorough literature review was conducted to understand the major payment systems across the globe such as Fedwire (USA), Clearing House Interbank Payment System (CHIPS -USA), Real Time Gross Settlement System (RTGS - India), Immediate Payment System (IMPS - India), Large Value Transfer System (LVTS - Canada), Artificial Intelligence concepts and its existing application in the banking sector.

In many countries, financial institutions / banks are the ultimate channels through which customers access payment systems. Each type of the system has its own risks and the financial institutions have to manage all the risks to avoid any failure. Further, financial institutions and banks are also participants in card payment processing systems like Visa, Mastercard, JCB.

Use cases for application of AI:

Liquidity / Collateral Management in Payment Systems

The financial institutions are required to maintain a balance in the accounts with settlement institution in order to settle inter-bank obligation. Further, few systems require financial institutions to pledge

collateral as a risk management measure (RBI D. o., 2017).

Systems which work on 'gross settlement' mode require higher liquidity, whereas systems that work on 'final settlement' and 'net settlement' mode allow participants (financial institutions) to operate with comparatively less liquidity requirements. Many payment systems provide different measures to optimize liquidity requirements. The examples of the same are provided below:

Indian Next Generation Real Time Gross Settlement (NG-RTGS): The system allows to define priority level for every outward payment message: "Urgent" and "Normal" and allows to re-sequence messages in order to optimize liquidity. A normal message can consumer only 10% of the balance available in the settlement account in the offsetting mode. Further, in order to make sure that other banks do not misuse liquidity bilateral and multilateral limits can be defined by every financial institution based on data analysis. Detailed information regarding the system can be found in RBI's circular on RTGS (RBI, New features in RTGS System, 2014).

Immediate Payment System (IMPS), India: In case of IMPS, net debit limit is granted based on collateral pledged by Financial Institutions with the system operator. The payment transactions can be done only if the amount is within the debit limit granted against the collateral (NPCI, 2019).

Clearing House Interbank Payments System (CHIPS), USA: Every participant can process payment by utilizing position granted against pre-funding – primary and supplemental (Position = Pre-funding Amount X System defined Multiple). In addition to primary pre-funding (where amount is determined by CHIPS system), system allows optional supplemental pre-funding and message priority classification. The message priority can be changed depending upon liquidity available in primary pre-funding channel and supplemental pre-funding channel. Further, the CHIPS system may change multiple as and when required. The financial institutions are required to adapt according. (CHIPS, 2018)

Large Value Transfer System (LVTS), Canada: Allows to process payments in two tranches. In

tranche I, a bank can send outward messages up to a limit granted to it (Net Tranche I Debit Cap). Such limit is granted based on amount of collateral pledged by the sending financial institution with Bank of Canada. In case of tranche II, such a limit (Net Tranche II Debit Cap) is granted by receiver of the payment. The receiver of the payment is required to pledge collateral for tranche II. The receiver can also determine a bilateral limit against the same.(CPA, 2015)

In nutshell, there are various dynamics which have to be monitored by financial institutions for smooth functioning of payments processing. In order to process every payment without any resistance, a financial institution may choose to operate using high level of liquidity or high amount of collateral. In such cases, cost of operations increases significantly. It is nearly impossible to optimize all such dynamics with manual intervention. Software applications working on business rules cannot handle adapt itself to dynamic environment (volume and value of transactions initiated by customers will change every day).One of the interviewees stated, “Managing liquidity at optimum cost is one of the major challenges faced by any financial institution. Since it is simultaneously participating in multiple payment systems across the globe. Deploying AI for management of AI is a savior for the treasury team as they can predict the cash requirement in advance and manage funds at optimum cost.”

Artificial Intelligence can be applied to analyze historical transactions.Predictive analytics can be used to ascertain optimum liquidity and collateral requirement(Kumar & Kothari, 2018). Optimization models can be developed to reduce costs of processing payments. This shall be beneficial to ascertain the optimum liquidity and collateral requirement and identification and management of subsequent shortfalls.

According to a research conducted in Canada, Payment Market Infrastructures (payment system operators) have holistic view of all the participants. This provides the ability to analyze the data to a much larger extent than a financial institution can individually do. This is likely to increase the accuracy of predictions (Ward, Mehta, Arjani, & Bewaji, 2019).

V. AI FOR CUSTOMER SERVICE

Parameters of customer service have undergone tremendous change with the advancement of technology. Banks focus on investing in technologies that allow them to provide better customer service at a reduced cost (Aliyu & Tasmin, 2012). AI is not an exception to this as banks try to improve customer service at a lower cost using AI.For the purpose of this paper, the authors define the term ‘customer’ as end-customers of banks who use digital payment systems for paying or receiving money. The term includes both retail as well as corporate customers. Since the types of payment services differ depending upon of type of customers, the studyis further sub-classified:

1. From retail banking perspective:

Introduction: These customers mainly include individuals and small business but exclude large corporates. These are generally high volume low value payments. These payments include person to person / account (P2P / P2A), person to merchant (P2M), person to government (P2G). The digital payment channels used for these payments include:

- Cards (ATM, debit, credit and prepaid) used at:
- Card present: Automated Teller Machines (ATM) or Point-of-Sale (POS),
- Card not present: E-commerce websites and Mail Order Telephone Order (MOTO)
- E-wallets
- Unified Payment Interface (in India only - BHIM, Google Pay, PhonePe etc.)
- Internet Banking

In case of P2M and P2G, these payment channels may be provided through payment aggregators and payment gateways. Using these channels, users mainly access card systems and instant payment systems. For high value payments, these users may also access High Value Payment Systems (HVPS). In retail banking area, the use-cases of AI are as below:

Chat-bots

Banks maintain customer care centers to support customer transactions. Many such centers operate 24

x 7 to provide continuous support and in certain cases, such as reporting fraudulent transactions, blocking credit / debit cards, the same is essential. Currently, such centers are operated manually and involve huge operating costs. Chat-bots are applications that can chat with human being in natural language using AI (Doherty & Curran, 2019)(Shanthi, 2020).

The chat-bots use AI algorithm and create an impression as if a customer is interacting with human on other side (Rykun, 2020). Although customer support centers may not be fully replaced by chat-bots, chat-bots can save a lot of manpower and operations cost. Research has been conducted on factors influencing millennial's technology acceptance of chatbot in the banking industry and it was observed that factors such as innovation, usefulness, ease of use of chatbot affect the behavioral intention of users. According an analysis conducted by Juniper Research Analysis (Zirkle, 2019), banks can save USD 7.3 Billion by 2023 from USD 209 Million in 2019 with the use of chat-bots. In terms of man-hours, 862 million man-hours can be saved by implementing chat-bots.

The head of a global financial institution stated that "Use of AI allows the customers with an exceptional experience when it comes to looking for data in a large repository. Instead of navigating through multiple sources, customers can get the required data by using a simple messenger i.e. chat bot and save their time and efforts."

Analysis of payments:

Many retail consumers do not keep their books of account. Consequently, they are unable to track and monitor their payments. Using artificial intelligence, financial institutions can analyze receipts and payments to generate insights regarding receipt and spending patterns. Further, it may provide recommendations to users. A fin-tech start-up has developed an application that learns about financial habits (patterns) and financial objectives of the customer and acts as a financial assistant (Trotman, 2020).

Managing direct debits:

In case of pull transactions such as debit of Equated Monthly Installments (EMI), mutual fund

Systematic Investment Plan (SIP), pre-approved billers, beneficiary of amount initiates the transaction and pulls money from payer's account. In such cases, it is customary (though not mandatory) for beneficiary to send a pre-notification to the payer. A Spanish bank has implemented an AI based application for managing such direct debits. Even if the beneficiary does not send pre-notification, payer's bank can send a pre-notification based on transaction history of an account holder. The AI based application also notifies consumer in case the account does not have sufficient balance. In case consumer is still unable to maintain sufficient balance, the application notifies banking advisor of the consumer and allows to permit bill payment by lending funds or delay debit for few days or reject it. It is estimated that such an AI based application is expected to save 82,000 hours of work. (Kolostyak, 2020).

In the view of an industry expert working with a multinational bank, "Direct debits are manifestation of recurring income for businesses. If the direct debit systems deploy AI and increase the success rate, it will be very useful for businesses to manage cash flow".

Suggesting preferred payment method through gateway

Users determine their method of payment considering various factors such as transaction value, type of merchant, ease of use, rewards or cashbacks, perceived risk of fraud, applicable charges etc. The preferences also change based on demographics of the user (Dharurkar & Raman, 2019).

One of the industry experts stated that "Although use of AI as a tool for intelligent payment intermediation appears to be a small enhancement in the entire payment chain, this can become a great tool for targeted marketing. However, there is a need to aggregate the data from various gateways to make the analysis more comprehensive."

From Corporate banking perspective:

Introduction: These customers exchange high value payments. These could be from one corporate to another corporate (B2B) or from one corporate to

consumers (B2C). These customers mainly use High Value Payment Systems (HVPS) or bulk payment systems (Automated Clearing House – ACH). Further, these customers frequently undertake foreign exchange transactions involving multiple banks in a payment chain. They also have relationship with banking consortiums wherein multiple banks provide services to a single corporate and one of the banks acts as a lead banker. Many a times, lead bank is also designated a single point of contact by the corporate.

Use cases for application of AI:

Choosing method of payment

A corporate instructing a payment may only have information about beneficiary's bank account details. However, it may not have details about the method of payment to be chosen and other financial institutions to be chosen in the payment chain to complete the transaction (payment path). In such cases, available details in payment message with respect to transaction priority, currency, value date, beneficiary's financial institution, charge bearer can be considered for determining the payment method and payment path to be taken. Each method and path will result in to different turn-around time, costs and risks. Using artificial intelligence, customer's requirements can be matched with the best possible payment method and payment path.

Choosing optimum bank out of consortium

As stated in above paragraph, a corporate may have a relationship with consortium of banks. For a given transaction, corporate uses one of the banks depending upon rates offered and average turn-around time. Generally, such decision is made by Finance / Treasury department of the corporate on the basis of past experience. Lead bank can develop an AI based platform within consortium wherein a corporate can be advised best-suitable bank for the required service based on turn-around time for previous transactions and existing cost / rate.

From Bank's own perspective

Introduction: In addition to corporate and retail payments, bank also needs to manage its own account payments in the areas of investments, foreign exchange, cash liquidity management.

Use cases for application of AI:

Execution of cover payments for exchange risk management

In the view of one of the payment professionals, "As a treasury head of a bank, we need to manage the exchange rate risk by way of entering into cover transactions. Deployment of AI can help us to take adequate covers at appropriate and minimize the risk with optimum cost."

Hedging of investments, currency and derivatives positions

The use of AI can result in deciding strategy for hedging of investments, currency and derivatives. According to the Treasury Head of a financial institution, hedging of positions becomes important in view of current dynamic environment such as COVID-19.

VI. POTENTIAL USE CASES FOR APPLICATION OF AI

In addition to above use cases of AI in payments industry, the authors try to explore the potential areas for application of AI.

Intelligent analytics of payment messages:

The financial institutions exchange structured payment messages with corporates, other financial institutions and clearing houses. Every payment system defines its own format of payment messages. As far cross border transactions are concerned, message formats defined by Society for World-wide International Financial Telecommunication (SWIFT) are mainly used. Further, major payment systems in the world have decided to adopt ISO 20022 based messaging format by the year 2025 (SWIFT, 2020). Post 2025, the same will be adopted for cross border payments as well. Refer figure 1 below for the timeline for implementation of ISO20022.

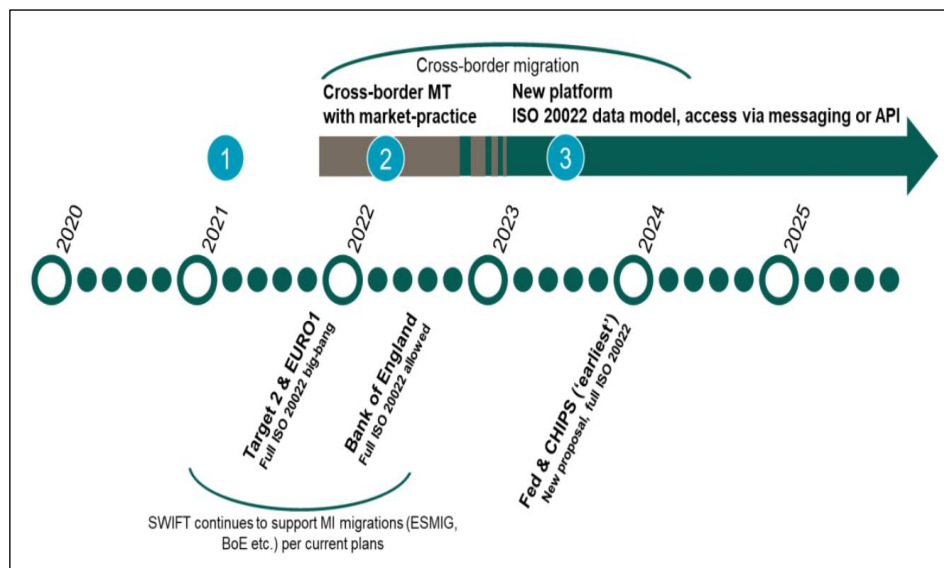


Figure 1: Timeline for global implementation of ISO20022

Source: Society for Worldwide Interbank Financial Telecommunication

New payment systems such as RTP in USA, SEPA Instant in SEPA are already using ISO 20022 messaging format. Such ISO 20022 messages have granular field structures which enable accurate data capturing and analysis to a greater extent as compared with other messaging formats. Data from such payment messages can be used as follows:

Opportunities for cross-selling: Many a times, payment messages initiated by corporates contain details of purpose of remittance. The payment messages may also contain details of invoices and trade finance instruments (letter of credit, bill collection etc.). Automated analysis of such data may allow a financial institution to offer additional trade services to parties involved in the transaction.

Intelligent stand-in processing in card payments: Whenever a card payment is initiated, acquirer of the card (acquirer) sends payment authorization request to card issuing financial institution (issuer). Issuer authorizes a transaction if it finds that card being used is genuine, cardholder initiating the transaction is genuine and the cardholder has adequate balance or credit limit available. Once the issuer authorizes the transaction, the same is processed. The acquirers and issuers are connected through interconnects like Visa, Mastercard or RuPay.

In case link between interconnect and issuer is lost, issuer would not be able to authorize a payment request. In such cases, issuer may authorize interconnect to approve / reject payment request based on certain business rules. Such business rules are common across a serial of cardholder. In other words, the same are not personalized to every cardholder. The rule-based processing may be replaced by an intelligent decision making. An interconnect may build analyze historical transaction patterns of a particular cardholder and decide individually in each and every case.

CONCLUSION

The study of above use-cases can be summarized to conclude that AI can be game-changer for financial institutions as far as payments industry is concerned. Although, commercially implemented use-cases of AI are limited, it has a potential to replace all those software applications which currently function based on static business rules. Although such rules can be reviewed and revised, AI possesses power to revise such rules on its own with a greater frequency.

Expected Benefits of Study

The study is expected to benefit financial institutions and FinTech companies in AI domain in terms implementation of use-cases using AI. Also, financial institutions can determine their focus on AI while developing their digital road-map.

LIMITATIONS

The authors explore the use-cases for application of AI in payments based literature review and analysis of payments industry.

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