Journal of Artificial Intelligence and Big Data Disciplines (JAIBDD)

International | Peer Reviewed | Open Access | Online

Agentic AI in Retail Banking: Redefining Customer Service and Financial Decision-Making

[1] Ramesh Inala, [2] Bharath Somu
1 Data Engineer, rameshhinala@gmail.com, ORCID ID: 0009-0009-2933-4411
[2] Senior Engineer, bharthsomu@gmail.com,ORCID ID: 0009-0008-6556-7848

Abstract

Artificial Intelligence (AI) has become one of the most dominant enablers of digital transformation across a significant number of industries in recent years. With the application of AI technology including natural language processing (NLP), creating human-like chat bots has become easier. Today, a greater portion of India banks have switched over to Chat Bot technology for their customer on-boarding, queries, complaints, fund transfers, etc., due their proficiency in handling numerous queries with high response time and round the clock service. This case study is based on the virtual assistant of State Bank of India (SBI) – State Bank Intelligent Assistant (SIA), which is engaged in providing personalized service to users based on their historical preferences, search frequency etc., via analyzing the data with the assistance of AI techniques. The recent developments and emergence of Virtual Banking in India and the current trends in the modern banking systems are explained along with the features of SBI-SIA virtual assistant.

As banking is reshaped by technology, financial stability is a key priority for the Bank of England. The Bank is engaging with FinTech companies to gather information and understanding on the financial stability risks that might emerge from FinTech developments. Such risks are expected from the explosion of technology-enabled financial services. It has now become common for many banks to integrate FinTech, machine learning and AI into their services because customers want more choices, flexibility and control over their banking. AI is a branch of FinTech but not every FinTech is AI. AI is machine intelligence. Machine learning and AI are often treated as synonyms. AI in retail banking is at its nascent stage in the UK, though the potential is extraordinary. In the UK, some banks have launched banking applications using voice recognition. The Royal Bank of Scotland (RBS) has decided to roll out its “Luvo” AI customer service assistant, powered by its partner firm, RBS Group, wider in its branches. Bank of America, Capital One, Société Générale and Swedbank are some of the banks that have experimented with chatbots.

Keywords: Agentic AI, Customer Personalization, Autonomous Decision-Making, AI-Powered Chatbots, Predictive Analytics, Financial Decision Support, AI-Driven Customer Insights, Smart Banking Solutions, Real-Time Financial Advice, Digital Banking Transformation, Automated Credit Scoring, Risk Prediction Models, Customer Retention AI, Behavioral Finance Algorithms, Conversational Banking.

1. Introduction

Artificial Intelligence (AI) is revolutionising the way banking transactions are completed through deploying an intelligent virtual Assistant or Chatbot. Automated customer service agents and chatbots are used to engage and resolve queries around the clock, offering a critical performance indicator for banks and other financial institutions. The State Bank of India (SBI) is exploring AI applications in a pilot implementation with chatbots to respond to some basic customer needs in the banking domain. A finite-state machine model is proposed to simplify the conversion of pre-defined conversations based on a subject of interest into conversational state machines from which relevant decisions may be inferred based on input information. The availability of vast amounts of unstructured, semi-structured, and structured data is continuously on the rise, which is the case in nearly any discipline or business domain. A rigorous and timely analysis leads to valuable insights driving important decision-making. AI is changing the way this is done, engendering new opportunities for better-informed financial decision-making. Agentic AI utilising a reactive approach to replicable circumstances, such as predicting the outcome of a stock by scrutinising price trends, is well-established in finance. The initiative to utilise a more agentic form of AI that can impact investments itself, rather than merely predict the outcome, hinders understanding not only of the agent but of the investment material as well. Instead, current algorithmic trading techniques enable speedier arithmetic analysis of fundamental malfeasance than even the professional traders could fathom, leading to superficially incomprehensible investment decisions.

Innovative bots are typically tailored to assist specific end-users instead of tracking mechanisms employed by other market participants at the institutional level. Additionally, custodian, back-office, and risk management functions are unexplored realms for agentic utility. A budding and impactful field of exploration includes risk assessment, intervention tactics for regulatory compliance, and the disproportionate impact agents have on formal and informal regulations. Encompassing changing knowledge structures and reward and punishment mechanisms, regulation fundamentally redefines actions deemed relevant in terms of compliance or punishment. With event-driven modelling failing to appropriately depict the outcome, it becomes essential to study these adjustments in bottom-up modelling focused on individual and collective actions.

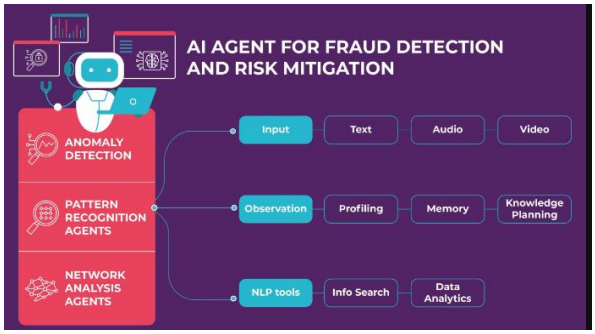

Fig 1: Agentic AI is Redefining Risk, Fraud, and Customer Service in Banking.

1.1. Background and Significance

The unity of intellect, perception, and psychomotor action is control; intelligence consists of the power to comprehend, to sense, to think, and to integrate; perception includes the sensory awareness of self and environment; psychomotor action comprises neuromuscular mechanisms employed in cognition and perception. The great properties are the result of the set of emergent properties that arise from this unity. An agent has a goal, purpose, and preference that governs its action. If an agent is sympathetically aware of its perception and preferences, it would be sentient. When several such entities interact symbiotically, one or more of them can become aware of self and others, endowed with knowledge, memory, judgment, and reasoning. Such entities would have beliefs, beliefs about their beliefs, beliefs about beliefs of others, imagination, deliberation, and temporal and existential reasoning as percepts. Man-made information systems possessing some of these attributes are agents, which intelligently perceive, decide, learn, and act.

New challenges in incorporating understanding, reasoning, goal oriented knowledge representation, educational/collaborative teaming, and being utilitarian all result from advances in communication technologies. As high-level achievement systems expand across concurrent systems of systems integrating people and machines, planning in pre-stated knowledge domains is no longer adequate for dependable, correct performance. Hence agents should learn co-designs that support collection thinking. The capacity for autonomous intelligent perception, learning control, or reasoning provides agents the means to transform information into actions. It presents numerous new control challenges, both technically and sociopolitically. System models built solely on mechanistic understanding and highly stochastic and adaptive environments have made it difficult to provide efficient adaptive abstraction-re-framing and anticipatory motion generation. Integrating adaptive abstraction with low-level controller nonlinearity and uncertainty is still an elusive goal.

2. The Evolution of Retail Banking

Traditional retail banking refers to the sectors of banks that deal directly with individual customers. Services offered include savings, checking, and other deposit accounts; financial and investment products such as home, auto, student, and personal loans; as well as payment and money transfer services. Traditional retail banks help consumers securely deposit their money and also provide the opportunity for savings growth through interest payments. The depositor earns a modest return, and the bank invests a fraction of the deposit into the financial markets or lends it to consumers at a markup.

Financial inclusion is considered as a vital prerequisite for delivering financial stability and inclusive growth. Inclusive finance is an effective and institutional instrument to provide a solution to the problem of financial exclusion. Financial innovation has been recognized as one of the effective instruments to provide the solution to the problem of financial exclusion. Financial innovation is the process of creation and design of new financial instruments, financial processes, and financial institutions. There are major sources of innovation in finance, viz improvement in technology, customer base, and practices of the bank and financial sectors. The impact of technology and various innovations in the banking sector has acted as a goldsmith to convert the Indian banking sector into a prominent leader in providing better quality innovative products and services.

Artificial Intelligence in the banking sector mainly aims at the deliverance of superior customer service experiences, better analysis of customer background, emotions, and behavior with respect to approval application/credit limit/interest rate/banking offers, better monitoring of credit cards/banking accounts/payments/investments from customer behavior perspective, money laundering/ fraudulence detection of transactions through pattern detection and training of an AI for one bank can be transferred and help other banks by pattern analyzation. AI is increasingly becoming common in the banking sector where AI is being used for more non-strenuous tasks and replacing the human workforce in several banking tasks. Voice recognition banking solutions are launched which are aimed at making it easier for bank customers to conduct transactions. An AI holding a dolly can assist in day-to-day banking activities as a contactless multi-feature banking assistant.

2.1. Research Design

In this paper, the first-of-its-kind Agentic AI framework for customer service and financial decision-making will be introduced and several applications of Agentic AI in the retail banking sector will be discussed. Further, ethical and regulatory implications of implementing Agentic AI will also be discussed, particularly the risks of auditability, explainability, and redirect ability of Agentic AI technology. The work aims at providing a research agenda to achieve a safe transition toward the broader adoption of Agentic AI-based applications in retail banking processes.The proposed research agenda will be framed around three primary research questions. First, investigating the technical and modelling requirements of developing an Agentic AI system for self-authored optimisation will be a crucial step towards developing the groundwork for researching real-world applications of Agentic AI. Second, understanding how Agentic AI can be deployed with trust, auditability, explainability, and redirect ability will be essential for regulatory compliance and public acceptance. Third, exploring how Agentic AI, when adopted widely, will impact customer and employee-centric processes in the banking sector will shed light on the broader implications of that powerful technology.

Equ 1: Fraud Probability Estimation (Bayesian Inference Model)

$$P(F|D) = \frac{P(D|F) \cdot P(F)}{P(D)}$$

- $P(F|D)$: Probability of fraud given transaction data D
- $P(D|F)$: Likelihood of data D under fraud
- $P(F)$: Prior probability of fraud
- $P(D)$: Marginal likelihood of data

3. Understanding Agentic AI

Although Agentic AI has far-reaching implications across various facets of human life, this paper aims to primarily focus on its impact on retail banking. Banking, especially retail banking, plays a crucial role in individuals' day-to-day life and impacts their standard of living. Agents represent one of the most integral parts of every domain in the modern economy. Similarly, AI and its application try to make banking more seamless and intuitive. Therefore, it is paramount to study the execution of a concept like Agentic AI in such a crucial sector. The recent advancement in Large Language Models (LLMs) has garnered significant media attention, altering how Artificial Intelligence and its potentials are perceived. From its mundane use as Virtual Assistants to breathtaking capabilities of composing poems, and writing software; AI has demonstrated strong capabilities in augmenting labour. However, it's also important to note that the scale of training these models may have unexpected consequences.

Fig 2: Agentic AI.

Conversely, it's vital to look beyond entertainment and focus on the more imminent threat—akin to what the invention of the Internet did to actual business models and marketplaces—i.e. how will Agentic AI influence goal-driven actions and decision-making? Traditionally, these questioned interactions involved a human agent making decisions based on the information and options made available by earlier narrow-aisle AIs. However, with the progression of natural language processing capabilities, a moment is upon us where machines, powered by cloud computing and vast amounts of data, can replace human decision-making altogether. Agentic AIs capable of goal-driven actions and unbridled access to information may soon challenge the status quo of entire industries.

3.1. Definition and Characteristics

Agentic artificial intelligence (AI), a subset of AI systems with increased capabilities, is becoming widely recognized and noted for the intelligence it can provide independently and autonomously in various domains. In conjunction with automation technologies, agentic AI is transforming processes and decision-making in industries/functions such as retail banking. Retail banking processes are seeing a slew of new agentic AI rude jobs in terms of customer service and financial decision-making domains, which includes not, previously processed robotic automation but robotic process automation (RPA)-coexisting agentic AI.

To frame the transformational impact of this new breed of agentic AI on retail banking, it is beneficial to analyze the different types/characteristics of agentic AI. Given the rapid advancement of these new breed AI tools, the agentic AI categorization herein expands on earlier efforts to define characteristics of AI tools adopting a more simplistic lens. Those previous efforts were useful for understanding the proposition and ideation phase of the AI evolution, however, agentic AI tools are closer in maturity with better adoption and deployment strategies that need to be studied from a nuanced lens.

Authoring of agentic AI content. A class of AI software is capable of creating texts/audio/visuals/image/sound through simple prompts. Agentic AI tools can author with quality on elementary tasks like answering questions, summarizing, or phrasing tasks in a coherent manner. Copywriting, blogging, news writing, story writing, etc., are content authoring processes in the human workforce, progressively seeing penetration of agentic AI. Agentic AI text authoring tools include , , , and . These are co-existing with intelligent tools, which were used to create templates with predictive text, facilitating educational writing activities but only finding familiarity in younger (15%) and older (12%) generations soon thereafter.

3.2. Technological Foundations

Agentic AI relies on data analytics and computation power via the deployment of cloud technologies. Public clouds dominate the capability landscape because of the high expenses associated with private clouds. The tremendous growth of options with on-demand use-cases has changed the commercial landscape of cloud-based service provision. Frameworks such as Amazon's Web Services, Microsoft Azure, and Google Cloud cost-effectively offer cheap electronics and storage, making possible everything from simple hosting to neural network data analytics centering on natural language processing. Agentic AI relies on three foundational technologies: cloud computing; advanced natural language processing; and smart conversations over text and voice. These technologies are the foundation of agentic chatting services, which link customers with knowledge databases and interactive agentic skills. Next-generation natural language technology has made it possible for these kinds of services to do two new sorts of things that were earlier hard. These two things have transformed a formerly limited collection of AI-supported telephone and text services into a wide spectrum of customer experience capabilities extending from conventional question-and-answer computing via neural net question interpretation to complex transactions efficiently conducted by computing agents. This evolution lays a foundation for transformative retail banking usages of agentic AI. Everywhere in the world, retail banking is experiencing problems it did not expect only a few years ago. Competition springs from emergent financial technologies as technology non-competitors such as e-commerce companies take over retail banking services. Threatened incumbent banks use AI via cloud services. AI-based approaches are either text-based or active voice-based chats developed on next-generation natural language processing technology. The development of conversational AI as a cloud service enables customers of the service provider to answer questions, conduct business bookings and transactions, and train agents effectively for human proxies requesting help from people.

4. The Role of AI in Customer Service

As AI-enabled assistants are transitioning beyond script-based chatbots to become more agentic conversational agents capable of managing multi-turn conversations with human beings across speech, text, and vision modalities, they will have direct access to banking information and customer contacts. In order to comply with new regulations, avoid reputational risk, and strengthen customer loyalty, banks will need to monitor their interactions. Despite being able to view algorithms, audits of multiple layers in a deep learning system would still be very difficult. However, since customers are enhancing their financial decision-making contextually through more nuanced agentic AI conversations, it is essential to reconsider the roles banks want to take on. By targeting the areas of banks, third-party data-led companies, and data protection agencies, it is also necessary to analyze where customers are most likely to lose trust, control over their data, and the ability to choose and benefit from complementary services.

From a customer-centric perspective, agentic conversational AI alters customer perceptions of financial services. It enables customers to control their financial situation and make informed decisions, thereby shortening their mental accounting time. For significant life events that require instant information and recommendations, conversational AI provides banking information and perspectives in a non-ambiguous and familiar manner. By coding and structuring customers' subjective, stateless, and contextually meaningful financial statements into objective beliefs, it expunges responsibility biases from the analysis of individual life situations. As a result, the customer's personal situation comes as no surprise to them, and they are better able to appreciate their need for help. By defaulting Nudge suggestions, bank agents provide timely opportunities for financial change, reducing interaction effort. As bank agents strive for more personalized and contextual conversations, customers will need to take on the role of additional service agents in order to safeguard the customer perspective and protect self-interests.

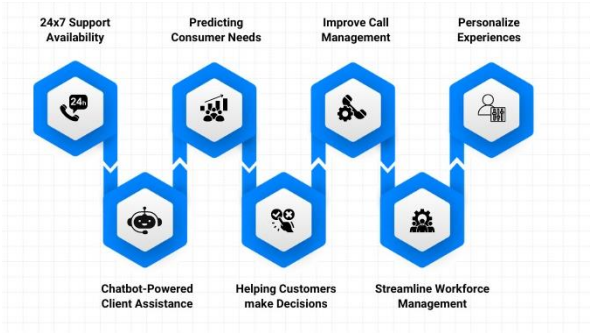

Fig 3: The Role of AI in Customer Service.

4.1. Personalization of Services

In the last few decades, competition in retail banking has been transformed, as many players globally deployed increasingly sophisticated systems and process improvements. An explosion of abstract customer data occurred at the same time as massive advances in processing power, thereby initiating novel machine learning developments as a new era for mobile and internet banking commenced. Retail banks will prioritize low-cost, high-performance financial decision-making systems to attend to the expanded bandwidth of customer requests and offer customer-advocacy councils for algorithmic traceability and accountability.

In 1990, Lomas started with a system regarded as a precursor to pure agentic AI, getting novice mortgage-seekers to stop self-deceiving about unrealistic properties affordability through the Digital Idol of a credible mortgage expert. Teta banks' LIME-conciliating fuzzy prediction-based systems will help retail banks re-design complex functional product strata of Swiss-cheese security coverage with connecting composite scripted-agent financial decision trees. Simultaneously, Davidson banks' risk dashboarding will assist arrogant recruits from wealthy, privileged staff in foreseeing diversification-charted losses.

This article speculatively examined the impact of agentic AI in retail banking on customer service and product strata design. Research should be fostered, especially in the Ivill-as-ID Docs-Information-IR-Supplying Lawful-Property-Ownership-Transfer domain, where gross-fees siphoning off accrued transaction fee-rent cash-flows can occur. Mega-data insulating of 'white-wheat', forex-hedging procedures deserves another good look. Finally, there is much un-perseveringly unwanted change to be.

4.2. 24/7 Customer Support

An explorer in the up-and-coming Generative AI SaaS tools for customer service, ChatGPT, is unveiled with a focus on various frameworks and applications. This new architecture of large language models has raised curiosity about its applications in the customer service industry. An experiment was designed and performed at an enterprise software company that focused on augmenting existing chat agents using chat-based generative AI from both technical and economic perspectives to remedy the issues by integrating the recommendations. Detailed discussions shed new light on the development of AI applications from a systems perspective to ensure its viability to be implemented as a product for end users and to provide a forecast with implications on economic status. The findings serve as guidelines in practice for the design, development, and evaluation of customer service systems.

The demand for customer service has risen along with online activity. However, it is labor-intensive and possesses inherent challenges with heterogeneous operations and problems. The insights and recommendations from an exploratory case study provide useful design considerations for action-oriented systems along the lines of structure, data, operation, and addition which when integrated could be used as guidelines to ensure the feasibility of deployment in practice. Investing AI from a developer-centric angle would lead to a loss of one dick of its value out of an associated expenditure of two dicks.

ChatGPT is the latest architecture of large language models with a significantly rising curiosity and interest in applications across a plethora of scenarios and domains. The growing attention has led to immense application opportunities and prospects of pervasive customer service models in practice. However, this echoing opportunity is also met with exasperated skepticism as it poses challenges to customer service companies to unleash its capabilities to ensure expected performance.

5. Financial Decision-Making Enhanced by AI

Smart banking is a new phrase to refer to modern banking made possible by rapidly advancing technology. Banks are utilizing intelligent tools such as an Intelligent Virtual Assistant (IVA), Conversational AI, Robotic Process Automation (RPA), and more. Innovation from voice command services has opened up new possibilities for banking and utilizing conversational AI-based tools. To capitalize on this trend, HDFC Bank is introducing Ava, a conversational AI-enabled voicebot that can satisfy customer queries in English and Hindi via an IVR system. Ava was created by the bank's in-house innovation team and employs Natural Language Processing (NLP) and Machine Learning principles to assist customers with self-service from location-based banking information to transaction details with voice recognition. Conversations can be natural and contextual, and the service will become more intelligent over time as it collects and analyzes data. Similar AI products are being tested by the SBI Bank. Ava's services include generating Mini-Statement information, providing answers to general FAQs, and assisting customers with grievances, transactions, wallets, and account opening. Interactive conversations trigger contextual tweet storms, offering the company an opportunity of raising awareness regarding Ava. Chatbots in banking was a popular trending topic in Google Trends after Ava was launched. Robotic Process Automation (RPA) will be important as the number of tedious processes such as account opening, loan processing, and KYC standardization increases, especially because of new on-boarding due-diligence measures. Banks like ICICI, SBI, and more are hiring Fintech vendors for RPA needs. The Indian bank, Punjab National Bank (PNB), decided to deploy Machine Learning-based/A.I.-based algorithms on the banking side for reconciliation of CA, SSI and other accounts to curtail unethical practices ultimately affecting higher stability & profitability. Hence, banks now control the entire banking process with utmost precision.

Across the world, retail banks are deploying their Conversational AI-based tools such as chatbot, voicebot, co-bot, and automated assistants, changing the customer service dimensions proportionally. In the UK, the banks involve AI tools for controlling erratic transactional behaviours. Santander Bank and HSBC have recently launched banking applications based on Voice Recognition systems integrated with Conversational AI. Royal Bank of Scotland (RBS) will soon roll out its "Luvo" AI-based customer service assistant. Similarly, Bank of America, Capital One, Société Générale, Swedbank, and many other major banks are planning to go live with customer service chatbots, which are enterprise-grade Virtual Customer Assistants powered with the latest AI Technology.

5.1. Data-Driven Insights

Understanding customer preferences, dislikes, loyalties, and trends are all significant parts of a data-driven intelligence framework. Customer insights generated across all banking touchpoints will ultimately shape product development, pricing strategies, marketing strategy and communications, and service delivery channels. Additionally, transaction details such as date, time, and mode must be maintained online and offline. To track spend behavior, behavioral details such as merchant category, transaction frequency, transaction size, and channel must also be captured and appended. Another important aspect is the collection across all communication channels to create a single view. Enriching user attributes with social and professional media insights enables the bank to proactively track changes and offer timely products and services. All the above should be followed by analytics using visualization and machine learning techniques to gain quick insights across time periods and segments. For analytics and identification of insights in the segments outperforming or underperforming based on various parameters, benchmarking with competition should be done, and decision trees should be built to understand switching. Rule-based alerting and notifications at both types – proactive and reactive – should also be implemented. Alerts such as folding of accounts or inactivity should be notified to capture switching, and overdue alerts should also be accounted for. Analyzing sequenced events related to financial decision stages should be able to capture gaps in the service usage. This includes analyzing customer behavior with regard to service selections undergone to gain insights into which services to cross-sell. Segmenting customers based on service usage and market popularity to plan campaigns to improve cross-sell also could be done. Analyzing customer data, credit ratings, and banking history enables prediction of existing product payment behavior and need for automated early payment alerts and decision trees to guide on types of products. This also helps in predicting and understanding loan switching. Analyzing spending rhythm helps identify monthly bill amounts against which pre-scoring of personal loan up-sells against eligibility can also be done, ultimately raising the probability of fundamentally changing banking.

5.2. Risk Assessment and Management

Intelligent risk control anticipates the risks that may emerge during the transaction by using data previously saved by consumers to determine the remedy in advance. AI may be used to evaluate this data, identify problematic data, perform risk prediction, timely tracking, and further determine if it fits the standards of bank transactions. Furthermore, AI can warn of difficulties in bank transactions, prohibit inappropriate transactions in real-time, and significantly increase banks' risk management levels. AI may handle the loan process when banks lend. It possesses the ability to examine

applicants' data and additional information, assess the risk, possess knowledge of other institutions' loan situations, approach to risk avoidance, and offer suggestions. By utilizing intelligent risk assessments, banks can simultaneously enhance their competitiveness and limit their hazards. AI applications in retail banking face several challenges. Internal and external factors have delayed the widespread application of AI systems. For example, the customer unavailability of digital identification has made banks reluctant to use AI systems. The multi-level and multi-distribution nature of banking systems, combined with resource limitations, poses additional challenges in utilizing deep learning globally. Holistic development is restricted given that the development level of each bank is distinct. Several banks are still in the building stage of AI environments. Without adjustments in current technology and processes, the synergy effect cannot be amplified.

AI systems regulation is another challenge for banking institutions. The characteristics of AI systems remain widely unexplained by policymakers. Banks expect the regulatory environment to settle down before undergoing substantive investments and transformations. Nevertheless, owing to the pervasiveness and significance of AI systems, a balance needs to be struck by authorities. Furthermore, the regulatory framework is complex and adopting this framework may be very challenging. Additionally, in-house talent, scarce allows banks to oversee the rapid development of AI systems. Moreover, the war for AI talent is encapsulated by the spike in demand for data scientists across all industries in the past decade, and no swift solution can be envisaged. Notably, organizational and people challenges are globally prevalent, irrespective of banking maturity and investor ownership.

6. Challenges in Implementing Agentic AI

While some banks have been early movers in AI adoption and have deployed it successfully, there remain many challenges to implementation that have prevented widespread adoption. AI projects in retail banking have been hampered by classic data barriers such as data quality, access, and geographical silos. However, banks quickly realised that the cost of collecting data from different departments and sources was too high.

A strong AI project usually requires a designated project team, but many banks lack the requisite expertise. Banks also often have to adhere to compliance and regulatory requirements that slow down execution speed. As AI is often perceived as a replacement for human input, there are workforce concerns regarding the re-skilling of employees. In addition to these typical obstacles to AI adoption, several unique challenges for retail banking remain.

Firstly, the customer-facing nature of retail banking means that AI deployment is likely to receive more scrutiny than other internal applications. A retail bank customer service agent acting erratically may publicly harm the bank's brand and expose it to regulatory risk. Secondly, there is a "Tech Math" problem specific to retail banking. While the financial model for trading is generally well understood and documented, banks often do not have a comparable framework for customer behaviour modelling. This lack of understanding of the "Tech Math" places banks in a precarious state, as customers need to be engaged but the maths behind behaviour modelling is not well understood. Without this understanding, there is the possibility of misaligned incentives and unexplainable behaviours on the part of the AI agent.

Lastly, relative to other sectors that have adopted customer-facing AI technologies, retail banks are at a laggard stage. This technological gap results in customers viewing banking groups as "retired" or "outdated" businesses and increases the pressure on the banks.

Fig 4: Challenges in Implementing Agentic AI.

6.1. Regulatory Compliance

It is increasingly being recognized that large language models (LLM) like ChatGPT are beginning to achieve basic levels of human-like comprehension and reasoning, prompting calls for government regulation, social constraints, and professional standards similar to what already exists in financial services. Such workers can expect increasing scrutiny in the following areas, all of which also have relevance for agentic AI. Financial services is a high-stakes zone. Successful failure can inflict far-reaching damage. The subprime crisis of 2007-09 is a vivid reminder. The notion of "too big to fail" arose precisely because it was deemed intolerable that the failure of certain financial institutions would be detrimental to the wider economy. There are positioned failures, such as the BBC's crypto-wallet scam; systemic failures, such as the collapse of Lehman Brothers; and indirect, cascading failures, such as the European sovereign debt crisis. Such failures catalyze demands for greater scrutiny and regulation to prevent reoccurrence. In finance, such demands will be directed at traditional institutions and newly emergent ones alike. Despite their assurance of algorithmic invincibility, high-stakes functions are figuratively "fallible." The non-adversarial nature of most data ensures that model drift is

generally benign; however, sooner or later, some failure will inflict serious economic damage. Independent audits and professionals' assertions of ethics and competence provide mitigation. AI will have to abide by the same expectations.

How knowledgeable regulators will keep up or whether scrutiny can be disentangled from micro markets' own understanding will determine the degree of curtailment. Regulators may monopolize explanatory proxies and accounts, and curtail incalculability. However, preventing bad uses is likely to be as difficult as it is to predict mere curiosity-driven probes functioning like experiments. It might be needlessly limiting. The most transformative advances may be more effortlessly pursued outside stringent oversight, tracing limited paths to commercial robustification.

Equ 2: Anomaly Detection Score (Multivariate Gaussian Model)

$$A(x) = (x - \mu)^T \Sigma^{-1} (x - \mu)$$

- $A(x)$: Anomaly score of transaction vector x
- μ: Mean vector of normal transactions
- Σ: Covariance matrix

6.2. Ethical Considerations

Despite the many advantages and opportunities offered by the integration of AI technologies, new ethical issues are also emerging, ranging from their design to their application. This is particularly the case in relation to algorithmic bias and the recruitment of AI systems. In relation to these issues, it is necessary to adhere to an explanation statement throughout the data collection phase to the AI system developer(s) to reduce as much as possible the risk of algorithmic bias. It is also important to work on the ethical nature of the AI application before its delivery. This is to ensure that it achieves ethically beneficial results without discrimination against various social groups. The recruitment of AI systems is highly critical because humans cannot read code or provide a clear expression of the AI system's behaviour. Because of this ambiguity, there is an impending need for safety verification through bounding a desirable domain for AI thinking. This involves indicating not only the desirability of goal states but also the undesirability of significant mistakes that the AI system must avoid. This is important because any goal-switching behaviours on the part of the AI system find human poses exclusion for AI too narrow in acceptable properties. They cannot accept probabilistic uncertainty or ill-defined or incompleteness specifications. AI systems need to possess an element of AI loyalty because they need to justify the choices made on behalf of the user and the predicted consequences. The selected paths and the final results need to reflect a prioritization among competing values, which affect the ways in which outcomes occur and to whom they are allocated. Any intentionally disruptive bias on the side of the AI developers in making decisions for the users can majorly affect the users. For this reason, with the technologies currently available, it is reasonable to lower the stakes of the decisions being made, starting with decisions or indications solely about numerical luck or text, moving toward tasks needing a more sophisticated judgment that require more extensive, harder to obtain, and processed knowledge prior to the choices made.

7. Future Trends in AI and Banking

According to a survey conducted on 208 banking executives, 36% of banking institutions have adopted AI-powered solutions, with 60% expected to implement them by 2022. The primary use of AI in banking institutions is chatbots/virtual assistants for customer service queries. Adoption of AI in traditional banking helps banks differentiate their customer services and deliver market defining, interactive and proactive services. Banks also invest in chatbots to reduce process costs involved in responding to service queries and offer intelligent self-help solutions to ensure better customer experience. Implementation of AI and chatbot solutions in banks have still a long way to go in India due to challenges in implementation and changing consumer behavior. AI is potentially a disruptive technology, which helps create genuine business value from data by generating insights. Banks synthesize their transaction and behavior data in a secure and compliant manner to develop Digital trails for their potential customers. AI powered lending helps banks underwrite small loans that were previously considered either as unattractive or high risk or required elaborate resource and effort to underwrite resulting in long TATs.

Fig 5: Future Trends in AI and Banking.

Many banks have signed partnerships with Fintech startups specializing in AI based solutions to augment their in house development skills and reduce time to market. AI will help banks up their game by detecting frauds - old and new types, developing new age augmentation services that will transform customer experiences, and mitigate extensive risks of regulatory reporting. Today there are over 183 solutions offered by 46 providers across various AI use cases in Banking - Automated reporting, Market Surveillance, Regulatory reporting, Cyber Security, Financial Fraud detection, Money Laundering detection etc. Cybersecurity is the most common use case with 101 Intelligent Automation solutions deployed. Banks can formulate AI governance at a consortium level involving the regulator, banks, vendors, and other stakeholders in identifying the training and clean datasets with well-defined data handling and retention policies and standards, performance evaluation metrics, use case and outcome alignment with regulations, reporting standards and procedures, and feedback mechanisms to flag and address unintended bias opportunities of AI systems and outcomes.

7.1. AI and Financial Inclusion

AI-Powered Financial Inclusion Tools: Prices and Accessibility

Financial inclusion has emerged as a significant concern in many developing economies, including India. At the onset of the pandemic, banks were compelled to use technology to maintain operations and offer services to clients. Business continuity was critical, and it was also essential to keep services available to users, especially those living in rural areas or working as daily wage laborers. Due to their limited financial capacity, these users are frequently underestimated and excluded from receiving any sort of assistance. To combat this, banks began using AI to offer personalized service and financial assistance to clients across a range of devices, especially mobile phones. AI solutions offered banking products and financial services using far less prior information than prior systems. By determining client creditworthiness using mobile phone transaction history, traditional banking transactions were highly automated, and entirely automated lending and insurance services were offered based on smartphone data.

The outcome was affirmative; during the pandemic, banking services were expanded to the most disadvantaged of the clients across developing economies like India. As a result, AI-powered services deserved to be given mass access in many different ways. However, compared to the prices offered by fintech providers, it seems improbable that banks will be able to provide them in developing economies. These products begin at about $50 in India, though their prices vary from 0 to 150. Examining the politics surrounding AI-powered financial inclusion services was subsequently imperative. The approval of AI-powered financial inclusion solutions is evaluated and expressed as a debate over their implications for banking practices, economies, and public interests in the Global South.

Contrary to the notion that depends upon new technologies and novel solutions as savior to developing economies, this debate is at once both a stewarding of solutions for damaged economies and an alert on the existing crises of; inequitable access, exploitation, adverse jobs and data privacy. The proposal is counterintuitive but profound: to ensure the viability of an AI-powered financial inclusion ambit in the Global South, the public interest in banking practices ought to be firmly regulated, pricing and treaties with fintechs ought to be produced transparent, and a gradual and cautious roll-out approach ought to be advocated over the present instant rollout.

7.2. Emerging Technologies

Presently, technology has advanced at a rate never before seen in human civilization. The cutting-edge disciplines of artificial intelligence and machine learning, among other digital developments, all have a high impact on one another. In the past century, monolithic computers evolved into superior and intricate desktop computers, which have now shriveled into the palm-sized or smaller smartphones that we all possess. Today, everybody can access instant video on demand anywhere in the world, interact with and influence people in far-off countries, and ask a virtual assistant nearly any question and have it answered immediately.

AI

Investment in AI is tremendous and growing. Companies are scrambling to understand and acquire or develop AI technologies, products, and skills. The mass media are publishing extensive articles describing AI breakthroughs. In finance, the AI implications are enormous. AI may revolutionize the collection, analysis, and dissemination of financial information, resulting in further waves of financial innovation. Current AI technologies can efficiently and accurately combine vast amounts of quantitative financial information with qualitative information from news articles and financial reports to deliver data-driven insights, recommendations, and intelligent services. Companies owning such technology or building it themselves could capture a large portion of the current players' businesses.

BANKING

According to various experts in algorithmic trading and financial machine learning, AI computers will trade stocks and other securities more and more intelligently. Algorithmic trading is presently a form of trading in which computer programs make trading decisions primarily based on historical price or volume information usually accompanied by technical indicators. Current algorithmic trading is viewed as relatively simple and naive, capturing only the predictable component of the market. Financial machine learning is a much richer set of AI disciplines. It focuses on rich, unstructured data from various sources to determine profit-generating trades. AI computers leverage information more quickly and intelligently than human market participants. However, there is a limitation that the training data can predict only a part of the future and leave the rest unpredictable.

8. Customer Perspectives on AI in Banking

The growing penetration of technology has impacted all human activity spheres, including banking. The customers today want easy and quick access to financial products & services. To meet this demand in the most efficient manner, the banking sector has embraced various tools & techniques of management like information technology, data mining, soft computing, expert system, artificial intelligence, etc. during the last two decades. Out of these, the advent of the internet, automation of banking & stock market operations, speed & perfection of computerized systems have taken beyond the bounds of reality. This study examined the customer awareness, satisfaction, perception about privacy & security while dealing with AI-based virtual assistants, the reasons for not interacting with virtual assistants, and demographic & psycho-graphic variables-wise responses towards AI-based virtual assistants. During the last two decades, the growth rate of the banking sector has been phenomenal in India with the introduction of technological advancements. These advancements have improved the productivity, performance, and efficiency of banks. The advanced delivery channels like ATMs, internet banking, tele-banking, mobile banking, etc., have benefited banks as well as customers. These e-channels have become the lucrative tool for banks to earn better returns through cost reduction and rationalization of branch banking. Customers with better socio-economic status have availed of these advanced banking services, which drastically improved their satisfaction. The gradual shift of the banking sector from traditional banking to modern banking has paved the way for the adoption of virtual assistants to cater to customers even during peak hours and in the absence of banks. The only understanding factor of customers in the recent past with regard to virtual assistants has been the use of "Chatbots" either in regard to answering service queries or sending bank offers or the immediate reply for the missed calls. AI enabled virtual assistants have ventured beyond the bounds of chatbots to assist in the banking services which in turn contribute to increased satisfaction of customers.

8.1. Trust and Acceptance

"Trust" is a term used in everyday discourse. Trust is a fundamental aspect of individual psychological development and social interaction. Trust has even greater significance in economic and political contexts. Analysts of the financial crisis of 2007–2008 agree that financial institutions begin to falter when trust breaks down and firms' reputations come into question. Trust and acceptance cover the perceived level of transparency, control, and regulation over financial decision systems and issues related to autonomous AI agents. The consequence of this is that many agents, and some regulators and system architects, may face blame with regard to unforeseen and regrettable decisions made by their agents. A lack of trust and acceptance poses problems for many issues regarding autonomous financial agents developed independently of human intervention. Additionally, it limits progress in research and development in areas where agentic AI holds great promise, e.g. personal agents that enhance transparency in algorithmically governed decision systems.

Designing regulatory frameworks that support this practical regulation of autonomous actors is thus of utmost importance. It is likely, however, that regulation falls short of accounting for all forms of moral responsibility related to algorithmically governed decision systems. Hence, increasing transparency in these systems and decision issues becomes paramount. The implementation of such transparency technology can be aided by the construction of acceptance communities, which include service designers, active special interest groups, and affected individuals. It is envisioned that this will limit the expansion of commercial systemic risk amplification, while also supporting the more widespread availability of agents that reduce many forms of personal risk amplification. Such a distribution of the advantages and risks of autonomous financial agents supports a more efficient financial system in which the various agents can cooperate to explore the wisdom of the crowds and other approaches to financially sound decision-making.

8.2. User Experience

Ongoing implementation of chatbots, Conversational AI, and Robo-Advisors in the Banking/Fintech industry dating back to 2013 with the emergence of smart assistants. Future Growth Predicted at 213B$. Unserved Demographic: Under 25 millennials & Gen Z with low-level financial literacy and reluctance to approach banks for advice. With 98% adoption rate, 89% usage in Retail Industry; 63% in Banking/Fintech industry. Agencies' AI development goals include improving UX, Derive competitive advantage, and aid Financial decision-making. Inferior UX Results in Increase of Abandon Rate. Conversational financial engineering entails consultation on amount, investment horizon, risk tolerance, choose approaches, product selection, simulation and visualisation of returns. Conversational Finbots is defined as Financial Chatbots and AI assistants with Conversational UX in a Financial context. Conversational Finbots design is composed of 15 Components organised in 4 Layers: Conversational Components (CC), Intent & Task Components (ITC), Knowledge Components (KC) and Fintech Components (FTC). Conversational Finbots Technical Architecture is composed of a Finbot Client for interacting with users, a Finbot Server that manages conversation design, a Fintech Microservice for integration with Fintech API, a Financial Data Augmentation Engine and a Conversational Finbot Database.

As a consequence of the high industry pressure for a greater Finbot UX with a faster time to market, Fintechs are prone to overlook conversational capability of Finbots. This leads to poor Customer Investment Experience and questioning of AI's fiduciary responsibility. Computational Linguistics is about extracting information from unstructured input language and includes, NLP, NLU, NLG. NLP applications in the financial domain include financial consultations and emotional analysis of prospectus and news. Nevertheless, continued pattern recognition limitations exist with regard to proper NLU due to context, ambiguity and ill-formed inputs. As a consequence of these limitations, systems are reliant on highly structured inputs. QoE is the 'perceived quality of all aspects of an end-to-end transaction' including various qualitative measures such as excitement, frustration and trustworthiness. state that assessing success is essential before delving into failure and note five requirements for a conversational experience to be satisfactory. But the provided finite verification solutions are not extensive or universally applicable. Discussed are metrics for HD-UDA I, II, III (Holistic Dialogue User Experience Assessment Interactions, User & System Dialogue Assessment).

9. Comparative Analysis of AI Adoption

The initial adoption of AI technology by corporate customers is critical to the successful integration of AI solutions. Agentic AI companies serving corporate customers can provide thick solutions to support the initial adoption of agentic AI applications. This thick solution is comprehensive and includes multiple components, such as technology, supervision and regulation, education, and security.

The very first component of the thick solution is technology. Data supervision technology, modeling technology, and solution development technology are important for AI-centric infrastructure construction. Data supervision technology ensures that high-quality data sources are obtained and uploaded. Modeling technology is a tool to provide specialized knowledge and skills embedded in AI to replace human data analysts. Fresh solutions are necessary to transform agentic AI models into corporate automation processes, such as automatic delivery AI chatbots. A monitoring platform that can be used in various industries is preferred for business automation.

The second component, education and regulation, is important for building up enterprise AI governance capabilities. Education regulates senior executive training, employee training, and AI ethics training. AI ethic committees are within the oversight structure to enhance responsibility and ethical concerns in automated decision-making systems and AI-based knowledge dispute resolution systems. Third-party regulators can provide regulatory technology to assess, supervise, and regulate the compliance of AI solutions. AI literacy training for employees in Q&AI/A&D remains a vital component to alleviate fear about potential job changes and bridge the skill gaps caused by agentic AI adoption.

The final component, security, includes firewall and human-in-the-loop approaches to ensure that security vulnerabilities and high-stake AI questions are handled or supervised by humans. For AI chatbots that automatically produce responses, an additional eager response screening mechanism is required to delete potential harmful and unintended-offensive responses. Debiasing technology is a class of AI tools to mitigate current injustice in biased datasets, biased features, or biased deployment processes.

The first analysis issues predictions of the AI-centric technological pathways for the next five years. The second analysis reviews business solutions that companies already commercially offer in the existing AI-centric technology ecosystem. The third analysis asks AI experts and AI businessisation implementers about corporate-level AI technology adoption challenges.

9.1. Global Perspectives

The emergence of AI technologies in finance holds unprecedented opportunities from an economic standpoint, but it also comes with risks that require mitigation, particularly with respect to financial stability and consumer protection. The scale and complexity of AI applications pose challenges for regulators and central banks. Furthermore, the potential for bias in algorithm development demonstrates the need for vigilance and accountability. Responding to this complicated set of issues, the Bank of England has undertaken a multi-pronged program of work examining the

implications of AI for financial stability, with an emphasis on exploring how AI systems are developed, implemented, operated, and monitored, as a necessary precursor to the understanding of how financial stability can be safeguarded. Concurrently, Bank researchers have been investigating how AI affects banking business models, financial market infrastructures, and monetary policy. This incorporates not only considering the use of models that exploit AI techniques, but also exploring how those business models engender feasibility, systematic, and network effects. Guaranty & Trust Company, the first bank in the United States, opened in 1886 in San Francisco, California, to serve the growing needs of the "City of Gold." In 1865, a consortium of gold miners had banded together to form a corporation which could profitably meet their banking needs by issuing paper notes that would be redeemable in gold. The agents of the bank would spread out across the mining region to accept deposits of gold dust, which would be packaged and stored in a safe deposit vault at its headquarters across from Union Square. Each note would carry a signature of a bank officer and how many ounces of gold dust was deposited that day. The bank notes became a circulating medium of exchange, and soon depositors were using a system of book transfers instead of presentment. An innovator from the fiscal agent, DeWolf, led the usage of complementary credit money to alleviate issues with mining town currency circulation.

9.2. Regional Variations

Talent and skills development necessitates tailored approaches in a multicultural and multilingual retail banking workforce operating across various countries. For auxiliary, middle, and back-office functions, the demand for larger hubs or shared services centers in low-cost locations may grow. For customer-facing services, continuous pressure to optimize costs while improving service levels may drive greater focus on monitoring and managing offshore locations in the tele-banking, tele-sales, and tele-marketing sectors. In terms of migration, it is likely that only the largest organizations will consider 'machine' underwriting, while smaller organizations will try to take a regional or national approach to avoid global data privacy concerns.

Codification of knowledge—such as banking regulations and new product development—will remain a focus. Regional variations will affect the processes that will be standardized [2]. Data protection and privacy laws are likely to vary considerably from region to region. Large multi-country banks will have to decide whether they should adopt a unified approach to data security and data privacy laws worldwide or localize compliance with regional regulations in a haphazard manner. Banks are likely to adopt the latter option, resulting in sub-optimal compliance in countries with weak resource enforcement. In order to enhance competition and consumer choice, competition authorities worldwide are likely to demand the codification and disclosure of the algorithms that drive the decisions made by machine-based credit adjudicators.

Banks with a high percentage of 'fast-growing' corporate and retail loans will innovate ahead. Only banks at Tier I (high capital, stable profit margins, low non-performing loan (NPL) ratios) and Tier II will embrace proactive innovation. Many Tier III banks may find their existing models adequate, but some may cease new loan offerings, while a significant minority will adopt proactive innovation. Retail-focused banks with a high proportion of multi-channel customers are more likely to innovate, as are banks subject to greater inter-bank competition, and U.S.- and European-owned banks will implement innovative solutions ahead of their peers.

Equ 3: Risk Exposure Score (Agent-Driven Adaptation)

$$R_t = \alpha \cdot L_t + \beta \cdot A_t + \delta \cdot V_t$$

- R_t: Risk score at time t
- L_t: Loss history (monetary losses due to fraud)
- A_t: Anomaly score
- V_t: Behavioral variance from expected profile
- α, β, δ: Learned agentic weights

10. Impact of AI on Employment in Banking

Machine learning, the backbone of AGI, occurs when an AI system adjusts its functioning based on historical data. Supervised learning depends on a data set with paired inputs and outputs to model mapping functions for novel inputs. In reinforcement learning, an AI agent chooses actions from a set while observing rewards and penalties for each action taken. The agent re-considers its policy in light of the rewards garnered over time, learning to take actions that maximize long-term rewards. In semi-supervised learning, a data set with limited paired input/output data is exploited together with a larger unlabelled data set to learn a mapping function. When models trained on divalent outputs are forced to work with multi-valued results, model-to-model learning is conducted. Again, AGI will presumably require innovations beyond these existing methods.

Consumer-facing questions like: "Why did it approve my loan?" are fundamentally explainable. However, the question "How does it drive?" can purportedly only be answered with non-perception results that allow one of the hypothetical inputs to be tested by changing it and observing the results. The outgrowth of explainable AI is as much about engineering as it is about new learning methods. The explainability challenge is particularly important in risk-sensitive domains like finance. Understanding "why" answers are generated by something that might only be able to describe how it reached every answer may require insights about AGI that do not exist yet. Financial risk preparedness entails many intricate parts that have a metamorphosis of risks with time-lethargy.

Digitalization in the banking sector has brought a major shift with growing expectations among customers and high competition. Customers expect banks to offer services through digital platforms that are convenient and easy to use. Today's banks are moving towards digital banking operations, which has brought major changes in the banking industry. Banks are differentiating their products and services to meet customer expectations. The banking industry is competitive, and banks focus on gaining a competitive advantage. Banks are focusing on Fintech companies. Fintech is a product or service related to technology and finances. As technology is growing rapidly, the banks are reviewing all their transactions and activities by implementing Fintech. AI is a part of Fintech that studies algorithms and data bases. AI reads customer behavior and stories and provides suggestions or solutions.

10.1. Job Displacement vs. Job Creation

In the last decade, rapid advances in artificial intelligence (AI), especially in automatic information extraction, data science, and machine learning (ML), have raised the potential that these techniques could dramatically change our economies and societies. These AI advances, along with the widespread share of general-purpose technologies (GPTs) - such as steam engines, industrial electricity, computers, and the Internet - have fundamentally restructured markets, industries, and organizations. However, economy-wide productivity gains from new GPTs can take decades to fully materialize. In the meantime, market reversals and rising inequality can be seen as the gains from new technologies initially being concentrated among a relatively small number of firms or individuals. The literature on the 145 GPTs falls into productivity and economic modeling, historical case studies on specific GPT events themselves, and work that estimates the economic impact of AI in some conservative and pessimistic scenarios.

AI has already entered the back offices of standard setting and strategy planning, with mixed results. Reports of falling levels of job satisfaction along with "quiet quitting," and a rise in terminations or a return to office demands revealed the difficulties involved as firms struggle to integrate these technologies with a largely unchanged organizational structure and job design. Customers returning to a storefront in the hope that gap between standards and experience might be closed saw reasonable success at this, but there was a clear need for firm-wide governance. For many retail banks, the crisis over missed opportunities related to ChatGPT and more general Large Language Models (LLMs) is just beginning. Yet there is reason to believe that for this sector the impacts of generative AI could be more profound, since for the first time important customer-facing activities can be automated.

From being primarily back office processes where humans check line items against rules and defaults, customer service processes are now shifting to the front office with human-like avatars or chatbots. Text communication with customer service representatives has already been largely digitized and filtered using keyword matching and Natural Language Processing (NLP) AI, with only some requests requiring human attention. With deep generative LLMs like ChatGPT or Bard, text comprehension and generation have dramatically advanced, allowing task automation to shift from filtering to information provision, advice, and decision-making. Generative AI has the potential to tackle parts of a broader set of banking functions.

10.2. Reskilling Opportunities

With great advancements in technology, financial institutions and banks are increasingly investing in an AI-powered virtual assistant. An AI-powered solution that automates conversations between the customer and the bank is the key to the mass adoption of banking financial services. The customer interacts with a tool called a virtual assistant, which can be either voice-based or chat-based. On the other hand, an algorithm interprets user inputs, decides how to respond, and controls the conversation flow behind the scenes. Any automated conversation can be classified as a virtual assistant or an AI personal assistant based on their boundary of understanding. Chatbots and voicebots, collectively referred to as virtual assistants, can act as a bank's digital workforce. These assistants can handle banking transactions, manage customer accounts, suggest banking products, and remind customers of events related to their accounts and finances. Voice and chat banking assistants are the new teammates that financial institutions must train and manage.

While banks are embracing digital change, they realize that their tech-disruptive foes are hyper-digital natives, as well as software and AI giants that are extending their business models to the banking industry. Banks face a growing talent gap in data science and programming, as these higher-order skills are in-demand and significantly enrich banking talents. The best engineers flourish and become instant multi-millionaires. As such, banks attempt to reskill existing employees as AI and quantum compute programmers, while employing boutique data science firms to expand their talent pool. The financial skills of risk, LIWO, trader, wealth advisor, business analyst, and quantitative researcher are being displaced or changed for roles such as algorithmic trader, AI research scientist, optimization engineer, digital currency economist, robo-advisor manager, and model validation analyst.

11. Conclusion

In the past decades Artificial Intelligence (AI) was introduced to chatbots, voice assistants, and recommendation engines, making inroads into consumers' daily lives. The resulting digital goods and services gave birth to a new wave of business models. Despite the adoption and deployment of AI in the financial sector, there still exists a lack of academic study in this area. AI, or agentic AI, is liaising with and servicing customer queries on behalf of banks. Understanding how agentic AI is redefining the traditional human consumer paradigm and rethinking human-bot approach in the retail banking context has not been highlighted in detail up to date. Consumers now regard money and finances as important in their day to day life. In the journey of change, retail banks play a role that consumers often regard as their "first point of contact" regarding money and finances in their scenario. In addition, traditional retail banking is considered a highly trust sensitive area in terms of money and finance. As the developments of technology, retail banks are now rethinking how they can serve consumers through bot to reshape the human-consumer paradigm in a digital economy and AI era.

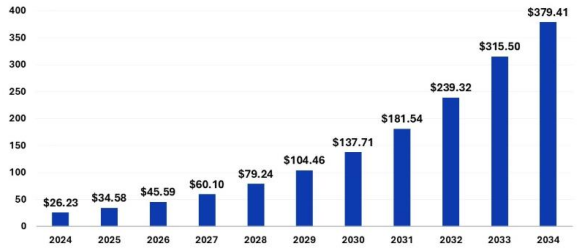

Fig 6: Agentic AI in Retail Banking.

The rise of big data has given banks unprecedented access to every minute detail of customers' lives. The evolution of AI/agentic bots has made these data points deliverable in real-time in an actionable form. From one-time simple in-peeking of bank transactions to constant digital stewardship, the banking landscape consumers are experiencing is starting to sound like science fiction. As the AI digital assistant keeps learning from customers' relationship with money, the services it provides will only become more insightful, bespoke and tailored. The banking and financial decision-making process that was formerly only engaged via a physical service delivery channel with an employed human bank staff is now transferring online to a virtual format. While benefiting from the digital transformation, rethinking the human-consumer paradigm is also vital in the age of ethical snooping.

12. References

[1] Challa, S. R., Malempati, M., Sriram, H. K., & Dodda, A. (2024). Leveraging Artificial Intelligence for Secure and Efficient Payment Systems: Transforming Financial Transactions, Regulatory Compliance, and Wealth Optimization. Leveraging Artificial Intelligence for Secure and Efficient Payment Systems: Transforming Financial Transactions, Regulatory Compliance, and Wealth Optimization (December 22, 2024).

[2] Revolutionizing Automotive Manufacturing with AI-Driven Data Engineering: Enhancing Production Efficiency through Advanced Data Analytics and Cloud Integration . (2024). MSW Management Journal, 34(2), 900-923.

[2] Pamisetty, A. (2024). Application of agentic artificial intelligence in autonomous decision making across food supply chains. European Data Science Journal (EDSJ) p-ISSN 3050-9572 en e-ISSN 3050-9580, 1(1).

[3] Paleti, S., Mashetty, S., Challa, S. R., ADUSUPALLI, B., & Singireddy, J. (2024). Intelligent Technologies for Modern Financial Ecosystems: Transforming Housing Finance, Risk Management, and Advisory Services Through Advanced Analytics and Secure Cloud Solutions. Risk Management, and Advisory Services Through Advanced Analytics and Secure Cloud Solutions (July 02, 2024).

[4] Chakilam, C. (2024). Leveraging AI, ML, and Big Data for Precision Patient Care in Modern Healthcare Systems. European Journal of Analytics and Artificial Intelligence (EJAAI) p-ISSN 3050-9556 en e-ISSN 3050-9564, 1(1).

[5] Kummari, D. N. (2023). Energy Consumption Optimization in Smart Factories Using AI-Based Analytics: Evidence from Automotive Plants. Journal for Reattach Therapy and Development Diversities. https://doi.org/10.53555/jrtdd.v6i10s(2).3572

[6] Federated Edge Intelligence: Enabling Privacy-Preserving AI for Smart Cities and IoT Systems. (2024). MSW Management Journal, 34(2), 1175-1190.

[7] Koppolu, H. K. R. (2024). The Impact of Data Engineering on Service Quality in 5G-Enabled Cable and Media Networks. European Advanced Journal for Science & Engineering (EAJSE)-p-ISSN 3050-9696 en e-ISSN 3050-970X, 1(1).

[8] Sriram, H. K. (2024). A comparative study of identity theft protection frameworks enhanced by machine learning algorithms. Available at SSRN 5236625.

[9] Paleti, S., Singireddy, J., Dodda, A., Burugulla, J. K. R., & Challa, K. (2021). Innovative Financial Technologies: Strengthening Compliance, Secure Transactions, and Intelligent Advisory Systems Through AI-Driven Automation and Scalable Data Architectures. Secure Transactions, and Intelligent Advisory Systems Through AI-Driven Automation and Scalable Data Architectures (December 27, 2021).

[10] Singireddy, J. (2024). AI-Driven Payroll Systems: Ensuring Compliance and Reducing Human Error. American Data Science Journal for Advanced Computations (ADSJAC) ISSN: 3067-4166, 1(1).

[11] Chava, K. (2023). Integrating AI and Big Data in Healthcare: A Scalable Approach to Personalized Medicine. Journal of Survey in Fisheries Sciences. https://doi.org/10.53555/sfs.v10i3.3576

[12] Challa, K. (2024). Enhancing credit risk assessment using AI and big data in modern finance. American Data Science Journal for Advanced Computations (ADSJAC) ISSN: 3067-4166, 1(1).

[13] Pandiri, L. (2024). Integrating AI/ML Models for Cross-Domain Insurance Solutions: Auto, Home, and Life. American Journal of Analytics and Artificial Intelligence (ajaai) with ISSN 3067-283X, 1(1).

[14] Malempati, M. (2024). Leveraging cloud computing architectures to enhance scalability and security in modern financial services and payment infrastructure. European Advanced Journal for Science & Engineering (EAJSE)-p-ISSN 3050-9696 en e-ISSN 3050-970X, 1(1).

[15] Recharla, M. (2023). Next-Generation Medicines for Neurological and Neurodegenerative Disorders: From Discovery to Commercialization. Journal of Survey in Fisheries Sciences. https://doi.org/10.53555/sfs.v10i3.3564

[16] Kaulwar, P. K., Pamisetty, A., Mashetty, S., Adusupalli, B., & Pandiri, L. (2023). Harnessing Intelligent Systems and Secure Digital Infrastructure for Optimizing Housing Finance, Risk Mitigation, and Enterprise Supply Networks. International Journal of Finance (IJFIN)-ABDC Journal Quality List, 36(6), 372-402.

[17] Kalisetty, S., & Lakkarasu, P. (2024). Deep Learning Frameworks for Multi-Modal Data Fusion in Retail Supply Chains: Enhancing Forecast Accuracy and Agility. American Journal of Analytics and Artificial Intelligence (ajaai) with ISSN 3067-283X, 1(1).

[18] Chava, K., Chakilam, C., Suura, S. R., & Recharla, M. (2021). Advancing Healthcare Innovation in 2021: Integrating AI, Digital Health Technologies, and Precision Medicine for Improved Patient Outcomes. Global Journal of Medical Case Reports, 1(1), 29-41.

[19] Annapareddy, V. N., Preethish Nanan, B., Kommaragiri, V. B., Gadi, A. L., & Kalisetty, S. (2022). Emerging Technologies in Smart Computing, Sustainable Energy, and Next-Generation Mobility: Enhancing Digital Infrastructure, Secure Networks, and Intelligent Manufacturing. Venkata Bhardwaj and Gadi, Anil Lokesh and Kalisetty, Srinivas, Emerging Technologies in Smart Computing, Sustainable Energy, and Next-Generation Mobility: Enhancing Digital Infrastructure, Secure Networks, and Intelligent Manufacturing (December 15, 2022).

[20] Meda, R. (2024). Enhancing Paint Formula Innovation Using Generative AI and Historical Data Analytics. American Advanced Journal for Emerging Disciplinaries (AAJED) ISSN: 3067-4190, 1(1).

[21] Sai Teja Nuka (2023) A Novel Hybrid Algorithm Combining Neural Networks And Genetic Programming For Cloud Resource Management. Frontiers in HealthInforma 6953-6971

[22] Suura, S. R. (2024). The role of neural networks in predicting genetic risks and enhancing preventive health strategies. European Advanced Journal for Emerging Technologies (EAJET)-p-ISSN 3050-9734 en e-ISSN 3050-9742, 2(1).

[23] Kannan, S. (2024). Revolutionizing Agricultural Efficiency: Leveraging AI Neural Networks and Generative AI for Precision Farming and Sustainable Resource Management. Available at SSRN 5203726.

[24] Transforming Customer Experience in Telecom: Agentic AI-Driven BSS Solutions for Hyper-Personalized Service Delivery. (2024). MSW Management Journal, 34(2), 1161-1174.

[25] Singireddy, S. (2024). Applying Deep Learning to Mobile Home and Flood Insurance Risk Evaluation. American Advanced Journal for Emerging Disciplinaries (AAJED) ISSN: 3067-4190, 1(1).

[26] Leveraging Deep Learning, Neural Networks, and Data Engineering for Intelligent Mortgage Loan Validation: A Data-Driven Approach to Automating Borrower Income, Employment, and Asset Verification. (2024). MSW Management Journal, 34(2), 924-945.

[27] Srinivas Kalyan Yellanki. (2024). Building Adaptive Networking Protocols with AI-Powered Anomaly Detection for Autonomous Infrastructure Management . Journal of Computational Analysis and Applications (JoCAAA), 33(08), 3116–3130. Retrieved from https://eudoxuspress.com/index.php/pub/article/view/2423

[28] Transforming Customer Experience in Telecom: Agentic AI-Driven BSS Solutions for Hyper-Personalized Service Delivery. (2024). MSW Management Journal, 34(2), 1161-1174.

[29] Sriram, H. K., Challa, S. R., Challa, K., & ADUSUPALLI, B. (2024). Strategic Financial Growth: Strengthening Investment Management, Secure Transactions, and Risk Protection in the Digital Era. Secure Transactions, and Risk Protection in the Digital Era (November 10, 2024).

[30] Paleti, S. (2024). Neural Compliance: Designing AI-Driven Risk Protocols for Real-Time Governance in Digital Banking Systems. Available at SSRN 5233099.

[31] Sriram, H. K., Challa, S. R., Challa, K., & ADUSUPALLI, B. (2024). Strategic Financial Growth: Strengthening Investment Management, Secure Transactions, and Risk Protection in the Digital Era. Secure Transactions, and Risk Protection in the Digital Era (November 10, 2024).

[32] Challa, K. (2022). The Future of Cashless Economies Through Big Data Analytics in Payment Systems. International Journal of Scientific Research and Modern Technology, 60–70. https://doi.org/10.38124/ijsrmt.v1i12.467

[33] Komaragiri, V. B. Harnessing AI Neural Networks and Generative AI for the Evolution of Digital Inclusion: Transformative Approaches to Bridging the Global Connectivity Divide.

[34] Annapareddy, V. N. (2024). Leveraging Artificial Intelligence, Machine Learning, and Cloud-Based IT Integrations to Optimize Solar Power Systems and Renewable Energy Management. Machine Learning, and Cloud-Based IT Integrations to Optimize Solar Power Systems and Renewable Energy Management (December 06, 2024).

[35] Pamisetty, A. (2024). Leveraging Big Data Engineering for Predictive Analytics in Wholesale Product Logistics. Available at SSRN 5231473.

[36] Dodda, A. (2024). Integrating Advanced and Agentic AI in Fintech: Transforming Payments and Credit Card Transactions. European Advanced Journal for Emerging Technologies (EAJET)-p-ISSN 3050-9734 en e-ISSN 3050-9742, 1(1).

[37] Gadi, A. L., Kannan, S., Nanan, B. P., Komaragiri, V. B., & Singireddy, S. (2021). Advanced Computational Technologies in Vehicle Production, Digital Connectivity, and Sustainable Transportation: Innovations in Intelligent Systems, Eco-Friendly Manufacturing, and Financial Optimization. Universal Journal of Finance and Economics, 1(1), 87-100.

[38] Adusupalli, B., & Insurity-Lead, A. C. E. The Role of Internal Audit in Enhancing Corporate Governance: A Comparative Analysis of Risk Management and Compliance Strategies. Outcomes. Journal for ReAttach Therapy and Developmental Diversities, 6, 1921-1937.

[39] Suura, S. R., Chava, K., Recharla, M., & Chakilam, C. (2023). Evaluating Drug Efficacy and Patient Outcomes in Personalized Medicine: The Role of AI-Enhanced Neuroimaging and Digital Transformation in Biopharmaceutical Services. Journal for ReAttach Therapy and Developmental Diversities, 6, 1892-1904.

[40] Kummari, D. N. (2023). AI-Powered Demand Forecasting for Automotive Components: A Multi-Supplier Data Fusion Approach. European Advanced Journal for Emerging Technologies (EAJET)-p-ISSN 3050-9734 en e-ISSN 3050-9742, 1(1).

[41] Sheelam, G. K. (2024). Deep Learning-Based Protocol Stack Optimization in High-Density 5G Environments. European Advanced Journal for Science & Engineering (EAJSE)-p-ISSN 3050-9696 en e-ISSN 3050-970X, 1(1).

[42] AI-Powered Revenue Management and Monetization: A Data Engineering Framework for Scalable Billing Systems in the Digital Economy . (2024). MSW Management Journal, 34(2), 776-787.

[43] Sriram, H. K. (2023). The Role Of Cloud Computing And Big Data In Real-Time Payment Processing And Financial Fraud Detection. Available at SSRN 5236657.

[44] Paleti, S., Burugulla, J. K. R., Pandiri, L., Pamisetty, V., & Challa, K. (2022). Optimizing Digital Payment Ecosystems: Ai-Enabled Risk Management, Regulatory Compliance, And Innovation In Financial Services. Regulatory Compliance, And Innovation In Financial Services (June 15, 2022).

[45] Singireddy, J. (2024). AI-Enhanced Tax Preparation and Filing: Automating Complex Regulatory Compliance. European Data Science Journal (EDSJ) p-ISSN 3050-9572 en e-ISSN 3050-9580, 2(1).

[46] Karthik Chava. (2022). Harnessing Artificial Intelligence and Big Data for Transformative Healthcare Delivery. International Journal on Recent and Innovation Trends in Computing and Communication, 10(12), 502–520. Retrieved from https://ijritcc.org/index.php/ijritcc/article/view/11583

[47] Challa, K. Dynamic Neural Network Architectures for Real-Time Fraud Detection in Digital Payment Systems Using Machine Learning and Generative AI.

[48] Lahari Pandiri. (2023). Specialty Insurance Analytics: AI Techniques for Niche Market Predictions. International Journal of Finance (IJFIN) - ABDC Journal Quality List, 36(6), 464-492.

[49] Recharla, M., & Chitta, S. AI-Enhanced Neuroimaging and Deep Learning-Based Early Diagnosis of Multiple Sclerosis and Alzheimer's.

[50] Malempati, M. (2023). A Data-Driven Framework For Real-Time Fraud Detection In Financial Transactions Using Machine Learning And Big Data Analytics. Available at SSRN 5230220.

[51] Pandiri, L., Paleti, S., Kaulwar, P. K., Malempati, M., & Singireddy, J. (2023). Transforming Financial And Insurance Ecosystems Through Intelligent Automation, Secure Digital Infrastructure, And Advanced Risk Management Strategies. Educational Administration: Theory and Practice, 29 (4), 4777–4793.

[52] Lakkarasu, P. (2024). Advancing Explainable AI for AI-Driven Security and Compliance in Financial Transactions. Journal of Artificial Intelligence and Big Data Disciplines, 1(1), 86-96.

[53] Gadi, A. L., Kannan, S., Nanan, B. P., Komaragiri, V. B., & Singireddy, S. (2021). Advanced Computational Technologies in Vehicle Production, Digital Connectivity, and Sustainable Transportation: Innovations in Intelligent Systems, Eco-Friendly Manufacturing, and Financial Optimization. Universal Journal of Finance and Economics, 1(1), 87-100.

[54] Meda, R. (2023). Developing AI-Powered Virtual Color Consultation Tools for Retail and Professional Customers. Journal for ReAttach Therapy and Developmental Diversities. https://doi.org/10.53555/jrtdd.v6i10s(2).3577

[55] Nuka, S. T., Annapareddy, V. N., Koppolu, H. K. R., & Kannan, S. (2021). Advancements in Smart Medical and Industrial Devices: Enhancing Efficiency and Connectivity with High-Speed Telecom Networks. Open Journal of Medical Sciences, 1(1), 55-72.

[55] Suura, S. R. Artificial Intelligence and Machine Learning in Genomic Medicine: Redefining the Future of Precision Diagnostics.

[56] Kannan, S., & Seenu, A. (2024). Advancing Sustainability Goals with AI Neural Networks: A Study on Machine Learning Integration for Resource Optimization and Environmental Impact Reduction. management, 32(2).

[57] Motamary, S. (2022). Enabling Zero-Touch Operations in Telecom: The Convergence of Agentic AI and Advanced DevOps for OSS/BSS Ecosystems. Kurdish Studies. https://doi.org/10.53555/ks.v10i2.3833

[58] Singireddy, S. (2024). Predictive Modeling for Auto Insurance Risk Assessment Using Machine Learning Algorithms. European Advanced Journal for Emerging Technologies (EAJET)-p-ISSN 3050-9734 en e-ISSN 3050-9742, 1(1).

[59] Mashetty, S. (2024). The role of US patents and trademarks in advancing mortgage financing technologies. European Advanced Journal for Science & Engineering (EAJSE)-p-ISSN 3050-9696 en e-ISSN 3050-970X, 1(1).

[60] Yellanki, S. K. (2024). Leveraging Deep Learning and Neural Networks for Real-Time Crop Monitoring in Smart Agricultural Systems. American Data Science Journal for Advanced Computations (ADSJAC) ISSN: 3067-4166, 1(1).

[61] Challa, S. R. (2024). Behavioral Finance in Financial Advisory Services: Analyzing Investor DecisionMaking and Risk Management in Wealth Accumulation. Available at SSRN 5135949.

[62] Paleti, S. (2023). Data-First Finance: Architecting Scalable Data Engineering Pipelines for AI-Powered Risk Intelligence in Banking. Available at SSRN 5221847.

[63] Gadi, A. L. (2022). Connected Financial Services in the Automotive Industry: AI-Powered Risk Assessment and Fraud Prevention. Journal of International Crisis and Risk Communication Research, 11-28.

[64] Komaragiri, V. B., Edward, A., & Surabhi, S. N. R. D. Enhancing Ethernet Log Interpretation And Visualization.

[65] Kannan, S., Annapareddy, V. N., Gadi, A. L., Kommaragiri, V. B., & Koppolu, H. K. R. (2023). AI-Driven Optimization of Renewable Energy Systems: Enhancing Grid Efficiency and Smart Mobility Through 5G and 6G Network Integration. Available at SSRN 5205158.

[66] Kommaragiri, V. B., Preethish Nanan, B., Annapareddy, V. N., Gadi, A. L., & Kalisetty, S. (2022). Emerging Technologies in Smart Computing, Sustainable Energy, and Next-Generation Mobility: Enhancing Digital Infrastructure, Secure Networks, and Intelligent Manufacturing. Venkata Narasareddy and Gadi, Anil Lokesh and Kalisetty, Srinivas.

[67] Dodda, A. (2023). AI Governance and Security in Fintech: Ensuring Trust in Generative and Agentic AI Systems. American Advanced Journal for Emerging Disciplinaries (AAJED) ISSN: 3067-4190, 1(1).

[68] Paleti, S. (2023). Trust Layers: AI-Augmented Multi-Layer Risk Compliance Engines for Next-Gen Banking Infrastructure. Available at SSRN 5221895.

[69] Rao Challa, S. (2023). Revolutionizing Wealth Management: The Role Of AI, Machine Learning, And Big Data In Personalized Financial Services. Educational Administration: Theory and Practice. https://doi.org/10.53555/kuey.v29i4.9966

[70] Machine Learning Applications in Retail Price Optimization: Balancing Profitability with Customer Engagement. (2024). MSW Management Journal, 34(2), 1132-1144.

[71] Someshwar Mashetty. (2024). Research insights into the intersection of mortgage analytics, community investment, and affordable housing policy. Journal of Computational Analysis and Applications (JoCAAA), 33(08), 3377–3393. Retrieved from https://www.eudoxuspress.com/index.php/pub/article/view/2496

[72] Lakkarasu, P., Kaulwar, P. K., Dodda, A., Singireddy, S., & Burugulla, J. K. R. (2023). Innovative Computational Frameworks for Secure Financial Ecosystems: Integrating Intelligent Automation, Risk Analytics, and Digital Infrastructure. International Journal of Finance (IJFIN)-ABDC Journal Quality List, 36(6), 334-371.

[72] Implementing Infrastructure-as-Code for Telecom Networks: Challenges and Best Practices for Scalable Service Orchestration. (2021). International Journal of Engineering and Computer Science, 10(12), 25631-25650. https://doi.org/10.18535/ijecs.v10i12.4671

[73] Kannan, S. The Convergence of AI, Machine Learning, and Neural Networks in Precision Agriculture: Generative AI as a Catalyst for Future Food Systems.

[74] Suura, S. R. (2024). Agentic artificial intelligence systems for dynamic health management and real-time genomic data analysis. European Journal of Analytics and Artificial Intelligence (EJAAI) p-ISSN 3050-9556 en e-ISSN 3050-9564, 1(1).

[75] Meda, R. (2022). Integrating IoT and Big Data Analytics for Smart Paint Manufacturing Facilities. Kurdish Studies. https://doi.org/10.53555/ks.v10i2.3842

[76] Nandan, B. P., & Chitta, S. (2022). Advanced Optical Proximity Correction (OPC) Techniques in Computational Lithography: Addressing the Challenges of Pattern Fidelity and Edge Placement Error. Global Journal of Medical Case Reports, 2(1), 58-75.

[77] Lakkarasu, P. (2023). Designing Cloud-Native AI Infrastructure: A Framework for High-Performance, Fault-Tolerant, and Compliant Machine Learning Pipelines. Journal for ReAttach Therapy and Developmental Diversities. https://doi.org/10.53555/jrtdd.v6i10s(2).3566

[78] Kaulwar, P. K. (2022). Securing The Neural Ledger: Deep Learning Approaches For Fraud Detection And Data Integrity In Tax Advisory Systems. Migration Letters, 19, 1987-2008.

[79] Pandiri, L., Paleti, S., Kaulwar, P. K., Malempati, M., & Singireddy, J. (2023). Transforming Financial And Insurance Ecosystems Through Intelligent Automation, Secure Digital Infrastructure, And Advanced Risk MaRecharla, M., & Chitta, S. (2022). Cloud-Based Data Integration and Machine Learning Applications in Biopharmaceutical Supply Chain Optimization.nagement Strategies. Educational Administration: Theory and Practice, 29 (4), 4777–4793.

[80] Pandiri, L., Paleti, S., Kaulwar, P. K., Malempati, M., & Singireddy, J. (2023). Transforming Financial And Insurance Ecosystems Through Intelligent Automation, Secure Digital Infrastructure, And Advanced Risk Management Strategies. Educational Administration: Theory and Practice, 29 (4), 4777–4793.

[81] Challa, K. (2023). Optimizing Financial Forecasting Using Cloud Based Machine Learning Models. Journal for ReAttach Therapy and Developmental Diversities. https://doi.org/10.53555/jrtdd.v6i10s(2).3565

[82] Chava, K. (2020). Machine Learning in Modern Healthcare: Leveraging Big Data for Early Disease Detection and Patient Monitoring. International Journal of Science and Research (IJSR), 9(12), 1899–1910. https://doi.org/10.21275/sr201212164722

[83] Kalisetty, S., & Singireddy, J. (2023). Optimizing Tax Preparation and Filing Services: A Comparative Study of Traditional Methods and AI Augmented Tax Compliance Frameworks. Available at SSRN 5206185.

[84] Sriram, H. K. (2022). Integrating generative AI into financial reporting systems for automated insights and decision support. Available at SSRN 5232395.

[85] Koppolu, H. K. R. Deep Learning and Agentic AI for Automated Payment Fraud Detection: Enhancing Merchant Services Through Predictive Intelligence.

[86] Sheelam, G. K. (2023). Adaptive AI Workflows for Edge-to-Cloud Processing in Decentralized Mobile Infrastructure. Journal for Reattach Therapy and Development Diversities. https://doi.org/10.53555/jrtdd.v6i10s(2).3570ugh Predictive Intelligence.

[87] End-to-End Traceability and Defect Prediction in Automotive Production Using Blockchain and Machine Learning. (2022). International Journal of Engineering and Computer Science, 11(12), 25711-25732. https://doi.org/10.18535/ijecs.v11i12.4746

[88] Chakilam, C. (2022). Integrating Machine Learning and Big Data Analytics to Transform Patient Outcomes in Chronic Disease Management. Journal of Survey in Fisheries Sciences. https://doi.org/10.53555/sfs.v9i3.3568