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Chapter 7: Integrating artificial intelligence and cloud solutions to drive innovation in retail and commercial banking

7.1. Introduction

Demanding market trends and changing consumption habits have kept many retail banks, those secondary banks focused on individuals and small- and medium-sized corporations, in a perpetual state of reform. They find themselves in the unusual position of no longer being able to draw their profitability maps on an established cycle of products and financial services. Instead, they are challenged by competitive technological disruptions and the completely distinct operations and lines of value proposed by the new key players in the value chain of transactions. At the same time, they need to reconsider their historical way of thinking in terms of services. The on-going digitalization of services is not a minor evolution in the way they propose financial services. It forces them to revise their industrial models and integrate technology-driven finance, algorithmic recruitment, and big-data-driven market transactions into their processes.

Retail banks, which have long remained bystanders in this evolution, are now deadlocked. In fighting to retain their services, value-chain position, and advantage in terms of client knowledge and balance-sheeted trust, the four major issues at stake for these banks are to foresee and propose new financial services, to use information available on the proposed service, to use information sent back by client interactions on the service and to use Exploitable Data from the clients widely, privately stored irrelevant for this service by the clients, the usage of which was unseen by the banks.

Information available on the service, which is ill-adapted for its usage, lead classical models of probabilistic scoring applied to industrial models of large size sales. It is a highly structured decision for which heuristic or greedy algorithms acceptably solve the return-on-fitness. The proposed financial services targeted to large and hugely structured information can be predicted with the word-of-type or nth providers. However, the bewildering variety of behaviours involved in interactions with the proposed product means that little information is received through these possibilities. The clients provide part of their service evaluation with a non-causal behaviour leading to difficult reverse modelling of scoring. Besides, on-going negotiation rules lead to an acyclicity between package decisions and scoring leading to structural impossibility.
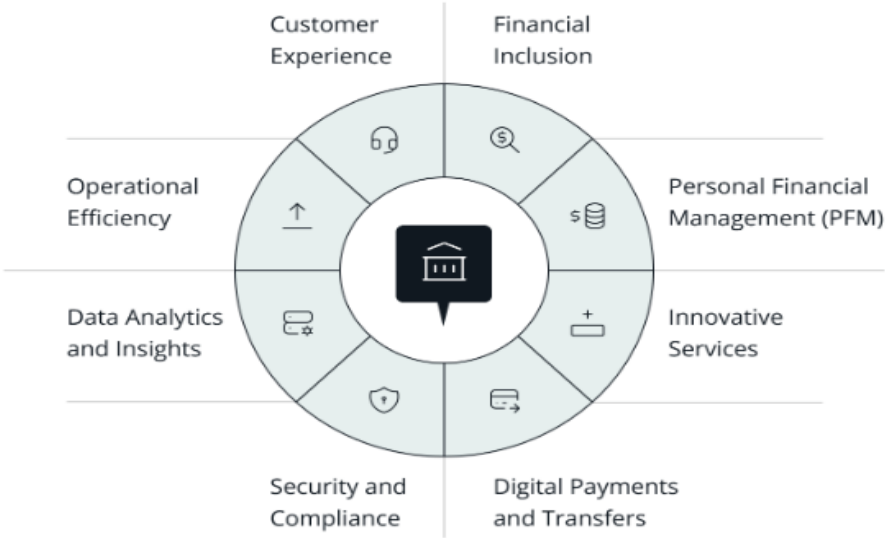

Fig 7.1: Retail Banking Digital Transformation

7.1.1. Background and Significance

Artificial intelligence (AI) is now widely acknowledged as one of the most important digital transformation enablers across a significant number of industries. AI is supporting Indian banks in upgrading their operations across the board, from accounting to sales to contracts and cybersecurity. This is a case study based on the virtual assistant of SBI-SIA. Digital transformation is among the most well-known important drivers of how businesses deliver value to their customers in a competitive, fast-changing business environment. Indian banks are progressively using technologies of the future in order to serve new-age clientele and expand their development potential. Recent developments and

emergence of virtual banking and the trends in the modern banking systems explained in this study. The banking sector is regarded as the lifeblood of every nation's economy. It performs a number of important functions including issue of currency, acceptance and management of deposits, granting of loans and advances, remittance services, advisory services and a variety of others. Banks serve a variety of customers' requests right away 24/7 in both physical and digital channels. Banks must quickly implement technological advancements and innovations in order to fully meet client expectations. Customers are served via traditional brick-and-mortar banking branches or service delivery structures that entail lengthy waiting times as well as inconvenient customer service experiences in banking scenarios that are still highly congested.

7.2. The Role of Artificial Intelligence in Banking

Artificial intelligence (AI) is widely recognized as a powerful enabler of digital transformation in many sectors, including banking (Rowe, 2024; Cyriac et al., 2025; Klein, 2025). Human perception is aided by Artificial Intelligence (AI) technology. The ability of a computer system to gather, store, and analyze information from the real world and automatically respond to it effectively, just like humans do, is thus referred to as artificial intelligence. In order to examine and analyze a large amount of structured and unstructured data and develop a solution, AI imitates human behavior or problem-solving capabilities. Robotic process automation (RPA) is a type of AI that emphasizes human effort by utilizing robots to perform automated tasks.

In every business, AI is a game changer and future evolving technology. Everyday activities like accounting, sales, contracts, and cybersecurity are being improved by AI technologies in support of Indian banks. By utilizing the cutting-edge technologies of the future, Indian banks are modifying and modifying their operations in order to cater to a new-age clientele and enhance their development potential. With a market share of about 24%, the State Bank of India (SBI) is the current leader in the Indian banking sector. An amazing $61 billion in revenue is generated by SBI, which operates in 26 countries, houses 25,000 branches, and runs 60,000 ATMs. SBI's internet banking platform was first launched in 1999 and has grown to become one of the biggest Indian banking channels, serving over 70 million active Internet banking customers.

7.2.1. AI Applications in Retail Banking

AI has been put to use in the loan process by retail banks. AI may extract key information from scanned documents, such as ID cards, pay stubs, etc. It may send users the

processed and required documents for their approval via the WhatsApp chatbot. AI may extract relevant content for studying the required information through text processing in natural language. AI may supplement the extracted information by interfacing with external web services to gain further insight into the user's history. It may further estimate the user's behavior through user classification using modelling and hiking functions based on historical data tracking. AI may process and generate the request documents with scrutiny, followed by document storage and submission to the bank.

Some banks have developed chatbots and virtual assistants for prepaid users to facilitate transactions. AI may personalize the user interface parameters as favorably and conveniently for the user as possible. Likewise, it may provide necessary reminders at optimal times so as not to affect the user's day. Integrated services from banks may be supplied to integrate existing products, including expenses calculation, bill payment, overdraft notifications, and further recommendations based on trust issues. AI may push these suggestions in a course of equal urgency and importance, thus supplying better satisfaction in quantity and timing. Employ requirements may be estimated through matching AI profiles of users and positions. AI may scrub through social media accounts to scrape public postings of job seekers and/or positions. It may also match job activities over time and content to find a considerable degree of match and domain transferability. AI coding assistance and transformation may streamline the human-machine workflow and development speed while guaranteeing code correctness.

7.2.2. AI Applications in Commercial Banking

Artificial Intelligence creates the perception of intelligence in a computer program or micro-sized machines, which allows computers to perform functions similar to human intelligence (Financial Times, 2023; Lloyds Banking Group, 2024). The application of methods in AI can identify a subject, classify problems, acquire data, and determine solutions based on reasoning and experience. AI is widely applied in many fields, such as computer programming, computer vision, natural language processing, and intelligent toys. In retail and commercial banking, AI application is being extensively studied and piloted, due to the power of deep learning models and the low cost and large amounts of data in banks.

In terms of data collection, banks have uploaded data to the cloud, including historical data on individual clients and automatically updated real-time data. AI is used to evaluate data, accurately evaluate variable amount data, effectively identify problematic data, and successfully simulate market transaction data of various types. Fraud prediction is used to define fraudulent transactions; likelihood and consequence analysis with graphs is continuously employed to identify potential fraud users. Error and incorrect behavior identification is performed using one-class classification techniques and natural

language processing to analyze unstructured data. Through pre-processed data, ML model training various features is applied. The data prediction state is then used to predict potential fraud transactions. The probability of fraud is updated by performing sampling adjustments on the original data continuously.

In risk prediction, AI detects the risk of transactions and calculates risk-type distribution and transaction value distribution. The probability and seriousness of each risk type are updated once again based on the suspect's features. Timely tracking is conducted by continuously judging whether the probability exceeds the threshold, and whether it is before the specified time phase. Each monitoring is conducted through a pre-defined risk assessment strategy. Considered principles include whether the transaction fits the standards and whether it passes the policy. In risk prevention, AI identifies the reasons for alerts and predicts whether transactions could proceed.

7.3. Cloud Computing in the Banking Sector

Since the trend is to streamline information technology infrastructure, every industry is deploying faster and more efficient IT. Cloud computing is one of the game-changing and transformative technologies of the last decade, particularly in the banking industry, where customers can have access to services and information anywhere with minimum constraints or restrictions. Cloud computing facilitates the banking industry with unique features compared to traditional environments where the technology is firmly and heavily owned and operated by the bank. Banking cloud computing offers a wide range of services for all banking performance from account opening to account closing, from cash deposit to loan disbursement, and services related to higher management, treasury and risk management. Cloud computing improves non-IT department efficiencies as it frees them from the burden of mundane IT tasks and maintenance as banks have unlimited resources which they can access at their convenience. Cloud computing enables the driver of the innovative services to launch and test it on dedicated cloud infrastructure without mortgage collateral equipment as new solutions can be live in a very short time compared to months-long project time. Tech savvy banks use a public cloud for an affordable development environment for services to assess business potentials, and a private cloud where commercially viable services are delivered to customers. Private cloud is also used for an economically appropriate redundant core bank for disaster recovery.

On top of that, challenges concerning cloud computing like confidentiality of data, reliability of data, control of data, vulnerability to attack or lost data, regulatory compliance, and reservation lock-in must be coped up with. The objective of the thesis is to propose a cloud computing architecture that addresses the overall and specific challenges of cloud computing in the banking industry. The proposed architecture is

believed to promote the aegis of studying cloud computing in the banking industry and cloud secure computing in general. This architecture can be contextualized to elaborate how the banking industry in the developing country can explore the cloud from a generic overall architecture. As study continues a banking cloud computing, a cloud computing architecture tailored for a banking cloud computing industry with respect to all the challenges of on-premise as well as cloud computing challenges will be designed, and developed in the next research strand. The result of the study would be an exciting piece of work, contributing its share in the knowledge domain.
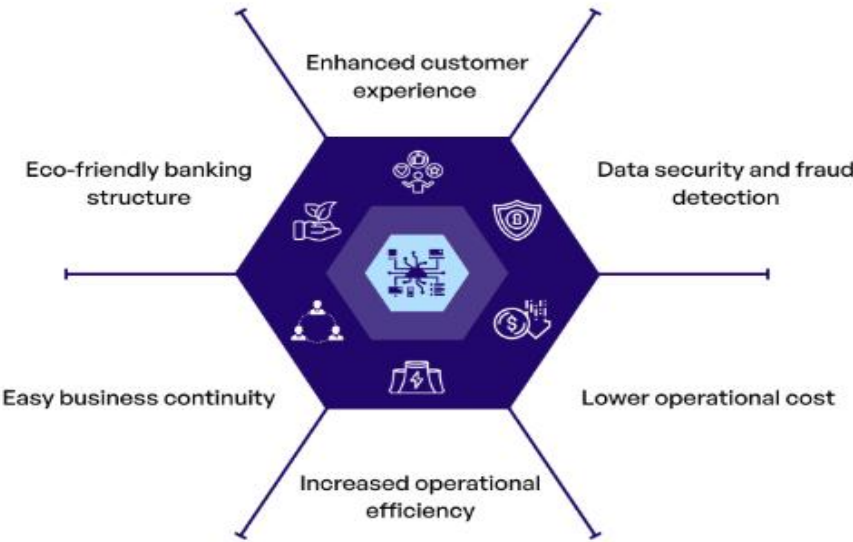

Fig 7.2: Cloud Computing in Banking

7.3.1. Benefits of Cloud Solutions

Cloud-based solutions are becoming quite popular with recent advances in cloud and mobile environments and will help organizations get the most out of their business value. Furthermore, many banking organizations often ignore the potential of cloud technologies because of central cloud processing concerns and by preserving and controlling customer data confidentiality. However, competitive challenges today force banking organizations to find consistent solutions to improve organizational flexibility, scalability, and in-time service. As a result, banking organizations are looking at cloud solutions that are flexible and affordable for most services, and allow them to enhance their resources, big data, and applications. In addition, banks are beginning to adopt cloud-based platforms enabled by Web-based microservices. The benefits of cloud solutions are not only for organizations but also for improving customer satisfaction and experience. Cloud banking, by offering services as a subscription, can help reduce costs

and allow customers to pay according to their needs. Furthermore, the economies of scale offered by the cloud can help banks drive prices down, which can benefit both banks and customers. Organizations that are struggling with a limited IT budget find it difficult to start large-scale business-management systems. Cloud banking would significantly lower the initial cost of entry for these organizations, allowing them to effectively achieve the same operational gains. The overall infrastructure savings can be put to better use elsewhere. By deploying new, less expensive solutions over the cloud, organizations can stop wasted investment in expensive monitoring tools in non-critical departments improving operational efficiency.

At a higher level, cloud banking has the potential to significantly enhance the banking industry across the board. Much of the recent development and advancements concerning cloud computing and customer advancement has occurred within the retail banking system, while other areas have generally lagged behind. Cloud banking is rapidly evolving in the area of corporate or commercial banking, with more sophisticated models emerging. The landscape and practices in corporate banking today are in need of innovation, given the significant value still offered by commercial banking and the general reliance on underlying services. This value fair stream and growing demand, alongside a generally cost-conscious environment, offer a significant opportunity for service providers. Current practices in corporate banking have evolved over the years, but remain constrained by legacy systems, historically low-margin services, and lackluster consumption across wholesale clients. This evolution, in tandem with recent positive trends in the wider sector, create a significant window of opportunity for innovators. Throughout this process, a greater focus on financial advisory, managed services, and the emergence of other business models have shifted the focus of banks on which users get most of the value.

7.3.2. Risks Associated with Cloud Adoption

Cloud computing involves a shift in control from the cloud user organization to the cloud service vendor. This means that the organization itself no longer has control over certain technical processes, and as a direct result, has less visibility into their status. The contract between the organization and cloud service vendor introduces a fine-tuned management delegation. As a result of this delegation, new risks arise, however, some of the original risks do not go away, and at best, there is a transition of risks to different actors. This transformation of risks brings forth risks that may be of considerable concern to the cloud user organization.

The motivations for cloud service vendors settling cloud computing deals that are likely to result in risky situations for the cloud user organization could come from multiple sources. The motivations could be financial, such as postponing or completely avoiding

investments in infrastructure. Poaching involves compromising data that has been collected during the provision of the service, and possibly the resale of confidential data to a competitor. Opportunistic re-pricing is rather similar to vendor lock-in situations. This stems from the vendor gaining leverage over the customer in negotiations, and being able to charge high prices. Some of these risks are discussed by , who note that tough competition in the cloud environment and reduced visibility into security and privacy arrangements may make it tempting for cloud service providers to make compromises that expose the cloud user organization's data to various threats.

A number of contractual obligations cloud user organizations face in cloud agreements would seem to be hard to assess from the user organization's point of view. Espionage is also a major concern. This is especially a problem in industries that have a high degree of intellectual property. There is a risk that the cloud vendor unlawfully utilizes the data that is stored for their own benefit or malicious designs. Data lock-in or vendor lock-in in the general sense reduces user organization control.

7.4. Synergizing AI and Cloud Technologies

More importantly, finance was regarded as the overheating industry as it was becoming more and more quantitative driven. As a result, new frontiers such as blockchain and bitcoin were set to be in the spotlight. After the 2008 financial crisis, it further raised awareness on the systemic risk associated with finance and the importance of soundness and safety of the banking system. Cybersecurity was forever a major issue not just for the banking industry but also for the overall economy. Understanding algorithms, systematic monitoring, and testing systematic risk will be the key. Since 1880 stocks have been used as savings accounts. After accumulating wealth, a person can apply for a mortgage loan.

A bank clerk will be able to comfortably program a loan calculator by inputting the relevant parameters and conditions. The process adopted by retail and commercial banks is tedious and a lot of man hours will be taken. Sophisticated technology investment and high fee charged on consulting these IT firms perceive that these financial services are provided with high chances of fatal errors. Chatbots with AI capabilities have emerged to answer simple queries and have been adopted by banks. Banks are trying to embrace biometric identification services because a bank created a way of identifying customers through fingerprints. In Indonesia, biometric ATMS that identify customers via cyan eye scanning will be launched too.

7.4.1. Data Management and Analytics

With the advancement of cloud computing and intelligent technologies such as artificial intelligence (AI), the financial industry has undergone profound changes, and the trend of integrated technology platforms has also emerged. Traditional financial services are relatively closed and fragmented, so data cannot be extensively analyzed and profits cannot be shared across businesses. The financial sector is now building cloud ecosystems and a unified platform for big data, AI, data sharing, and application for the use of banks, insurance companies, and other financial institutions. With the development of public cloud infrastructure, the competition between tech companies and financial institutions in the generic industry cloud sector has become more intense.

AI can be used for business innovation scenarios (front-office) such as intelligent client marketing services, intelligent credit risk assessment services, and investment strategy research. In terms of supply chain finance scenarios, based on the cloud finance platform, AI can expand beyond the financial sector and improve the breadth and depth of financial services through an integrated ecosystem approach. Data processing methods can be used to filter data and identify key variables affecting performance. Based on AI and supportive data collection methods, the primary goal is to provide opportunities to estimate return on investment for users, making it easier for them to improve performance over time. Cloud solutions can also be applied to reducing churn models. Focusing on benefits and costs, insights on investment and competitive advantage can lead to suggestions on how to make advertising campaigns more beneficial for clients and to prevent churn faster and more accurately. In early investment decisions, AI can improve the return on investment and make sound investment strategies more effective. Big data can also be utilized for processing risk-reward ratios, counterfactual reasons, and breach tracking.

7.4.2. Enhancing Customer Experience

In numerous areas of human life, artificial intelligence (AI) is quickly gaining popularity, including in banking, healthcare, surveillance, and many others. With the aid of a number of technologies, including machine learning, natural language processing, and more, AI-based processes, systems, and techniques aim to offer solutions to complex issues in a variety of fields. Currently, AI is one of the most well-researched areas in the world, with an increasing number of research papers and businesses developing and applying their own AI systems. Everything has undergone a change as a result of the pandemic, particularly customer behaviour with the non-essential product sector. To satisfy the changing needs of people's purchasing behaviours and choices, businesses are turning to e-commerce, whether they are small and local merchants or well-known supermarket chains. Ease of use for processing, the platform's appearance, and confidence in handling

and protecting confidential information and transaction details are crucial factors. The sector is quickly developing, along with the quantity of suppliers delivering their items to the consumers. AI-based technologies are modernizing the entire experience of purchasing items, from evaluating the product description on various platforms to scheduling delivery appointments.

Minimal emphasis had been placed on leveraging AI for in-store experiences through smartphone platforms, most of which are web-based. Businesses, even those from various fields, successfully implemented their own retail mobile e-commerce platforms to reach and direct consumers. Mobile commerce apps give businesses a greater and better approach to boosting participation in their product delivery field and utilize these AI technologies in the back-end and information foundation to evaluate their customers. On the other hand, because of the pandemic, consumers feel more secure purchasing items and availing feed-in to numerous products online rather than going to local shops. Therefore, businesses have begun working individually and collectively to implement AI technologies to help this industry grow. For the traditional retail field, AI applications in retail are highly common and effective methods to improve communication and offer a one-of-a-kind, personalized customer experience.

7.5. Regulatory Considerations

IMToken believes the core of a regulated crypto economy is "where it is reliable, transparent, and controllable." IMToken is actively experimenting with innovations such as smart wallets, multi-party computation (MPC), and multi-application one-click swap that pierce through perceptions of user experience and product functionality. However, IMToken also recognizes that the users' digital asset management process should comply with the principles of cryptocurrencies adopted by the Financial Action Task Force (FATF) and the security and cyber risk management principles proposed by the Basel Committee on Banking Supervision (BCBS). With this in mind, IMToken will work with regulators and industry partners to promote the innovation and development of a reliable and transparent crypto economy based on crypto protocols that the market endorses, and that is controllable with secure operating environments, governance structures and rules, and compliance technology by the regulated. The crypto economy complies with a risk-based approach to crypto assets.

Crypto assets, also known as crypto currencies, virtual currencies or stablecoins, depend for their value on a technology platform or protocol, on which they are exchanged, transacted and settled. Crypto assets vary from tokens, which add capabilities to the existing technology platform or protocol to allow the underlying network to solve more use cases, to cryptocurrencies, which are native assets of a transparent, reliable and uninterrupted technology-based protocol. The former (tokens) are useful in gaining

insights into companies, in monetizing digital identities and creations, and in facilitating transaction processing and settlements. The latter (cryptocurrencies) are relatively good as stores of values but poor as settlement and payment currencies. Presently, banks and regulated crypto finance institutions conduct risk-based KYC assessments and monitoring according to relevant national and global laws and regulations. A risk-based, country-specific, and end-to-end approach to crypto identification is necessary for risk mitigation.
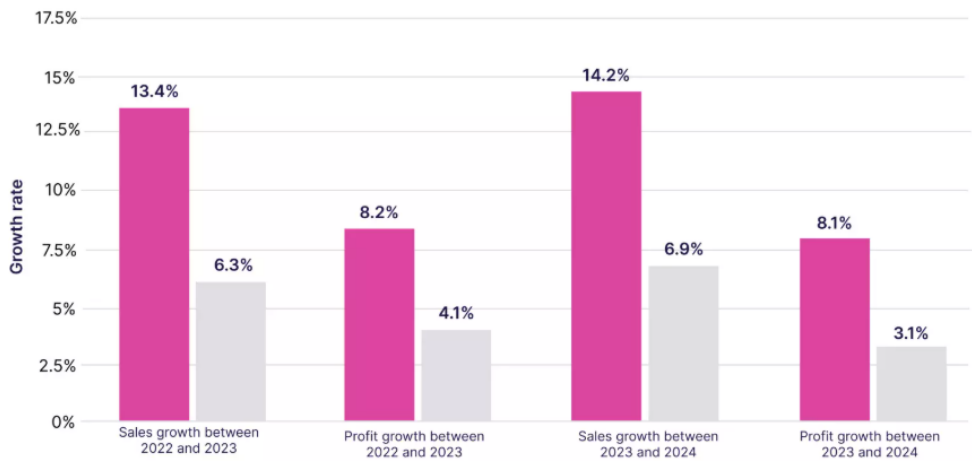

Fig : AI in Banking

7.5.1. Compliance Challenges

Financial stability is a key priority for the Bank of England. The Bank is engaging with FinTech companies to identify emerging financial stability risks as banking is reshaped by technology. Technology can bring many benefits, but it can also introduce new sources of risk. Financial stability may be challenged by operational risks arising from new technology architectures, by business model disruption and by the growth of particular business models that are unregulated or under regulated. Many banks are integrating FinTech into their services, with their motivation often driven by customer preferences for more choices, flexibility, and control . AI is a branch of FinTech specializing in machine intelligence, with the financial sector being a sector where AI and FinTech can offer banks robustness of processing, improved efficiency, effectiveness, security, responsiveness, and reduction of costs. AI governance is key to achieving responsible and ethical AI outcomes in financial services. AI is the area of FinTech that drew the most interest, and the area that was perceived as both the greatest opportunity and the greatest risk. There is much on AI in the financial sector, but little on AI in the retail banking sector. The objective is to elucidate and discuss the benefits

and challenges of AI on local retail banks as they navigate potential AI applications in the retail banking sector at large.

In the UK, a couple of retail banks have launched banking applications that use AI voice recognition with far processing. Some banks will roll out its "Luvo" AI chatty banker/assistant to a wider audience. Other banks have been experimenting with chatty bankers/assistants. AI is the FinTech technology underpinning chatty assistants. AI systems in finance face 1) security and privacy and 2) non-trustworthy AI challenges. Whether customers trust chatty bankers- AI systems can be seen in the experiences of certain banks. The experiences of these banks would foster strategies to improve customer trust in chatty bankers, and, hence, deeper adoption and usage of chatty bankers amongst retail customers.

7.5.2. Data Privacy Concerns

Concerns regarding privacy and the impacts of Artificial Intelligence (AI) on society and individuals are among the most crucial ethical issues facing the financial sector today. Sophisticated AI systems pose a multitude of risks both for institutions and clients, such as biases in credit approval processes or a lack of accountability in fraud detection and recovery algorithms. Financial institutions need help to reassure society that an AI system used on their behalf will not act in unexpected and harmful ways. While such systems enable institutions to gain better forecasts and produce results faster than their rivals, the complexity of these algorithms makes them (to some extent) controllable black boxes. As a result, clients often question how AI-generated processes work, what information was used, and how to confront an improbable denial or discrimination. Customers who do not trust AI-generated outputs could easily take their money elsewhere, leading to reputational losses for banks.

While institutions must address fiduciary and reputational duties in their mainstream business, understanding and trust in the compliance of these AI systems is of vital importance and a prerequisite for successful AI use across the commercial spectrum. A special need arises from regulators and policymakers to understand whether the actors of the broad financial ecosystem engage in this digitally-dominated future at the lowest and most productive equilibrium or whether there are spillovers from unregulated or underregulated entities that could endanger the financial ecosystem through a form of regulatory arbitrage. It is one of the significant challenges in shaping relevant controls, rules, and laws.

Ultimately, banks need to balance the use of AI systems between their own priorities and compliance needs and clients' expectations and why AI-enhanced services would be in their interest. Hence, further conceptual clarification and practical proposals are required

to cover the system estimation, data handling, provisioning, enforcement, and monitoring in detecting controllability, interpretability, and explainability. While the focus is on the machine learning and deep learning application in banking, major points learnt from other sectors will also be considered.

7.6. Innovation Strategies for Retail Banking

The retail banking sector needs to react to and anticipate technological advances and the rapidly changing marketplace. In order to do this, Bank X must take into account how technology has impacted customer behavior and expectations, as well as how competitors and entrants have responded to these altered customer expectations and behavior. Moreover, it must also comprehend how to integrate its organizational structure and attendant culture with the forces driving change. Taking these concurrent activity streams into the portfolio ensures that the bank does not adopt a range of independent activities randomly without consideration of the whole. The model for innovation in retail banking consists of three components: market forces, which include competition, channels, regulations, and the economy; the responses of retailers, which include reengineering business processes, re-organizing and re-culturing, and opening up the business; and the implications for customers, which concern pricing, service breadth and depth, speed, and convenience. As these forces change in intensity and weight across the retail banking landscape, bank managers must react by reconfiguring their organizations. As long as the banking sector was fairly stable and the bulk of revenue was generated from quite standard and relatively simple products, the retail banking business model could remain effective. However, the impetus of change must not be underestimated. There are signs of a crisis-induced plunge in the customer banking relationship, and a gradually increasing anxiety as the default behavior of consumers and small businesses changes from "bank" to "not bank." In American retail banking, a vicious circle has been set in motion. It is reinforced by traditional competitive responses, and accelerated by external forces. This vicious circle, in conjunction with the increased interdependencies between the causal relationships, makes banks very vulnerable.

7.6.1. Personalized Banking Services

AI deployment would facilitate improved customer relationship management. The key objective is to ensure the acquisition of a very low-cost banking experience nevertheless being in a highly competitive banking industry. AI induction path involves Virtual Assistants deploying AI bots in the implementation of the age range Indian Banking system. AI can learn consumer behavior patterns with big data analytics that are often

collected from thousands or millions of consumers globally. Banks act as regional organizations and maintain every extra customer data like online transactions, behavioral/ transaction-based records, etc. With these available huge possible data sets, banks are trying to focus on a single view of the consumer. Smart analysis and collection of data can be used to alone and comprehensively understand customer needs and provide them more consumer-centric goods. Proactive advice of BOTS can also help consumers avoid unforeseen bad situations and can espouse the customer's portfolio across discretionary management or advice-based management.

This project demonstrated that a cloud-based virtual assistant is deployed on the bank's website, which utilizes AI features to help customers address almost all of the banking queries and complaints previously addressed by bank call centers or branch offices. The Virtual Assistant has been developed through multiple stages, including requirements gathering, design documentation, coding, testing, deployment, and maintenance. Currently, it comprises 2430 FAQ intents, of which 577 intents utilize AI & ML services, while the remaining 1853 utilize the Rule-Based NLU approach. Based on the test cases and experiments carried out on both the ML-based FAQ intents during testing, the bot was able to answer 440 questions correctly, whereas the standard accuracy of the previously deployed bot was only 74%.

The virtual assistant can help about 90% of consumer queries proactively. A set of APIs developed on the back end are also provided for IT teams so that these services can be integrated into any newly developed digital banking application. Thanks to the prudence of the data science group, the bot continues to develop based on active learning, much to the operator's delight and trepidation. As for challenges going forward, there are concerns on how the bot will decide what data and FAQs remain compatible while continuing to learn automatically as a feedback loop.

7.6.2. Fraud Detection and Prevention

Fraud detection and prevention is the process of detecting fraudulent transaction attempts and fraud management in commercial banks. Fraud is defined as a deceiving act, which is meant to promote an unjust gain. Fraud can be perpetrated in many different ways. For instance, fraud may be done on bank account opening, bank account takeover, identity theft, unauthorized credit card usage, collusive fraud, etc. Fraud detection and prevention is scalable and involves enhancing machine learning models, to detect complex fraud patterns in transaction data with millions of records. The challenge is to prevent and detect fraud, when the pattern of fraud is itself changing. As a result, every transaction that is going to happen is viewed differently, based on the predictions of the machine learning models.

The intention here is to design a solution that detects and prevents fraudulent transactions in real-time, on the payment transaction channel by introducing the idea of a federated learning architecture. Transactions moving through the payment network are required to be classified as normal or fraudulent transactions by querying the model. The application of advanced machine learning models will emulate the human thinking and thinking process to analyze complex transaction behavior, thereby augmenting existing fraud systems. All the models of each bank would be in the same architecture and would help them share the model parameters, which would quench the need for data and prevent unauthorized access to customers' private data.

In this process of federated learning, the fraud detection bank will make a query to participate, which is then entertained with model training and inference execs. A Local Expert Model is designed, which would keep track of historical transactions and pass its parameters, as well as local gradients to the center model. In the merging stage, an input to the merging stage is used to update the central model, which is passed to all the banks after encrypting the model parameters. Based on the number of transaction parameters, model responses are given for better federated traffic control. The final layer encodes and decodes the share data to the signing bank. Each bank node makes a signing transaction in the second stage and generates a character model response. If a query is invalid or malicious, then a zero response is given by central (0,0). The fraud detection bank will receive a series of predicted results after the random querying amount has been passed on in stages. Based on the additive knowledge, the predicted results are randomized.

7.7. Conclusion

The advent and ubiquitous nature of artificial intelligence (AI) techniques and cloud solutions is gradually and undeniably revolutionising the processes embraced by the retail banking sector. A transformation brought by the utilising of these tools seems to be needed, firstly. Then an overview of the tools has been presented, including AI techniques and cloud services, subsequently. The purposes and prospects of usage have been described, application scenarios of AI in banking, perceived benefits and difficulties of implementing AI, and the importance of innovation in this sector. Digitalisation and the increased use of technology and AI in banking is probable to create new roles, while displacing many tasks for which machines can provide a superior service. The disruptions brought by AI techniques are overwhelming, but humans are still preferable to AI in many cognitive tasks, especially in social and ethical contexts.

The banking sector is shifting from information technology to technology infused with cloud-based models and AI applications. Digital customer engagement strategies, enabled by cloud and AI innovations, can help banks to differentiate themselves. Based

on the findings, the innovation ecosystem frameworks are suggested for adoption by retail and commercial banks. Further research can examine the exploratory and exploitative innovations in various financial services sectors. Cloud computing and AI are expected to empower financial firms to rebuild their customer engagement strategies. Practical implications and recommendations are to convert the internal requirements into simple solutions, develop an innovation culture, engage with cloud service vendors and fintech providers, and form alliances and innovative ecosystems with the relevant parties. Finally, future research can take existing studies further by focusing on the AI and cloud opportunities in cybersecurity, online deposit banks, risk management, financial crimes, and AML compliance. If anyone wishes to conduct cross-sectional studies, emerging markets, south–east Asia, Africa and financial service firms from several sectors may be good topics.

7.7.1. Future Trends

1. Cloudify has co-developed Cloudify AI, a Cloud Cost Optimization platform powered by AI that integrates with cloud providers and manages cloud exports, prevents overspending, and provides actionable insights using ML. Cloudify AI automates resource optimization to save up to 50 percent of cloud expenses every month, generating quarterly cloud expenditure reports, predictive analysis convergence graphs, and actionable insights with specific specifications for cloud instances.

2. Future Trend: AI-Enabled Chatbot, an AI product platform, harnesses voice and text recognition technologies to improve communication services. AI RADA is an AI platform that improves employee productivity by capturing regular business parameters and converting them into business reports. AI Intelligence taps data from multiple data pools, applies ML algorithms to detect anomalies, and provides various reports.

3. All banks make larger investments in AI, cloud computing, data analytics, RPA, blockchain, and IoT. AI, cloud computing, and data analytics will have the greatest impact. Voice recognition and deep learning are considered the most important technologies in the finance sector. A two-way interactive VR-based financial management service platform is needed. In developing countries, investment in HR tech, AI, cloud computing, multi-channel distribution, data analytics, and mobile payment will surpass developed countries. Use of social media Big Data stock text analysis will increase.

4. It is difficult to measure the contribution of AI to financial services due to the complexity of assessment techniques and determining cost and revenue associated with AI systems. Mobile devices have broadened the possibility of digital testing for financial services, leaving banks with the responsibility to protect the safety and privacy of

customer data. Financial openness depends on collaboration and experience. FinTech payment platforms collaborate to provide services. Financial literacy is a precondition; regulatory openness is a necessity.

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