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SPECIFICS OF ARTIFICIAL INTELLIGENCE APPLICATION IN THE BANKING INDUSTRY

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ABSTRACT

Increased use of artificial intelligence (AI) in banks has huge profit potential through the improvement, audit, and alignment of business processes, increased efficiency, and enhancement of customer experiences. It enables the automation of business processes, data entry, data processing, and verification, thus enhancing the operational efficiency of the bank and redirecting employees to more important tasks such as critical thinking and decision-making. The application of AI represents a key aspect of the development of the banking sector through the transformation of the value chain from the front - office to the back - office. In the front office, it serves as a valuable tool in acquiring and retaining clients as well as in risk management. Through chatbots and virtual assistants, banks achieve significant improvements in interactions with service users through personalized support, addressing their queries, and reducing the operational effort of employees. AI enhances cross-selling and upselling based on the behavior and preferences of individual bank service users. It also enables an increase in user trust, better risk assessment, and the detection of fraud based on extensive datasets.

KEYWORDS

artificial intelligence, banking, risks, efficiency, chatbots, security

INTRODUCTION

In an era of geopolitical instability, an evolving regulatory environment, and a volatile economic landscape, the banking industry today faces a multitude of challenges such as macro and microeconomic challenges, digital transformation, intense regulation, and employee expectations (KPMG, 2024; Capgemini Research Institute for Financial Services Analysis, 2024). Banks are financial institutions that manage the money and investments of their clients. They strive to maintain trust with their clients and achieve high levels of security and efficiency in their operations. They offer a wide range of services such as managing various types of accounts, payments, loans, and more. Artificial Intelligence (AI) is a modern digital technology that enables computers and machines to make decisions. Generative artificial intelligence development and implementation represent a revolutionary technological advancement. Today, AI plays a significant role in various aspects of our daily lives, particularly impacting the functioning of financial and banking systems where it has made significant progress.

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Banks globally are utilizing artificial intelligence to make banking operations faster, simpler, and more secure. According to the McKinsey Global Institute report, generative artificial intelligence could increase total revenues in this sector worldwide to over \$300 billion annually, representing more than 4 percent of total revenues, through enhanced productivity (McKinsey Worldwide Institute, 2024). The banking industry is expected to increase its investments in generative artificial intelligence to reach \$84.99 billion by the year 2030, with an annual growth rate of 55.55 percent (Statista Research Department, 2024). This significant growth highlights the increasing importance of artificial intelligence in redefining the banking sector, aiming to leverage AI-based technologies to improve customer experiences, streamline operations, and drive innovation. In the year 2023, the banking sector was one of the largest investors in artificial intelligence, with over 20 billion dollars, in line with global investment trends in artificial intelligence by the corporate sector, which surpassed 95 billion dollars in 2022. This substantial increase underscores the growing importance of developing artificial intelligence on a global scale and provides a strong foundation for further advancement and implementation of AI-based technologies.

The advancement of digitalization and data analytics enables significant benefits from the application of artificial intelligence in industry, in business processes, and in company business models. It enhances companies' ability to make decisions, create sophisticated innovations and trading strategies in the financial market, and implement measures for cybersecurity protection (Paramesha et al., 2024). According to (Königstorfe, Thalmann, 2020), the implementation of artificial intelligence enables banks to reduce losses, improve risk detection, increase security in the payment system, operational efficiency such as speeding up processes and optimizing client documentation compliance, advanced data analysis, decision-making assistance, automation of repetitive tasks, and acquiring new service users through improved customer relationship experiences. However, it also carries increased exposure to operational risks in data management, model management, and responsibility risks.

BASICS OF APPLYING ARTIFICIAL INTELLIGENCE IN BANKING SYSTEMS

The specificity of artificial intelligence lies in its ability to mimic human functions (speech, learning, understanding, perception, problem-solving, autonomy, creativity, mechanical control). It can create music, trade in the financial market, manage airplanes or solve puzzles. Each of these tasks requires solving a specific technical challenge. Essentially, artificial intelligence solves certain technical challenges and enables repetitiveness instead of specific abilities.

As a result, the definition of AI is expansive, encompassing a multitude of solutions primarily used to model goals, states, or elements instead of the nature of modeling itself, which is fundamental to understanding AI (Lui, Lamb, 1970).

Machine learning is based on mathematical models that can process large amounts of complex data. It represents a crucial part of AI, as its application enables machines to independently process new data based on experience. By processing large amounts of data, algorithms find behavioral patterns and can improve their predictions over time. Machine learning is a powerful tool for recognizing patterns and making future predictions. In the banking industry, it can streamline processes, improve efficiency, and enhance security. There are various types of machine learning techniques, with supervised learning being the most widely used in banking. (Mhlanga, 2021). In supervised learning, the algorithm is trained with a dataset that includes both the input variables and the corresponding outputs. These datasets allow



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the system to learn how to predict the output from the input variables. There are a large number of techniques that allow the development of supervised learning systems at different levels of complexity. Popular sample techniques are Bayesian classifiers, artificial neural networks, and k-nearest neighbors.

Natural language processing (NLP) is one of the most important branches of artificial intelligence. It enables systems to understand, interpret, and respond to the language spoken by humans (Shaik et al., 2023). Natural language processing is a valuable tool in banking because it allows for the analysis of queries, complaints, and customer feedback. This way, banks can gain insights into their customers' feelings and preferences, respond more quickly to their requests, and enhance their satisfaction. NLP plays an important role in ensuring the security of the bank and clients, as it can analyze client data and thereby uncover patterns of their behavior that may indicate potential fraud opportunities. Chatbots represent important segments of AI; they are NLP tools available to clients 24 hours a day. They are crucial support for clients and banks because they can provide answers to user questions and direct them to the sector of the bank that can resolve their issues.

Another important role of NLP is the automation of business processes, such as extracting vital information from client documentation that is crucial for approving loans and addressing other banking business problems. Through NLP, banks receive concise information regarding, for example, a client's creditworthiness, based on which they make decisions on loan approvals or rejections. NLP in this segment enables rapid data processing, analysis of extensive documentation, and reduces the chances of human error. Based on the summarized reports obtained, banks can make quicker and more efficient decisions that result in improved customer satisfaction and the bank's competitiveness in the banking services market. Robotic Process Automation is also a very significant part of AI that refers to software used for task automation. It is used for automating repetitive activities or business processes according to business rules and logic. It is an emerging technology with the ability to mimic human behavior and automate human tasks such as reading emails, opening web pages, working with software, acquiring information and instructions from humans, and automating repetitive activities. With the implementation of robotic process automation in banking systems, these mundane and repetitive tasks can be outsourced to robotic process automation solutions, which will enhance operational efficiency. Robotic process automation would ensure that the human workforce can focus on value-adding activities instead of attending to these mundane tasks.

BENEFITS OF ARTIFICIAL INTELLIGENCE IN BANKING

By incorporating AI, banks can reduce expenses and improve processes, ultimately leading to increased profit. AI has the power to significantly boost efficiency in several key areas, including back-end processing, regulatory compliance, fraud detection, and customer service (Bank for International Settlements, 2024). Banks are also permitted to use AI systems to take control of operations such as processing loans, asset management, and managing stocks and deposits. These systems are potentially hundreds of times faster than products of human labor, meaning better market outcomes for the banking operation. AI enables lenders to accurately assess individuals' creditworthiness, especially among underserved groups. This, in turn, promotes financial inclusion by better identifying creditworthy borrowers who may not have strong traditional credit scores. AI's ability to sift through vast amounts of data to identify important patterns is especially useful, making it a valuable tool for improving know-your-customer processes and detecting fraud in the financial industry. Additionally, AI can enhance the user experience for banking customers, offering personalized services and reinforcing financial literacy.

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Improving Operational Efficiency

Banks are characterized by activities such as accepting deposits, giving loans, and even more complex activities like foreign exchange. This, blended with the volume of the transactions, means that retail banks are among the top sectors embracing artificial intelligence. By employing machines to understand and interpret complex messages from customers, AI improves operational efficiency, thereby optimizing the time spent by the human workforce. In today's digitally driven environment, financial institutions need to focus on adopting the latest technology and tools to be used by customers. Digitally savvy customers expect faster, secure, and easier services.

According to a study by Capgemini Research Institute (Figure 1), a survey among employees showed that employees in the banking sector spend around 70% of their time at work on operational activities, while the remaining 30% is dedicated to clients. Due to operational tasks, the banking sector faces decreased productivity and efficiency of employees in client relationships. Over 60% of banking employees are frustrated with lengthy documentation processes in compliance with regulatory requirements related to basic client checks and documentation. Client risk assessment is also time-consuming due to a high number of inaccurate data and fragmented client databases, which slows down responses to clients, account openings, credit approvals, etc., leading to client dissatisfaction (Capgemini Research Institute for Financial Services Analysis, 2024).

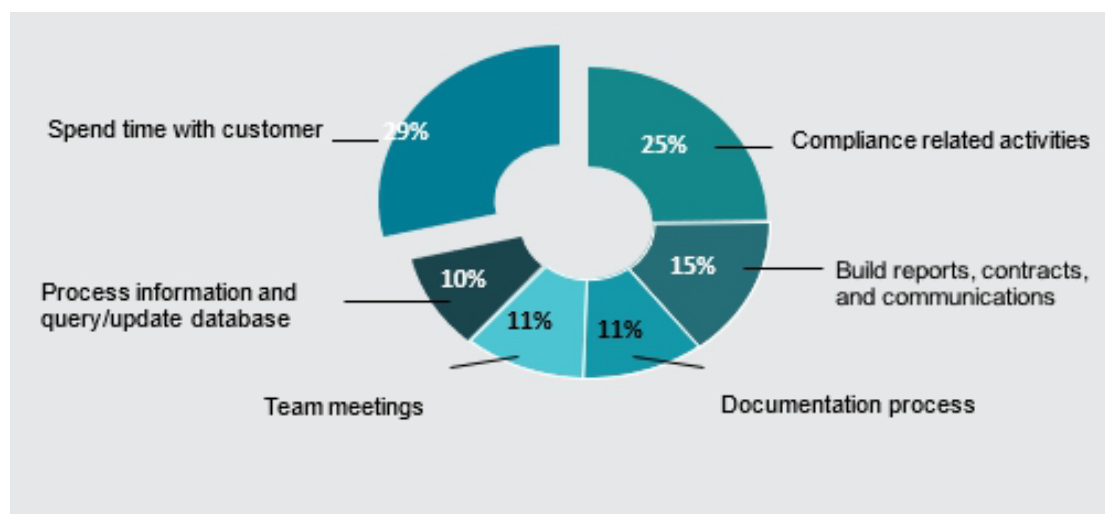


Figure 1. Customer experience suffers as bank employees struggle with mundane tasks

Sources: Capgemini Research Institute for Financial Services Analysis, 2024, World Retail Banking Report 2024 bank employee survey

The use of AI in the form of chatbots for real-time customer engagement supports customer requests and provides support while improving customer convenience and enhancing employee productivity. The zero wait time feature for customers is the primary conventional support for these chatbots. On the client side, AI in chatbots can be used to improve the banking user experience. Big data processing of clients' transactions can personalize service offers. AI can also reinforce financial literacy by informatively generating articles and answering questions regarding personal economics. This technology is crucial for the future of the banking industry, making it a vital area of research and development. With fast computing and networking, financial institutions can use AI (fintech) to analyze transactions on the go, instantly finding patterns of fraudulent transactions and data breaches.



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Enhancing Customer Experience

Today, banking is not just about exchanging money but much more about enhancing the customer experience by providing high-quality and understandable information and services to clients. The idea is to achieve ease of use for clients. The new digital banking system should aim to place the customer experience as the main driver of business through the development of new applications as a key tool aimed at gaining the trust of new digital clients. The focus should be on building customer loyalty through various benefits without imposing conditions. (Barroso, Laborda, 2021). Clients want a bank that knows them and offers something more personal than personal meetings. Banks need to understand clients' goals and provide appropriate services to help them achieve them. Artificial intelligence is extremely useful in providing a more personalized service to banking clients. It is an assistant that can persuade the client and put necessary documents in one place, provide missing information, and advise on maintaining customer accounts and protecting their data.

Data compiled by financial companies contains keys that can enhance the financial well-being and security of bank clients. To do this, collecting all the necessary data and critical rules that will help protect financial institutions from customer behavior and identification detection is necessary. Using AI in customer identification has an added advantage that it is constantly changing. Mobile and online platforms are beneficial for AI algorithms that learn by example. Incorrectly used data promotes illegal conduct. However, it is not just bad actors with access to financial services data that can undermine the security of a financial institution. All people who provide bank services must be aware of banking information, as this information is the most valuable data that bank clients must provide to be helped and trusted. The AI process will take a lot of time in the future to provide advice and all levels of feedback on the protection and care of client finances.

To enhance their services and deliver satisfactory customer experiences, banks analyze customer data such as transaction history, merchant names, and level purchase data, as well as demographic information. AI algorithms such as NLP processing are a form of artificial intelligence that allows computers to understand human language, whether it be written or spoken) technology already enables chatbots to handle routine tasks. The first generation of chatbots was rule-driven and worked within a limited scope. However, advances in NLP, applied deep learning technology, have allowed banks to expand the capability of these chatbots to hold full conversations. This has increased the economies of volume and allowed banks to expand their customer support services. NLP has also enhanced area-based tools, which assist clients with tasks such as foreign exchange trading. Data analytics has allowed banks to use marketing insights to transform a segment into an audience one.

In conjunction with NLP and data analytics, advanced signal processing and machine learning techniques can improve the overall banking customer service experience. Particularly useful are deep learning technologies including ordinal regression and anomaly detection. Anomaly detection tools and algorithms can help detect and reduce POS terminal failures and fraud rates. Backend solutions can use multimodal emotion recognition to analyze body language, voice intonations, and conversational context to deliver rapid insights on client sentiment and suggest routes to effective issue resolution. NLP can be applied to marketing and sales in the form of autonomous customer profiling to predict how clients will behave. Automated conversation recommendation technology agents provide more effective sales and customer-facing teams, suggesting additional products and services to add value to the customer. The advances in facial recognition technology could also help to spot when clients are displeased or uncomfortable during conversations. Acing sales representatives can be alerted to potential issues, with bank managers briefed on aggregate customer service performance to enhance the broader feedback and coaching.



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In recent years, retail banking institutions have been striving to give clients a better experience by offering more personalized services and developing stronger relationships. These institutions can better understand their clients by collecting data about clients' transactions and creating clients' profiles. Clients' profiles include their behavior, transactions, age, income, location, preferences, and needs, among others. Personalized recommendations can be used for promoting the banking institution's products, for increasing customers' loyalty, and for cross-selling and upselling products, which will increase banks' profits. Deep learning and artificial intelligence can be used as a means of aiding organizations in dealing with big amounts of data and delivering personalized recommendations.

Deep learning methods have proved to be effective in solving numerous problems such as speech, image recognition, and natural language processing. These methods are not an exception in personalized recommendations because they can manage huge datasets, find complex patterns, and learn the interaction between features. However, these methods are very demanding in terms of resources and need to be trained in big data infrastructures. Moreover, the models generate recommendations that can be difficult to explain.

Chatbots initiate user engagement through their near-humanlike conversations and are commonly used in retail banking. Some banks use chatbots for purposes like providing information and answering simple banking-related questions online. The technology could also be extended to act as the first customer contact point to respond to customer requests and implement a follow-up route. Currently, customers can contact the chatbot through their preferred digital channels like mobile apps, Facebook Messenger, web browsers, or Twitter. These chatbot conversations save time and add a sense of security with a banker, present context, solve problems, and gently guide customers. AI powers some advanced chatbots and also provides trade and currency exchange opportunities and can provide account balance and transaction details.

Virtual assistants and chatbots can answer user questions, find content, reply to messages, and perform tasks. They have become so advanced thanks to advancements in speech recognition and natural language processing technology. On the other side, chat kind of clogs data and communications adjusts bank brands, and makes banks more interactive and closer to customers through a more social channel. Banks should include chatbots and virtual assistants in their online portfolio of personal assistants like Siri, Echo, and Google. By adopting AI-driven chatbots or autonomic systems, chat apps will improve conversations with customers and reduce effort in ordering and personal service. AI chatbots are also used to continuously train algorithms in a self-learning process. AI virtual advisors provide wide-ranging opportunities for customer engagement in different retail banking environments.

Risks Associated with AI

Artificial intelligence enables numerous benefits to the banking industry, especially in assessing credit risk. By utilizing advanced machine learning algorithms and powerful big data, financial institutions can significantly improve assessments of clients' creditworthiness. This, in turn, allows low-income earners, small businesses, smallholder farmers, women, and other marginalized groups to gain access to much-needed credit. As a result, we witness a tremendous surge in financial inclusion, leading to substantial increases in incomes for these underserved populations. Moreover, the implementation of AI technologies has the potential to address widespread issues like information asymmetry in credit markets, effectively mitigating problems such as adverse selection and moral hazard that currently plague the industry. Incorporating AI in credit analysis revolutionizes how large and complex datasets are shared and analyzed, significantly reducing our dependence on human agents. By minimizing human involvement, we eradicate potential biases and inefficiencies that often lead to adversarial outcomes.



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Consequently, the use of AI minimizes the risks associated with moral hazard and ensures a fair and objective evaluation of creditworthiness. The transformative power of AI also extends to the broader picture of global economic development and poverty reduction, particularly within emerging markets. By empowering marginalized groups with access to credit, AI stimulates entrepreneurship, innovation, and economic growth. Artificial intelligence today enables banks to reevaluate credit requests that were previously postponed or denied, significantly improving the financial position of marginalized groups and reducing poverty in developing countries. Additionally, it can help address issues such as moral hazard, information asymmetry, and adverse selection. The use of artificial intelligence can revolutionize the banking industry by promoting fair development and inclusion within the ecosystem (Mhlanga, 2021).

There is a trend in the banking industry towards reducing correspondent international banking due to low returns and high-risk transactions worldwide associated with money laundering and terrorism financing. Artificial intelligence plays a key role in client identification processes and combating money laundering by enhancing the understanding of compliance and reputational risks, analyzing payment methods, and identifying anomalies. Many financial institutions are already harnessing the power of artificial intelligence to address a range of obstacles, from improving fraud detection to identifying security vulnerabilities. Surveys show that a large number of financial firms around the world are harnessing the potential of AI to enhance cash flow predictions, improve liquidity management, fine-tune credit scores, and strengthen fraud detection. While banks have been using machine learning for credit assessment and lending, AI offers the potential to significantly enhance credit scoring by incorporating unstructured data (Bank for International Settlements, 2024).

The rise of AI presents both significant opportunities and risks for the financial sector, as it deals with many cognitively demanding tasks and relies heavily on data. Table 1 demonstrates how AI is impacting key areas such as payments, lending, insurance, and asset management. This illustrates the importance of understanding and harnessing the power of AI in the whole financial industry (Bank for International Settlements, 2024).

Table 1. Opportunities, challenges and financial stability risks of AI in the financial sector

	Payments	Lending	Insurance	Asset management
General opportunities	Back-end processing, virtual assistants, co-pilots, fraud detection, regulatory compliance			
Sector-specific opportunities	Liquidity management, AML/KYC	Credit risk analysis, financial inclusion	Risk assessment, pricing, claims processing	Portfolio allocation, algorithmic trading, robo-advising, asset embeddings
General challenges	Lack of explainability, data silos, third-party dependencies, algorithmic collusion, hallucinations, cyber security risks			
Sector-specific challenges	Liquidity crises, sophisticated fraud and cyber attacks	Algorithmic discrimination, privacy concerns	Zero-sum arms race for private gains, herding, algorithmic coordination	
Financial stability challenges	Herding, network interconnectedness and procyclicality, single point of failure, incorrect decisions based on short samples of non-representative data, spillovers from real sector			

Source: Adapted from Aldaroso, Gambacorta, Korinek, Shreeti and Stein, 2024.

Artificial intelligence plays a paramount role in increasing the efficiency and safety of banking systems. As banking systems are digitalizing and the internet's purchase capacity is growing more popular, the new digital currency and transaction systems are gaining momentum. Many banking institutions are online now. Nevertheless, many banking systems are suffering from a security attack that may be caused



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by denial of service, impersonation, phishing, malware, or fraud. Terrorist who are instigated by their friends or relatives uses their knowledge and financial support from outside of the country to use the bank accounts of innocent persons by receiving funds, phone calls, and information. Artificial intelligence represents one of the most reliable and specialized technologies that banks use to increase efficiency and reduce fraud (Congressional Research Services, 2024).

AI's strength and efficiency, compared to humans, can increase systemic financial risk, potentially leading to serious financial crises and economic recessions. The application and capabilities of artificial intelligence can destabilize financial systems, and jeopardize the mechanisms of their functioning considering their complexity, benefits, and economic growth (Danielsson, Uthemann, 2023). Therefore, it is very important to carefully consider and identify the risks and challenges that its application brings to ensure financial stability and reduce exposure to systemic risks. The intensive use of artificial intelligence can lead to errors, complications such as generating false or illogical information, and limitations in transparency in operations (McKinsey Worldwide Institute, 2024). The overall impact will depend on how challenges related to data, model development, and implementation are effectively addressed by financial institutions and the financial system as a whole (Leitner et al., 2024).

Increased AI implementation raises serious concerns regarding cyber attacks, which pose a major problem for the financial industry. Frauds through phishing emails, and data mining for accessing customer accounts involving the misuse of user data, names, and passwords are prevalent. Using artificial intelligence, hackers could strengthen their abilities by creating new ways to steal information, block a company's files for ransom, mimic the voices or writing styles of individuals, and create fake avatars. All these factors could significantly increase security risks for banks and their clients (Bank for International Settlements, 2024). The increased use of AI could lead to issues in user protection, bias, and discrimination in fair lending processes. Specifically, AI models may reflect biases in decision-making due to being trained on a certain type of data, resulting in unfair decisions when approving loans for users. Additionally, the question of data security and confidentiality arises in line with high standards in this field. These issues must be addressed to maintain user trust and avoid legal risks (Bank for International Settlements, 2024).

Market participants' overreliance on a small number of algorithms may pose financial stability risks. As AI becomes more prevalent in the financial system and gains the ability to make independent decisions at a speed far beyond humans, there is a potential for increased market volatility and procyclicality. Furthermore, the rapid development and introduction of new products by AI could introduce new and unknown risks. (Bank for International Settlements, 2024).

AI TECHNOLOGIES – TOOL FOR ENHANCING SECURITY

In today's rapidly evolving banking landscape, security is of utmost importance. AI technology has emerged as a powerful tool for enhancing security in banking systems. One key application of AI in banking security is biometric authentication. By leveraging advanced algorithms, biometric authentication provides an additional layer of security by using unique physical characteristics such as fingerprints, facial recognition, and voice patterns to verify the identity of customers. This not only reduces the risk of unauthorized access but also improves the overall customer experience by streamlining the authentication process.

Another significant security enhancement through AI in banking systems is anomaly detection. AI-powered anomaly detection systems are capable of analyzing large volumes of data in real time to identify irregular



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patterns or suspicious activities that deviate from normal behavior. Artificial intelligence enables banks to act quickly in the process of risk reduction and protecting the interests of clients. It can identify fraudulent activities such as money laundering or vulnerabilities in bank security concerning both the bank itself and its clients. It provides increased security for banks and clients through the use of biometric authentication, which offers a high level of accuracy and reliability in carrying out banking transactions. It surpasses traditional security methods such as passwords and PIN codes and the need to memorize them. It relies on physical and behavioral human characteristics (fingerprints, voice recognition, and iris scanning). This advanced authentication method has significantly reduced the risks of theft and unauthorized access, enhancing efficiency and security in this field. In the future, this technology will enable banks to authenticate their users through facial and vein recognition, significantly increasing their efficiency and security. One of the significant benefits of implementing artificial intelligence is its ability to detect anomalies, learn, and adapt to new threats, and various forms of fraud. This proactive approach allows banks to anticipate potential security threats, minimize fraud risks, and ensure safety in operations, ultimately securing their business and the interests of their clients.

CHALLENGES AND ETHICAL CONSIDERATIONS

As the banking sector increasingly integrates artificial intelligence (AI) to enhance efficiency and security, it is imperative to examine the potential hurdles that might impede its successful deployment. High-value, often confidential transactions take place in seconds - second to none. One mishap could ruin clients' trust and war the bank with criminal organizations; therefore, banking systems demand high safety precaution losses and malfunction avoidance (Radanliev et al., 2024). Banking flows represent one of the largest datasets across the globe and allow tracking of every customer like a GPS point. This raises ethical dilemmas related to data-accessible usage in prediction models, tracking employees' activity, and revealing highly confidential information without the owner's consent of usage. Additionally, as commercially available solutions would be improved over a larger amount of training data, there is a risk of exposing banks to system malfunction and crimes that involve secrecy agreements.

An ethical issue is the incomprehensive and obscure (black box) style of predictions generated from bank accounts compliance with the law. Irregularities in credit ratings and outsources credit capability information could keep people from opportunities enlarging holes in the financial system. A black box error in intention for fraud cannot challenge the decision and genuine reasons for a credit hold would raise a smoke signal for lawsuits. Should algorithms work based on older social studies and thus disadvantage social groups, it would be discrimination as well as in the case of using sex, age, national culture, etc. data in calculations.

CONCLUSIONS

In summary, the text sheds light on many aspects in which artificial intelligence can be utilized in the banking system. Firstly, it is evident that AI can be a stepping stone toward greater efficiency; fraud detection makes real-time analysis of vast datasets possible, and AI trading can achieve both quicker and more precise trades. Secondly, AI can dramatically improve banks' security, detect attacks in the early stages, and protect sensitive data, which is very important as banking systems become increasingly complex and more vulnerable to potential risks. NLP enables the processing of large databases that banks handle and analyze with optimal efficiency. The data processing process enables the preemptive



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detection of fraud and money laundering. However, artificial intelligence is a very complex and multidimensional field. Its implications must be uncovered, with banks being cautioned to do this task in collaboration with professional investigators and regulators.

As for the future, expectations are that the development and refinement of artificial intelligence will continue even though abuses are still possible. Nonetheless, financial institutions are encouraged to invest responsibly in research and development, as the benefits of using AI far outweigh the risks. The banking system has accelerated the evolution of the Internet from an elite technology to a democratized source of information. Exploring opportunities to rename the process with artificial intelligence produces the potential to induce yet another monumental transformation of this financial system. Such a transformation has the power to address injustices in banking operations, such as irregularities in loan approvals and credit card debts, creating financial uncertainty for millions of banking service users. The original wrongdoings of the banking system ought to catalyze a responsible investment of their resources in shoring up its safety and integrity given the deadliest threats to democracy posed by their actions.

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