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Transforming Money Transfers and Financial Inclusion: The Impact of AI-Powered Risk Mitigation and Deep Learning-Based Fraud Prevention in Cross-Border Transactions

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This research examines two transformative technologies entering the world of cross-border money transfers: the first helps to perform compliance checks in a more sophisticated way (with more effective risk mitigation), and the second technology dramatically enhances AI's ability to stop scams (a deeper capacity for fraud prevention). Rather than organizations optimizing transaction speed, prices, and execution/correspondent banking fees, the research asks what might happen if AI is first and foremost deployed to guarantee security and eliminate or at least reduce social risk exposure for vulnerable stakeholders in a less well-served area. Reducing the 'hassle factor' of use to avoid fraud is an invaluable resource in the accessibility game – there is a combination of people who are simply excluded because they have a very low capacity to pay for adherence to the compliance regime as it stands, a group who don't use it because of the wonkiness explained by fraud, and a group who don't use it because of general cost/financial efficiency. The work here provides critical evidence of how AI increases customer safety and security, between orders of magnitude on key metrics derived from the global legal quiver of financial engagement, significant for the state's security concerns proceeding through two fundamental 'filters' – and relating them to significant real-world phenomena in financial services and cross-border money remittances. Two large creative leaps – this research measures sociological effects of both orders of magnitude convenience efficiency increases, financial services making money from the 'in-betweens' of far cheaper compliance at much higher pricing, and financial sector development advancing the empowerment by and incidence of wealth remittance inflows. As a primary interest for central banks and the UN is financial stability and the primacy of an enabling landscape for financial services and its possible products, domestic and international money remittances via the formal banking system/projects are key to the ends of financial inclusion and economic development. Troublingly, the SDGs and a host of industry and national financial inclusion, as well as scaling—all indicate on the empirical side that no matter how cheap you make it in convenience terms, there are intransigent non-users who are not reachable with efforts to drive down the cost of sending below the global baseline at 4.07% of the fee, nor are the senders interested in different offerings or added value of any normative kind.

Keywords: Cross-Border Money Transfers, Compliance Checks, Risk Mitigation, Fraud Prevention, AI Security, Social Risk Exposure, Financial Accessibility, Compliance Costs, Transaction Efficiency, Customer Safety, Financial Services, Money Remittances, Wealth Inflows, Financial Inclusion, Economic Development, Central Banks, Regulatory Compliance, Financial

Stability, UN Goals, Non-User Intransigence.

1. Introduction

The volume of global money flows has shown vigorous growth over the last few decades. A steadily increasing share of money is transferred across borders, driven by cost-reducing opportunities in developed countries and adaptive pressure towards formal international transfers due to increasingly effective anti-money laundering and counter-terrorist financing regulatory regimes. International remittances are a crucial means of financial inclusion for the world's poorest, who, often on account of forced migration, work under the table and live in cash-based societies. Unbankedness is most pronounced in sub-Saharan Africa, which has a 16% banking penetration rate and an enormous growth potential given that there are only two mobile money companies present in the top 20 largest economies. However, these cross-border transactions alone require significant trade finance by themselves, which this study will consider. Though it is in the poorest regions with the fewest digital footprints where transactional data is scant, perhaps limiting some elements of this study and with its implications for money laundering risk, though less significant for trade finance.

The growth in international transfers, coupled with an increasingly risk-averse financial landscape, has attracted illicit money and made international payments more difficult for genuine actors. False-positive friction is created to ensure that reserve banks and other financial institutions adhere to policies that ensure only income that does not contribute to money laundering, tax evasion, or sanctions busting crosses borders. In this study, we offer a glimpse into where transactions may be heading. The use of leading artificial intelligence and information technology on live money flows could automatically cut the risk of receiving party defaults for risk-mitigation services from the present available under existing services down to a lower percentage. Mitigating possible launderer defaults or trade buyer defaults could be lower yet if administrative costs were not prohibitive. Cutting down the purchaser's unbilled amount from one would expect business to cut without access to external services to a lower percentage, or cutting it to zero without the customers going through significant manual work. Furthermore, fraud stories in the trade and remittance spaces suggest that new fraud patterns are being observed. Even with the growing popularity of mobile money, in East Africa in particular, new channels and remitter trends are worth monitoring. In this paper, we analyze historical data, explore how global transactions are developing, and anticipate future input in light of global trends.

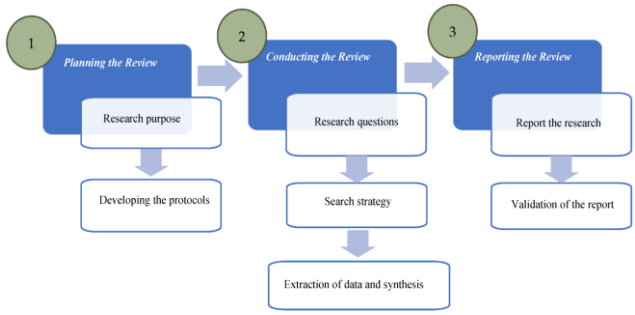

Fig 1 : Financial Fraud Detection Based on Machine Learning

1.1. Background and Significance

XTech solutions to transfer money cross-border are built in the latest two decades from scratch, following the development of the modern financial system and the disrupted e-money. However, financial development has not been even across the world. Existing imbalances, particularly in the global payment systems, make cross-border transactions more likely to be considered for inappropriate supervision and controls. There is thus a need for innovative solutions that can improve the quality of supervision and differentiate between groups of transactions that require closer attention and those that can be fast-tracked across international transactions to foster economic integration and globalization.

One of the rationales of financial technology lies in that it bridges gaps in service delivery due to existing institutional constraints and legal coverage. From the supervisory perspective, the relevance of the use of digital technologies to combat money laundering and terrorist financing can hardly be overemphasized. Ongoing technological advancements in artificial intelligence (AI) and data science come with the potential to overcome the limitations of conventional transaction monitoring systems and surveillance data. In particular, this paper takes an interest in exploring the impact of two specifically AI-based risk analytic methods, including an AI-powered risk mitigation tool and deep learning-based fraud prevention techniques, for the value-added potential of money transfer services. The next sections outline the relevance of AI-empowered counteractive measures within the context of money services businesses provide theoretical background and discuss related literature on AI deploying transaction risk management and risk-control frameworks. In conclusion, AI modules contribute significantly to the expansion of financial services and in general improve non-discriminatory financial inclusion policy across the unbanked population.

Equation 1 : Risk Mitigation Equation: $$R_{\text{new}} = R_{\text{old}} - \alpha \cdot \text{AI}_{\text{risk}}$$

R_{new}: New risk level after AI intervention.

R_{old}: Original risk level.

α: Effectiveness factor of AI in reducing risk.

AI_{risk}: AI-powered risk mitigation capability.

1.2. Research Aim and Objectives

This research paper explores the latest technological developments that are expected to have a significant impact on money transfer operations and financial inclusion. In particular, the impact of existing solutions based on AI-powered risk mitigation and deep learning-based fraud prevention in cross-border transactions is considered. Therefore, the main aim of this study is to gauge the impact of AI and deep learning-based payment protection on financial inclusion and how such solutions could aid in fostering market expansion. Objectives towards the ultimate goal are proposed: 1) to assess the effectiveness of AI-powered risk mitigation in retail cross-border money transfers; 2) to gauge the effectiveness of AI and deep learning in retail cross-border transactions fraud prevention; 3) to determine the application scope for such technological solutions, and 4) to gauge the impact of current regulatory initiatives and

legislation for providing these technologies. Given the existing preferences of the targeted population studied, reaching the research objectives would empower global money transfer providers to optimize products and become more competitive, thereby serving the broader aim of exploring financial inclusion in the context of the global remittances industry.

The cross-border retail money transfer sector is key for the remittance industry given its potential to provide financial inclusion solutions. The global applicable Sustainable Development Goal and national development plans aimed at financial inclusion underpin this position. Yet this sector faces high regulatory barriers to expansion due to low regulatory tolerance levels for error in the financial cold chain. Geographic coverage development is important to further open up the sector yet will exacerbate unmanageable risk levels when user-friendly trading interfaces that are not hindered by excessive anti-money laundering controls are used. It is therefore timely to examine how two core functions of the risk management requirement for this sector, in turn impacting inclusion, can be made more secure and effective: that risk mitigation and fraud/misuse prevention. Hence, the following research questions are addressed in depth within the paper.

2. The Evolution of Money Transfers and Financial Inclusion

Money transfer systems have universally existed in almost every culture and region throughout human history. Historically, settlements between long-distance traders have required services to facilitate the secure and efficient movement and exchange of value. Over the years, the payments sector has adapted and embraced new technology to replace these old intermediaries with faster and more efficient methods of making payments to friends and family back home.

As a result of economic and social drivers, how money transfers are sent and received is rapidly changing. In some cases, people are transferring larger amounts to support migrants unable to return to their home countries due to the pandemic. Financial inclusion historically has had a strong emphasis on global development principles, where the underpinning premise is that equitable access to basic financial services and education can have significant positive effects, especially in impoverished or remote areas. The potential of modern financial technologies and the Internet provides an ever-increasing suite and sophistication of services that can be used to send and receive money within a domestic and global market. Tools such as mobile phone applications, mobile wallets, or digital remittance companies that use unique financial management platforms and user-centric interfaces are currently being developed and adopted even in those regions previously excluded from financial services. 'Leapfrogging' traditional technologies such as banking institutions and pursuing these modern financial applications is seen as an effective avenue to further inclusion. As opposed to dismantling banks, regions that go down this path tackle financial inclusion through technology that also has an efficiency advantage. Banking the previously unbanked can be transformative not just for communities but for the individual as well. Lone parents and women in developing countries are some of the worst affected, for example, if they are excluded from financial transactions and use payments that are less secure and less efficient. By banking and promoting digital and financial literacy, fraud directly targeting them is also reduced, and in turn, the safety and security of women and children will increase as the improvements go hand in hand.

However, despite our increased connectedness to each other as well as our rapid technological progression, there remain significant barriers to identifying a truly cashless society. For example, despite the increased access conducted through banking infrastructure, the digital divide is very real. The relatively 'unbanked' or 'underbanked' in the more informal sectors of an economy straddle two worlds: an informal world using cash and mobile money, and the more formal world where credit cards are issued, but significant online banking is also required. Those using cash are hard to 'bank'. For example, it is the very poor who may not have adequate identity documentation, fixed-line telecommunications, or addresses to enable them to gain access to banking services. Even when a broad policy framework that includes and draws on private sector innovation to improve financial outcomes is probably necessary in an era of widening inequality and structural barriers. Moreover, innovation may not necessarily mean 'informal' access when digital technology is changing how both public and private sectors operate.

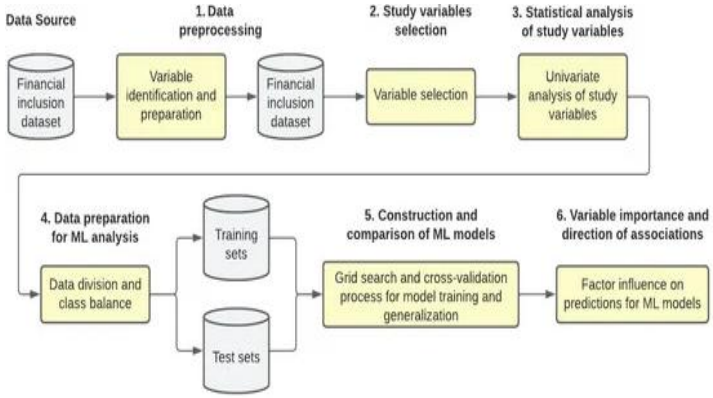

Fig 2 : Predicting Financial Inclusion in Peru

2.1. Historical Overview of Money Transfer Systems

Systems for transferring funds are as old as the economy and commerce itself. In ancient times, barter was the most preferred method for exchanging monetary items. With increasing financial complexity, the convenience of store-of-value coins inevitably found favor, making cash the most convenient method for settling any outstanding obligations. The currencies or fiat issued by the respective regional central authorities reinforce the idea that the instruments are fungible, thus making a defined measurable standard accepted by the community. From the days of carrying around large quantities of coins issued by local and regional authorities, the prevalence of monetary equivalents has constantly evolved from improved kitchen-table rates, improved access to ensure local availability of goods and services, to simple centralized points to extend the trade options in today's electronic community. The electronic funds transfer method using machine-readable bank cards was derived from the vital need to speed up transactions. ATMs, which essentially automate the teller, provide 24/7 access to funding services, with Point-of-Sales terminals and online banking ensuring the reach of e-banking into the home. While offering valid alternatives for merchants and shoppers, the explosion of wired and wireless computers, the birth of e-commerce, and corresponding electronic mechanisms call for effective and fundamental change to embrace today's free-flowing information economy. Electronic money transfer systems are an evolution of centuries of

monetary systems development that may serve as a guide or model for a future truly widely accepted payment recording system, beyond the frontiers of one national legal system. International regulation - or rather, the lack of it - offers more living proof that modern governments follow modern money. Major leaps in the modern world as we know it have been the rise of the financial system and the increasing trend in globalization. Given the unparalleled social, human, and economic interaction, globalization drives, the most significant and clear growth in this context is that of the world's banking institutions. National financial systems have developed to the point of being the world's financial system, attracting the world's best. Focusing on the core banking business, they have plenty of global opportunities to cater to and capitalize on. Cross-border transactions have grown significantly, both in terms of value and, more importantly, in frequency. There are over US $5 trillion a year in cross-border transactions. The most recent information shows that nearly 33 million transactions, averaging US $6 trillion a day, are shifted on the banks connected to the network. There is an urgent necessity to have a completely new, technologically advanced risk-handling process, given the rapid increase in globalization and trade. This is increasingly facilitated by effective electronic-based payment and settlement mechanisms. This is where AI has a robust role in improving our current international money transfer mechanism.

2.2. Importance of Financial Inclusion in Cross-Border Transactions

Economic stability and sustainable economic growth are important for poverty reduction. Development and stability, in turn, benefit from financial flows in the form of foreign direct investments, foreign portfolio investments, remittances, and aid. Financial services can make or break business transactions and strongly influence local economies. Financial services enable people and businesses to make investments, manage cash flows, and save money and assets. This passage highlights the importance of offering high-quality and available services like business transactions and financial flows to ensure economic stability and growth. Benefits extend to improvements in and support of local economies as well. By offering access to financial services, an institution can facilitate raising living standards in marginalized communities. Prosperity in local economies can be expected once the underbanked and unbanked have access to robust financial services and relationships that may stimulate cross-border transactions and economic development.

The main deterrent for the unbanked is the fees associated with creating and maintaining a bank account and the lack of sufficient funds needed to open an account. The unbanked believe that banks are only for rich people and do not consider that they must have some form of a banking relationship to receive funds from the government for child support, social security checks, etc. This is where the unbanked may need to be contacted by banks and solicited to create an affordable and manageable account. A report on financial inclusion in Somalia highlighted three major categories of reasons why Somalis are either underbanked or unbanked. These barriers are the very thing that financial inclusion hopes to outgrow going into the later part of 2020 and beyond. The prohibitive fees for bank accounts and money remittances are first among the barriers to financial access by the Somali population. Money transfers from foreign workers as well as remittances from Somalia were cited as expensive and problematic due to the lack of a stable banking system within Somalia. Also, remittances to Somalia go unfunded for more purchases given the costly fees. The adaptability of ATMs among Somalis was not sufficiently advanced enough to make these a profitable, affordable,

and viable banking option and mobile phones offered little banking support.

3. AI-Powered Risk Mitigation in Cross-Border Transactions

Artificial Intelligence (AI) can be described as algorithms that enable centers of computer processing to simulate certain activities of the human mind or decision-making processes. Today, it can know, comprehend, and conclude—usually suggesting solutions that comprise possible replacements whenever faults arise. Said solutions may be resolved and embraced by people who monitor the system. Moreover, ideally, AI technologies can consider the transaction along with the risk assessment result and can suggest how they should be revised. They can also predict how financial and non-financial regulators might change regulations, combined with how industry participants could adjust their risk thresholds.

The components that makeup AI include machine learning. Machine learning is the most important component of AI. Using machine learning, even a modest volume of unusual data can be identified in a large volume of data using training software to monitor and analyze corresponding data over an extended period, which further instructs it to pinpoint and report. Machine learning in cross-border transfer risk management systems can contribute to the development of advanced predictive analytics. Like man-made brains, AI systems learn on the go. Once a new set of facts has been fed into the system and risk metrics and thresholds are continuously updated, it will provide real-time warnings if risk levels rise above an acceptable range.

The potential of AI in cross-border transactions has been lauded by several financial services stakeholders not only because it enhances the security of such transactions, but it also maintains the convenience of executing them. For instance, AI models can detect fraudulent activity in a fraction of a second, whereas traditional AML models take hours. In this respect, AI in cross-border transactions can also follow emerging trends and not wait for KYC guidelines or AML screen updates before it can recognize compliance risks and propose more sophisticated transaction monitoring. More specifically, many secretive activities go undetected until many years after the event. We understand that criminals can move money through an average of 11 or more financial transactions over two years without being detected by traditional AML solutions.

Fig 3 : AI in Financial Fraud Detection

3.1. Definition and Components of AI in Risk Mitigation

Definition and Components of Artificial Intelligence in Risk Mitigation Artificial Intelligence (AI) is the use of algorithms to make a computer system carry out decisions in a way that they

classify, evaluate alternatives, and forecast the consequences of each alternative. Based on the learning method, we can classify AI approaches into two broad categories: heuristic-based AI and learning-based AI. An additional feature of AI is that data processing capabilities, data quality, data variety, and data structure can have a significant effect on the performance of an AI system while data is in the form of records, documents, images, sound, and statements in natural and formal languages. AI technology can be used to solve tasks specific to the financial services sector related to the assessment and consideration of various risk factors. Many software solutions based on AI and neural networks are used in credit scoring, fraud detection for online payments, and risk management. AI has proven to be a more accurate and economical decision-support system to complement or replace traditional risk assessment methods. Neural networks, for example, have also been applied in different stages of the lending process, such as applicants' creditworthiness assessment and cash flow estimation. Other technologies, such as decision trees, have proved to possess adequate classifier properties for detecting fraudulent loan applications. Models and variants of deep learning have also provided superior results in this domain. However, certain challenges are vitally important in the course of integrating AI technologies within the existing risk management and fraud detection frameworks. AI requires a profound knowledge of transactional patterns of known fraud cases, which are often not available. When applied in finance, doubts may arise concerning the fairness of using risky personal attributes in loan granting. Apart from this, the act of processing financial data is also ethically challenging, given that financial institutions are legally and, more importantly, morally obliged to handle the monetary activities of their clients with the highest level of confidentiality. All of these indicate the continuous need for innovation in AI research and support services.

Equation 2 : Financial Inclusion Equation:

$$I_{\text{new}} = I_{\text{old}} + \delta \cdot (1 - R_{\text{new}}) \cdot (1 - F_{\text{new}})$$

I_{new}: New level of financial inclusion.

I_{old}: Original level of financial inclusion.

δ: Scaling factor for inclusion improvement.

R_{new}: Reduced risk level (from Equation 1).

F_{new}: Reduced fraud level (from Equation 2).

3.2. Applications of AI in Money Transfers

A large portion of this survey is devoted to the analysis of the practical applications and impact of AI-based risk mitigation and anti-fraud techniques in the area of money transfers. For instance, the possibility of reducing agent power by implementing an AI-based automation process that can carry out risk evaluations for agent networks in tandem with human managers is examined. There is also a brief mention of the possibility of enhanced customer verification. Various applications include the classification of transactions and the establishment of transactional patterns. AI is also useful in terms of customer services, complementing the other features available in Fintech.

In all cases, AI allows the development of algorithms that can perform the analysis tasks automatically. In doing so, in addition to the benefit associated with reduced processing time, another clear benefit is operational. For instance, the supervision of an average of 70 licensees per examiner is noted. Therefore, a significant percentage of respondents state that they use such tools as a way of overcoming examiner staffing limitations. An AI platform is also able to learn new ways to profile transactions and can evolve as threats evolve. It can also process vast amounts of data from many different sources, way above the threshold at which most humans can assimilate. However, while AI can be used to spot potential red flags and assist in investigations, there is a risk of over-reliance on such systems. Moreover, their underlying complex algorithms may be considered to be a "black box," in the sense that it can be difficult to ascertain the decision-making process. On the other hand, across different financial sectors, AI and related technologies also raise legitimate privacy concerns, given their omnipresent collection and potential use of digital data. It can also lead to biases and protection against discrimination and guarantee explainability. Thus, stringent international privacy and data protection regulations and guidelines must be reinforced, especially when considering systems that use AI and deep learning. While AI has the potential to significantly change and enhance money transfers.

4. Deep Learning-Based Fraud Prevention

Deep learning is a subfield of machine learning using artificial neural networks with multiple non-linear processing layers to automatically detect patterns in data representations. The strength of deep learning methods lies in pattern recognition and predictive analytics, especially under highly unstructured data of varying types and formats, and it has been widely employed in several use cases, including vision-based applications.

Deep learning applies to fraud detection, based on a wide representation of features derived from the history and behaviors of both legitimate and fraudulent activities. It offers considerable advanced capability over these heuristic-based rule engines in identifying suspicious behaviors, often undetectable by more conventional rule-based solutions. Deep learning algorithms have shown surprising effectiveness in identifying anomalous patterns within a wide variety of transaction types for a range of financial service institutions without requiring explicit or predetermined feature engineering. This solution has improved the model's fraud catch rate by 10% and has helped the organization save more than $700 million in potential losses. In a similar fraud use case, the same type of deep learning algorithms, with enhancements for managing sequential information, outperformed existing systems with a four-fold increase in fraud detection improvement.

4.1. Understanding Deep Learning and Its Applications

Deep learning is a powerful subset of machine learning defined by using stacked neural network architectures with many layers to learn hierarchical representations of data features. While deep learning uses the same learning algorithms as other machine learning methods, it also uses relatively unstructured representations. Deep learning systems learn directly from analyzing data, and the logic in data is used to provide a connection appearance, even if the developer cannot understand it. Deep learning has also been classified as an AI-based,

technology-driven approach that learns from data related to tasks, concepts, and discriminative properties. Unlike traditional machine learning methods, which use feature selection and definition to inform learning algorithms, deep learning models can learn and make accurate predictions from raw data, such as audio or images.

Deep learning has notable applications in the field of fraud detection, with a wide range of financial firms using this method to secure processes, transactions, and overall systems. While some firms are adopting deep learning to secure their systems from payment fraud, others are collaborating to deploy a machine learning-based approach that detects fraud by monitoring and understanding normal behavior. Some companies are using a patented fraud model to detect spending anomalies within transactions up to 90 days back. In healthcare, deep learning systems have been used to predict insurance and payment fraud by recognizing outlier groups within historical claim patterns better than traditional models. In trade finance, deep learning is used to map nodes and identify clusters to extract specific information from sets that span from a large data bus.

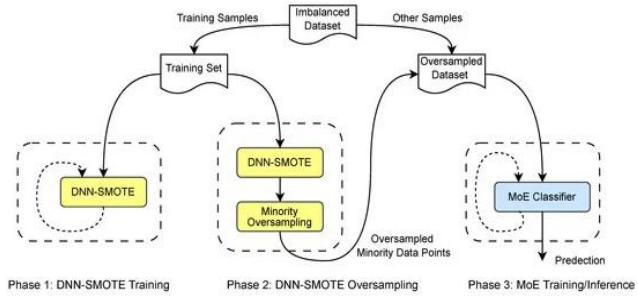

Fig 4 : Leveraging Mixture of Experts and Deep Learning-Based Data Rebalancing to Improve Credit Fraud

Deep learning models are particularly efficient at detecting anomalies in large data sets, as they are capable of discriminating between new data points that do not fit a sufficiently detailed, abstract representation of the input patterns. These human-like abstract representations give deep learning systems the ability to detect data point anomalies, which essentially represent new clusters or feature spaces that did not exist in the original training data. Over time, deep learning algorithms can improve their ability to discern which new clusters or features are irrelevant or relevant to the system by evaluating more data. However, using deep learning algorithms to empower a model for the particular task at hand also requires a substantial amount of computational processing power, a considerable volume of data, and the right data quality. This could be challenging if privacy protection is necessary and may require data manipulation before it is fed into the model to obfuscate key features.

4.2. Challenges and Opportunities in Fraud Prevention

Unknown to most customers, digital and financial systems running in the background of money transfers are hardcoded for fraud prevention methods. Every attempt to make a transaction crosses numerous digital checkpoints in a matter of seconds. While financial service providers strive to tailor their fraud detection systems to maximize robustness, some challenges arise with fraud prevention. The main challenge in creating robust financial systems is that these bad actors adapt and evolve fraud tactics over time as new technologies arise.

Furthermore, traditional strategies for spotting fraudulent actors tend to be late and change slowly enough to keep pace with a fast-moving digital system. Legacy models tend to be both rigid and cost an organization time and money, making any updates significant payoffs for fraudsters.

There is an opportunity to apply AI risks and fraud checks at every point of every transaction, to update the risk flags in real time based on innumerable data point flags available for each transaction, and to deepen and broaden the risk scoring systems used by companies about who and what to trust with cross-border transactions. Changing fraud detection capabilities also requires investment in fraud response to create real-time money transfer systems that do not fraudulently freeze the transfers that need to be executed quickly. Integrating cutting-edge technologies into legacy compliance and fraud detection systems is a pragmatic approach. Providers can either augment existing systems with external players within the system or build entirely new systems and reinvent the internal process. To do this requires an industry-wide solution in which all sectors and the different systems that govern them operate in synchrony rather than in competition with each other. The existing implementation of cutting-edge product taxonomies is specific solutions that also allow the building up of much better and more resilient strong AI systems. They are a useful method for instrumenting the metrics, products, and system dynamics that can then guide more powerful fraud checks in the AI era. A final pragmatic step is to tackle systemic weaknesses required for influencing fraud checks by using a taxonomy to change the incentives of the different participants in a network. While new threats and adversaries will continue to emerge, those challenges should also be seen as an opportunity to push the barriers in fraud prevention.

5. Case Studies and Real-World Applications

Operational Case Studies

Applications of AI in Money Transfers Applications of AI in Practice. In this section, we present case studies of how AI is being used in practice by multiple financial institutions around the world in developing markets, including banks, mobile network operators, and fintech platforms.

Transforming Money Transfers In these case studies, the proofs shown indicate the level of success of fraud prevention and the cost-benefit to financial institutions. We present several lessons from these case studies. Most importantly, driving technology innovation and adoption takes evidence of impact, and driving to success needs evidence-based practices. It is also clear from the case studies that there is a core to success that has focused on risk. The ability to do what "best" looks like, independent of current systems, was powerful guidance for organizations when providing advanced solutions that they had to believe would be successful. The case studies have also shown that impact can be measured in many ways, but there is a common denominator in how to be successful.

AI's social impact: financial inclusion How does this fit with financial inclusion? The presentations have shown that the prevention of news reports about fraudsters has a widespread impact on not only those businesses employing the fraudsters but also the growing number of digital financial services that touch many underserved populations, leaving them

with less money to work with and turning to other alternative methods. The applications are different as we have been able to come into five vastly different entities: two banks servicing very different markets and systems, one bank turned fintech provider in Kenya, founders of the mobile money service that has changed the face of fintech business on the African continent, a mobile banking joint venture in Madagascar, and the Filipino entity operating interchanges between various services.

5.1. Successful Implementations of AI in Money Transfers

Several implementations have been developed for altering the traditional bank process with AI, based on the same principal approach. At Inpay, they use AI to check the bank, downscaling the overall review of the day with a couple of simple questions. For a regional VR Bank in Germany, the AI had 79% accuracy, reducing human failure in manual checking by 25%. Furthermore, AI is used for checking the bookings for AquaScope, where they apply the control unit to several legal entities and can create a new AI model that is trained faster than if the professional had been taught according to the particularities of a business. Western Union explores the presented deep learning fraud model and is in the latest step of the implementation process after demonstrating the fraud reduction in a test environment and confirming that there was no data leakage to the unethical business supplier. Xpate, an Estonian fintech developing a B2B payments solution, has already applied several AI algorithms with success, including KNN, and intricate clustering, and reported that the accuracy of the transfer contracts' validations could exceed 95%. These use cases are a clear illustration of AI applied to prevent fraud and ensure that risk is correctly managed; one could argue that these methods are applied in real money transactions.

Each of these cases demonstrates that it is possible to incorporate AI technologies as a tool that suggests what needs to be done: “It would be necessary to have an expert for the last approval, which can be checked traceably” or even “If people look at it (the results) in reality, they would say you are not just a tool; you are Superman”; they are compatible with M10. The machine learns features of the bank statements, comparing the metadata of the AI algorithm with a reference such as the SWIFT Rules or the standard. From banking to money transfer, the initial idea can be adopted for exchange control, as a money transfer model as proposed in the use case mentioned above. Considering the current technology, there is a real use case in the field of cross-border money transfers. However, some principles need to be discussed with the AI systems. AI is a special application of data processing, and its computation differs from traditional logical and mathematical operations. During an AI training process, many operations are completed within a very short period; therefore, the operation of AI technology comes with a cluster of potential results. This facet is yet to be researched and addressed effectively to ensure the smooth facilitation of the industry. It is important to have further discussions concerning AI, fraud, data, transactions, and compliance, as it is already clear that AI has to ensure adaptability according to market needs. This is especially timely given the ongoing pandemic, which makes the adaptation of financiers, criminals, and regulation very difficult. The pandemic will inevitably change the way we approach compliance in the future, and performances might shift based on different criteria. Furthermore, AI fraud risk could be developed and adapted to new markets. For example, it could be an alternative for card payments or in markets with less implemented anti-fraud measures. Based on these examples, it could be concluded that the implementation has shown its capability in five indicators:

validity, data availability, efficiency, effectiveness, and implementation cost. The money transfer industry needs to further adapt these technologies to ensure flawless processing of money while reducing fraud levels.

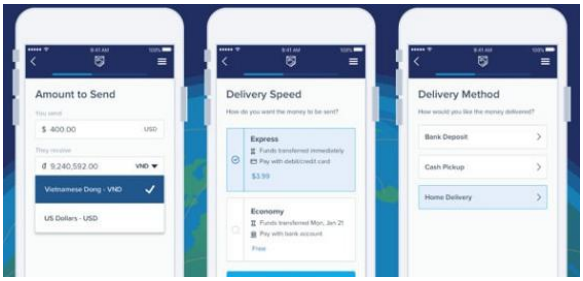

Fig 5 : AI in Money Transfers

5.2. Impact on Financial Inclusion

One key impact of AI-driven money transfer solutions is expanded financial inclusion. This is evident in the types of migrant families and members of previously underserved communities that innovative AI-based systems have been able to bank. One AI solution has made it possible for Nigerian nationals living in countries such as Benin, Togo, Ghana, Côte d'Ivoire, or The Gambia to open bank accounts with some Nigerian financial institutions. This was considered particularly remarkable because many people—especially in the ECOWAS sub-region—enabled by the solution had never visited Nigeria, making their first trip on the back of the bank account. AI transfers have also brought many of the dispersed and disconnected expatriates living in various communities in Karnataka, India, back to the financial system as customers.

AI is a powerful tool that enables significant reductions in cost and other barriers to accessing basic financial services that banks and other players may not be able to reach and deliver services to because of stringent compliance requirements. Free and simple value exchanges are fundamental to reducing poverty and uplifting humans. In much the same way that mobile phone technology has reduced the need for and deployment of fixed-line infrastructure, cutting across the cost of deploying telecommunication technology, the ability to receive money transfers and store these in a mobile phone wallet—and even pay for goods and services—reduces the transaction costs as well as the cost for service providers. AI finance and digital ID offer the promise of a secure, transparent, working cross-border money transfer network for hundreds of millions of underserved or unbanked end-users in a network that promotes inclusion, using technology friendly to all.

Similarly, the transformative value of cross-border transfers was explored, linked to insights based on user journeys and direct interviews with migrant workers from a diverse range of countries, many undocumented and without ID. These transfers can (i) help family members and migrants overcome financial setbacks and invest in their futures; (ii) create self-reliance in receiving remittances across borders; and (iii) be a catalyst that triggers the voluntary adoption by recipients of greater financial literacy and inclusion, in some cases accessing bank accounts and providing national ID. The findings also include statistics on the uptake of financial services by previously underserved populations, showing favorable changes in bank

account access and net worth for a majority of remittance recipients and the development of significant foreign assets through the voluntary adoption of formal transfer mechanisms that foster inclusion. Encouragingly, the survey reveals that the adoption of such alternative mechanisms is not driven by cost alone. Our interviews highlight the importance of careful product design and understanding the clients, their motivation, and prevailing attitudes towards technology. Inclusive technologies are designed for the entire population and its diversity and work for the many, not just the few.

6. Conclusion and Future Directions

The AI and deep learning technologies available today are poised to solve two significant issues affecting the financial industry today, those being a reliance on knowledge-based systems for AML sanctions filtering and the cyber vulnerability of current fraud prevention systems. Implementing these technologies will have a direct impact on reducing false-positive rates and furthering financial inclusion. The first technology, peculiar risk mitigation, brings in more low-income customers by reducing barriers to entry by lowering compliance expenses with reduced false positives. The second technology, deep learning-based fraud mitigation, enables at-scale fraud prevention in both remittance corridors and personal-to-person transactions.

We identify three significant challenges to furthering financial inclusion: the advancement of new banking solutions, cyber risk, and improving the economic standing of vulnerable populations. Ultimately, the push for further financial inclusion requires constant innovation to meet these challenges. Future research should focus on extending the narrow use cases presented to address these challenges as well as future-proofing AI algorithms to upcoming market changes that have been identified as not being addressed by contemporary AI. A promising direction for furthering the research would be to create a system that employs both peculiar risk assessment and deep learning-based fraud prevention to create a comprehensive risk assessment for clients and firms. Collaboration between stakeholders is well-positioned to drive these technological innovations that have the potential to greatly decrease cyber risk, increase AML accuracy, and foster greater financial inclusion. Additionally, this would require collaborations between bank partners to safeguard against the growing regulatory backlash against the rise in robo-challenger banks.

A related future issue for financial institutions going forward is the prediction that 1 billion people will use an uncontrolled digital, cryptographic ID, with a significant percentage being influenced by a non-governmental global entity or business. This case may lay the framework for future issues that will be relevant in fintech identity, including mandatory changes to current international identity infrastructure. For monetary infrastructures, financial institutions might need to change their remittance paths to support cross-border transactions with different economic entities built above these case categories. Further follow-up work on the regulatory overview of the implementation of peculiar risk assessment and deep learning in the entire system for AML sanctions filtering and fraud prevention may be necessary. This also requires an AML filter for sanctions, PEP and adverse media exposure as systems may need extra care to ensure against the deep learning models including socioeconomic variances. In addition, tracing the future user standards of identity and online securities would be important, where

the case studies are currently more applicable to cryptocurrencies.

Equation 3 : Non-User Reduction Equation: $N_{\text{new}} = N_{\text{old}} - \eta \cdot (I_{\text{new}} - I_{\text{old}})$

N_{new}: New number of non-users.

N_{old}: Original number of non-users.

η: Conversion factor for financial inclusion gains.

6.1. Key Findings and Implications for the Industry

The reported study presents the results of a two-year collaboration for understanding and developing solutions to overcome two key barriers in cross-border money transfers: compliance technology and fraud risk. The findings are as follows:

1. The research results share how two remarkable artificial intelligence (AI) initiatives combine to provide more effective management of risks and costs, thereby opening new avenues for financial stability and inclusion.

2. By testing historical data with self-learned algorithms of successful or unsuccessful transactions using a deep learning algorithm on humanly unrecognizable features, we were able to minimize incorrect predictions, following strategic investment in priority transactions to gain more insight. We expect financial institutions to use these proof-of-concepts to effectively create their unique narrow AI tools to help address fraud prevalence.

In conclusion, our research insights show how financial institutions can choose AI technologies to further reduce the prevalence of fraud by making proactive investments and thereby holding less cash to offset fraud-related risks as a percentage of the transaction value. We also show how continuously improving AI based on newly available data and customer behavior learnings will likely further reduce fraud prevalence. The implementation of these technologies will provide considerable benefits to financial services firms. Therefore, the research team recommends that financial institutions adopt AI technologies and solutions in strategic and incremental ways.

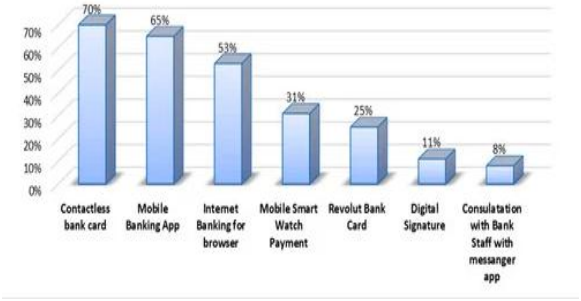

Fig 6 : Unraveling Digital Transformation in Banking

6.2. Future Trends and Research Directions

The development of AI-powered solutions for money transfers is in its early stages, and it is naturally an iterative process due to continuous changes in technology. In the immediate

future, the effort will be to integrate these AI-powered solutions into the current systems to deliver value. The need for integration lies in the fact that the systems have evolved to synchronize with the current business processes developed by financial service providers for formulating their risk mitigation and fraud prevention strategies. The same applies to financial inclusion, where digital IDs have been issued. However, in the long term, it can be expected that the use of AI will again induce changes in business processes. The current transaction processes are also expected to change from end-point to pico-transactions due to the use of IoT, edge computing, and distributed ledger technologies, which are expected to become the norm.

We expect the rise of DeFi, where lending and borrowing are anticipated to take place across borders through the Internet as a decentralized network. Complex DeFi smart contracts could also potentially eliminate some requirements or, in extreme cases, provide live compliance since smart contracts execute the terms and conditions. The research is still embryonic and speculative at best, but there may be some categories that make it to real-world deployment in the immediate future, while others may remain more speculative. Specifically, risks around negative nudges in saving and borrowing and data privacy laws will be important to navigate and validate before research translates to deployment. In terms of technology, there is no doubt that trust in AI is important, and we anticipate that research and validation in this area are expected to grow, building on prior research in transparency and interpretability. Additionally, interdisciplinary research should be conducted from various disciplines, including law, economics, management, and others, to understand broader societal impacts and to collaborate with other stakeholders to set guidelines and standards so that the technology is aligned with regulations and legal requirements.

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