Integrating Artificial Intelligence and Blockchain for Assessing the Financial Risk of Fraud in Banking Sector

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Abstract

Purpose: This paper investigates the integration of Artificial Intelligence (AI) and Blockchain technology in assessing and mitigating financial fraud risks within the banking sector. It aims to explore how these technologies enhance the efficiency, transparency, and security of banking operations while reducing cyber threats and operational vulnerabilities.

Design/Methodology/Approach: A mixed-method research design was adopted, combining exploratory and analytical approaches. The study reviews extensive literature and incorporates a case analysis of JPMorgan Chase to illustrate real-world implementation. Data were sourced from peer-reviewed publications, financial reports, and institutional studies. Machine learning models such as Random Forest, Support Vector Machine (SVM), and regression algorithms were examined for their effectiveness in fraud detection. Blockchain's decentralized and tamper-proof ledger system was analyzed for its role in improving compliance, data integrity, and fraud prevention.

Findings: The integration of AI and Blockchain enhances fraud detection accuracy, reduces false positives, and minimizes transaction manipulation risks. AI-driven predictive models identify anomalies in real time, while Blockchain ensures transparency and immutable recordkeeping. The JPMorgan case demonstrates that these technologies collectively improve operational efficiency, cut investigation time, and strengthen compliance with KYC and AML regulations. However, challenges remain in areas such as data privacy, interoperability, and ethical governance.

Practical Implications: The research provides actionable insights for banks and policymakers to develop AI-Blockchain frameworks that bolster fraud prevention and regulatory compliance while fostering customer trust and financial inclusion.

Originality/Value: This study contributes to the growing body of interdisciplinary research connecting AI, Blockchain, and financial risk management, emphasizing their synergistic potential in transforming global banking security.

Keywords: Artificial Intelligence, Block-chain, Machine learning, Regression, Algorithms, Security, Economy.

Introduction

Artificial Intelligence is known to be the science and engineering of creating machines that can easily perform the tasks with the help of human beings. Banking is the most important financial system which regulates the money. Financial Risk is the risk in banks or other financial institutions due to operational risk, credit management risk etc.

Traditional Banking is considered as a place where people can easily store their money and other valuable material like gold and silver but slowly banks started providing the facilities of providing loans to people which encourage them to be self-entrepreneurs and adds to the economy of nation. With the advent of digital financing and more technological advancement modern banking systems consist of various financial institutions and instruments which further enhance the functioning of money and make it more convenient to use. But there are chances of fraud. Now one can access their accounts 24/7 and can protect them by using security passwords. (Abdel et al., n.d.) Managing financial resources in banks now comes to be very challenging task for all managers and the policymakers. Gulf regions are also affected by this system, and they are also developing more multi-dimensional techniques to control the resources (Ahmed et al., 2023). The financial threat of fraudulent activities and credit risk management has become a global challenge, and many people lost their money in this cybercrime. The advent of digital and online system has further increased the complications of managing the resources and increasing the fraudulent activities. Traditional methods have failed to prevent all these crimes which necessitate the emergence of a system which detect the fraud at the earliest and protect it by some security passwords. (Sohel et al., 2024) Artificial Intelligence can easily analyze big transactional data by studying the fraud and highlights the anomaly in data and study the behavior of the transactions. The introduction of KYC- Know Your Customer is being introduced with the help of Natural Language Processing. (Abdel et al., n.d.). AI has emerged as a powerful tool in financial risk management by analyzing large volumes of data in real time. Machine learning models continuously adapt to identify anomalies, assess credit risks, and detect fraudulent activities with greater precision. The ability of AI-powered systems to learn from past fraudulent transactions and enhance predictive accuracy enables banks to proactively mitigate risks while ensuring regulatory compliance (Johora et al., 2024; Meghani, 2020)

Issuing a loan in the bank needs a lot of attention as to assess the possibility of getting the loan back is very important for the banks Various documentary and case studies have been studied to collect the data from the public and to make the information in a very systematic order and to assess the transaction at the earliest stage by analyzing the ability of the customer through transaction history. (Mhlanga, 2021). Simultaneously, Blockchain technology introduces a decentralized and tamper-proof ledger that enhances transaction transparency and security. By eliminating intermediaries and ensuring data integrity, Blockchain significantly reduces risks associated with fraud, double-spending, and unauthorized data modifications. Moreover, smart contracts, which are AI-powered self-executing agreements, further optimize banking processes by automating risk assessments, compliance verification, and fraud detection, reducing human intervention and improving efficiency (Meghani, 2020; Meduri et al., 2024).The main objective of the study is to assess the various AI algorithms and machine learning techniques to detect fraud and manage the credit risk at the earliest and to prevent it. It

further helps in building the trust of the customer, making the system more reliable, faster and precision. It makes the decision-making process easier and develops the risk preventing strategies at national and global level. (Sekar, 2023) The integration of AI and Blockchain not only strengthens risk management and fraud prevention mechanisms but also enhances financial accessibility, particularly in underserved regions. These technologies improve operational efficiency, lower costs, and streamline regulatory compliance. However, challenges such as data privacy concerns, scalability issues, and system interoperability need to be addressed to facilitate widespread adoption (Meduri et al., 2024).

1.1 Types of Financial Risk

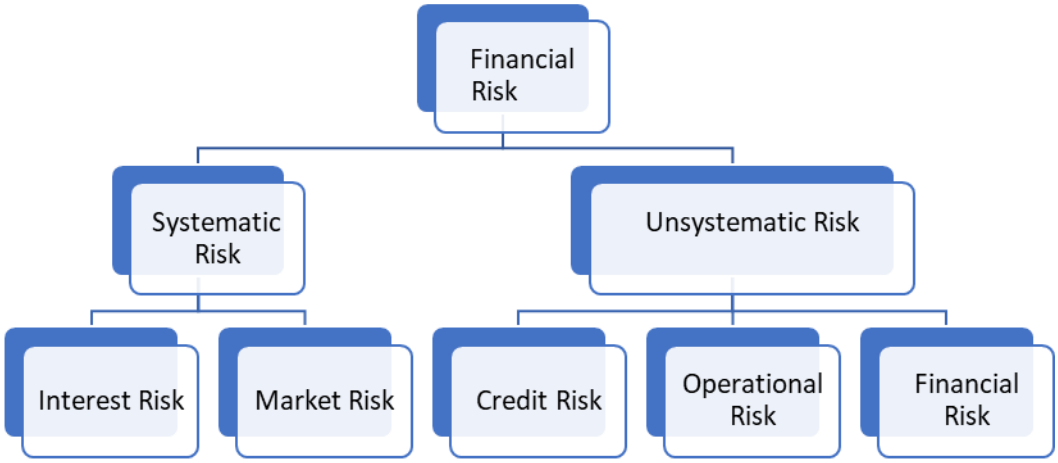

Figure 1

Review of Literature

Johora et al. (2024) examine the transformative role of artificial intelligence in fraud detection within the banking sector. The study highlights the increasing complexity of cyber threats and the inefficiencies of traditional rule-based fraud detection methods. It emphasizes the shift towards AI-driven models, particularly machine learning algorithms, which enhance fraud detection accuracy by identifying patterns and anomalies in transaction data. The research underscores AI's ability to continuously adapt and learn from financial data, thereby improving its capacity to detect fraudulent activities in real time. Furthermore, it discusses the importance of encryption and data privacy measures to secure financial transactions and protect customer information from potential cyber threats. The authors conclude that AI-powered fraud detection can significantly strengthen banking security by reducing financial crime and enhancing trust in digital transactions

Sohel et al (2024) focuses on to research tactical methods for decreasing risks related to identifying credit card fraud. To evaluate the way new technology helps fraud detection and prevention. To give users an adequate understanding of modern methods for handling risks in financial transactions. Preferred Reporting Items for Systematic Reviews and Meta analysis have been used to collect multiple academic data related to credit fraud detection. Previous 97 articles were studied to identify the common problems and technological

approaches adopted. Mining and Block chain techniques were also to analyze the advance data. To detect fraud 67% of the study focused on machine learning techniques which indicate its dependence. As compared to the traditional methods, notable improvements have been made in improving the efficiency of the fraud detection system. 85% have been seen in false system which enhance the users experience and cost for operations also reduces. Machine learning and Block chain will help in improving credit and fraud detection. By using ML driven technique, it helps in providing financial security. The system shows the innovative technologies to develop risk management strategies.

Meduri et al. (2024) provide an in-depth analysis of the integration of AI and Blockchain in the financial sector, with a focus on their applications in risk assessment, fraud prevention, and operational efficiency. The study highlights AI's capability to enhance predictive analytics, market analysis, and fraud detection through machine learning models that assess large datasets in real time. Additionally, it explores Blockchain's ability to ensure transparency and security by creating decentralized, tamper-proof transaction records. The paper discusses real-world applications, such as smart contracts that automate compliance checks and streamline risk evaluation. The authors also examine the potential barriers to the adoption of these technologies, including interoperability concerns, evolving regulatory frameworks, and ethical considerations. Despite these challenges, the study emphasizes the transformative potential of AI and Blockchain in revolutionizing financial security, minimizing fraud, and improving accessibility to banking services

Lin (2024) delineated the study focuses on the benefits of AI which helps in increasing efficiency and accuracy in detecting fraud. The study further investigates the use of Random Forest Algorithm in investigating fraud and detecting patterns. Data is to be collected from the different banks to see the pattern of financial transactions. Model training and Model evaluation methods are used to optimize the data. Line charts and scatter plots techniques helps in taking action for stakeholders. Specific hours and unusual patterns are found to see the pattern of anomaly transactions. The study highlights the usage of AI as a tool for fraud detection.

Xu (2024) advised to focus on the creation of strong framework by using deep learning and AI to identify fraudulent transactions. To assess how well the suggested model performs as compared to the traditional system. To study different factors that affect the effectiveness of fraud detection. Forest Algorithm technique has been used to detect accuracy for the top 1000 transactions. The Autoencoder algorithm has also been used to detect fraud in an unsupervised learning technique. Correlation methods and F1 scores have also been used to assess the performance. 4. Data from previous study include both legitimate and fraudulent transaction have been studied related to the transaction history.

Abdel et al (2023) emphasis on the effectiveness of AI in detecting and preventing fraud banking. To assess how AI can aid in ensuring compliance with evolving regulatory standards and explore the role of AI in improving risk management practices. The research paper is qualitative in nature as it takes literature review of previous paper and few case studies to explain the role of AI in modern Banking. AI helps in detecting the phishing of the data by using modern algorithms and further helps in monitoring and interpreting regulations with the required requirements of the system. It makes the banking system more reliable and helps in

enhancing authenticity of data. Assessing financial risk at the earliest opportunity gives competitive advantage to the banks.

Ibrahim at el 2023 said that banking fraud is the paramount problem which needs to be encountered at the earliest with proper AI methods. The study is to analyze using Adaptive Neural Network and fuzzy Inference system to compute, analyze and develop overall risk index in gulf regions. The researcher took data from 45 banks over a period of 5 years and calculating ratios and sensitivity technique is being used. Net Interest Margin Ratio is the most important ratio that indicates variations. It helps in formulating various strategies for the banks which helps in future decision making.

Zanke 2023 said that Artificial Intelligence is one of the most important key points in managing finance in sectors like banking, health and insurance. The study is to assess the effectiveness, flexibility and usability of AI powered fraud detection system across different sectors and how stakeholders can improve the outcome of fraud detection. Key performance indicators involve coding and statistical techniques like regression is being used. The study proposes that it helps in decreasing false claims and cost savings and further sectors work with more legal compliance. The outcome of protection against fraud and cost saving helps in designing and implementing methods.

Nuthalapati (2023) focuses on studying cybersecurity methods to detect fraud in digital banking systems. The objective is to combine AI and machine learning models for developing an advanced cybersecurity model and to increase the customers' trust in the system and provide them financial security. It further increases real time detection and reduces the cyber security threats. Data set is divided into two studies loan acceptance prediction and fraudulent credit card detection. Random Forest algorithm shows 92% accuracy in loan acceptance model. Credit card transaction records have been taken from 30,000 users over 6 years. Support Vector Machine techinque used in credit card transactions shows accuracy upto 90%. This system will increase the security measures and improve the operational efficiency of the banks. Continuous preventive changes will bring improvement in emerging threats.

Bohdan (2023) investigated to examine the fraud in online banking system which has increased globally after pandemic Covid 19 and to bring new AI algorithms that can help in examining transaction patterns and anomalies in the transactions. It further checks some preprocessing methods to improve detection rate. Various machine learning techniques like Random Forest, Regression, Decision Tree and SVM for data processing have been used. Data set for credit card fraud detection from European cardholders has been comprised. Precision, F1 score and Recall are another evaluation metrics that have been used. Logistics Regression outperform other individual models by achieving an AUC of .946. Ensemble methods will outperform than standalone classifiers. Ensemble models are efficient in reducing financial fraud. More integrated AI models should be encouraged to reduce operational risks in the banking sector.

Khare et al. 2023: To study machine learning methods to detect and prevent fraud in online transactions. European credit card data will be collected to enhance fraud detection efficiency. To study various models like F1 score to develop performance metrics. Machine learning models like Random Forest and decision tree have been used. Z score is used to normalize the data and to transform the non-numeric data to numeric data. SMOTE technique has been used to reduce the redundancy of data. Performance metrics F1, accuracy and precision have been used. The decision tree shows the accuracy of 99% but with lower precision. Random forest

shows the performance level at 95.9% and 95.1% F1 score. Logistics Regression also lags 90% in accuracy. Detailed analysis of ML model will help in the future search. Integration of digital and hybrid methods will increase the authenticity for detecting performance.

(Doumpos et al., 2023) presents the use of AI and OR in banks over the last decade. It highlights the important aspects like bank efficiency, performance assessment and fintech innovation. A detailed analysis of 338 studies have been made to identify the trend and challenges of AI and OR in banking systems and how to improve them for future operations.

(Sadok et al., 2022) reviews the combination of AI in banking operations to increase the potential of effective decision making. It emphasizes shifting the paradigm from traditional approach to big data analysis. The researchers further explores the social, ethical and regulatory concerns to implement AI in better way. Big data analysis and machine learning statistics tools were used to benefit the users and economy at large to mitigate the risks.

(R. & Ravi, 2021) focus on to study the estimate of service differentiation variables on employee performance. To explore the relation between the adoption of disruptive techniques and the quality-of-service delivery in investment banks. These further analyses the relevance of service differentiation enabled workflows in investment banks. Data to be collected from 250 respondents by using cluster sampling technique in foreign investment banks of Bangalore, Mumbai and Chennai. Likert scale is used to assess demographic data, employee performance and service differentiation. Statistical techniques like correlation, regression and chi square test was used. Transparency, Reliability, validation and controlling operating costs helps to enhance the employee performance. Integration of AI and BC increases the transparency, operational efficiency improves the employee's performance by decentralizing ledger.

(Mhlanga, 2021) is to assess and contrast AI powered fraud detection systems in the study how to detect financial fraud and reduce cyber security threat in digital banking system by using AI model.The study main purpose is to develop the model of AI algorithm to predict cash movements and increases the efficiency of banks. Literature reviews from different sources, for example government, non-government and other media articles have been used to study. Documentary and Case- study analysis has also been used to see the impact of AI assessing risk. Compared to traditional methods, using AI helps in reducing chances of fraud. It further helps in simplifying the information and to estimate the trend which helps in effective decision making. By increasing their credit risk assessment methods, financial institutions may utilize AI and ML to encourage greater financial inclusion. The adoption of these technologies by financial service providers and policymakers might assist underbanked individuals solve their financial issues and eventually promote peace and growth in the economy in developing nation.

Meghani (2020) explores the implementation of AI and Blockchain technology in India's banking industry, with a specific focus on major commercial banks such as HDFC Bank, ICICI Bank, and SBI. The study examines how AI-based solutions, including chatbots, robotic process automation (RPA), and advanced credit scoring models, are streamlining banking operations and improving customer experience. It also discusses the role of Blockchain in strengthening transaction security, enhancing Know Your Customer (KYC) verification processes, and mitigating fraud risks. The research highlights case studies from global banking institutions and evaluates the benefits and challenges of AI adoption in personalized banking services. However, the study also acknowledges key challenges, such as regulatory

compliance, data privacy issues, and technological scalability, that must be addressed to facilitate the seamless integration of AI and Blockchain in the banking sector

(Umamaheswari et al., n.d.) emphasizes the transformative aspect of AI on the banking sector by making use of automation, reducing dependency on human and improving profitability of the system. AI tools like virtual and chatbot are used to increase efficiency and to address the customer needs and to detect the fraud. The study focuses on the importance of AI in reducing operational costs and detecting fraud and to improve the overall efficiency of the banking sector.

(Patil, n.d.) said to investigate whether AI could enhance the efficacy and precision of identifying fraud and financial risk assessment. To explore whether AI-powered solutions may enhance financial businesses evaluation of credit risk and decrease fraud losses. To investigate the ethical dilemmas generated by AI in financial applications, such as confidentiality of information, prejudice, and responsibility, and to provide remedies. Data from the bank related to loan and credit processing has been taken and then mean and modes techniques have been applied. Algorithm model i.e. Random Forest has been used to detect the fraud and how to reduce it. By using AI model, the study is able to achieve loan status prediction about 94%. This study helps to make the decision-making flow chart of relation between input and output value. Collaboration with fintech and other institutions will increase the authenticity of data.

Research Gap

The various study focuses on different methods and performance metrics that have been adopted to examine the financial risk to detect fraud and credit risk in online and offline banking system. AI and machine learning models have been helpful in detecting fraud and improving the transaction system specifically to predict the loan back period. Random Forest, Autoencoder, Performance Metrics, FI accuracy, precision and scalability are some of the methods but still study does not cover Block chain technology method. This method provides a secure and transparent technology to examine the data more accurately and efficiently. This gap provides an opportunity to analyze the block chain potential in examining fraud detection and credit risk.

Importance of the Research Gap

The study helps to analyze the various methods to detect fraud and prevent financial risk in the banking sector. The Block chain method which is still not explored properly needs to be examined as it is significant in various ways:

1.It will help us to get a more secure and transparent fraud detection system.

2.This method will revolutionize the whole banking system as now online transactions are being preferred by people.

3. It increases the trust of the customer as continuous monitoring is being done.

4. To detect fraud and suspicious anomaly in transaction at earliest.

5.The manual efforts will also decrease to manage the transaction as compared to traditional method.

6.It will further ensure the legal requirement of the banking system.

Objectives

1.To analyze existing literature on AI and Blockchain applications in fraud detection and risk management within the banking sector.

2.To assess the impact of AI and Blockchain integration on enhancing financial security, reducing frauds and improving regulatory compliance in the banking sector.

Table 1. Fraudulent banking approaches and threats (Mytnyk et al., 2023).

Fraudulent Banking Approach	Threat
Phishing (Abidoye & Kabaso, 2021; Barker, 2020)	The attacker steals login credentials or other personal information by tricking the victim into entering them on a fake banking website or through a fake email or text message.
Malware (Shah et al., 2022)	Malicious software is used to steal login credentials or other personal information and may be used to take control of the victim's computer or manipulate banking transactions.
Social Engineering (Maulana & Fajar, 2021)	Attackers use psychological manipulation to trick victims into disclosing sensitive information or performing transactions they would not normally. This may include pretexting, baiting, or quid pro quo tactics.
Skimming (Al Hattali et al., 2020)	Attackers install devices on ATMs or other card readers to steal card information. This information is then used to create counterfeit cards or make unauthorized transactions.
Account Takeover (Tsai & Su, 2021)	Attackers access a victim's account by stealing login credentials or other means. Once in the account, they make unauthorized transactions, change account details, or otherwise manipulate the account for their gain.
Fake Checks (Hammi et al., 2021)	Attackers send fake checks to victims, asking them to deposit them and send back a portion of the funds. The check eventually bounces, leaving the victim responsible for the funds they sent to the attacker.
Money Mules (Abdul Rani et al., 2024)	Attackers recruit unwitting victims to help launder money by having them receive and send funds on their behalf. The victims say they are performing legitimate work but participating in illegal activities.

Methodology

Research Design and Approach

This study employs a mixed-methods research approach, integrating Exploratory and Analytical Research to comprehensively explore the role of Artificial Intelligence (AI) and Blockchain technology in financial risk management within the banking sector. The qualitative aspect involves an in-depth examination of conceptual frameworks, theoretical models, and industry best practices through a systematic review of academic literature, industry reports, and regulatory guidelines. This approach helps identify key trends, challenges, and the evolving applications of AI and Blockchain in banking operations

Data: Record from Published Financial Resources.

Case Study

Overview

Analysis of JPMorgan's AI and Blockchain Integration

A. Enhanced Fraud Detection and Prevention

JPMorgan's AI-driven fraud detection system continuously analyses vast datasets to identify suspicious patterns in financial transactions. Unlike traditional rule-based fraud detection, AI-powered systems adapt in real-time, making them highly effective against emerging threats such as identity theft, synthetic fraud, and unauthorized access.

Blockchain technology further enhances fraud prevention by ensuring data integrity and immutability. Transactions recorded on a Blockchain ledger cannot be altered, reducing the risk of unauthorized modifications or fraudulent manipulations. The combination of AI and Blockchain creates a multi-layered security approach, where AI detects fraud attempts and Blockchain ensures that transaction records remain tamper-proof.

B. Efficiency and Cost Reduction

The adoption of AI and Blockchain has significantly reduced the time and costs associated with fraud investigations and financial settlements. For instance, JPMorgan's Coin platform has automated the review of over 12,000 contracts, cutting down document processing time from 360,000 hours to a matter of seconds. Similarly, Blockchain-powered interbank transactions have improved payment processing speed, reducing manual verification costs and delays.

C. Compliance and Regulatory Advancements

Regulatory compliance is a key challenge in banking fraud detection. JPMorgan's AI and Blockchain integration helps financial institutions meet Know Your Customer (KYC) and Anti-Money Laundering (AML) regulations more effectively. AI automates the detection of high-risk transactions, while Blockchain ensures an auditable and transparent record of all transactions, making regulatory reporting more accurate and efficient.

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4. Results and Impact

The implementation of AI and Blockchain in fraud detection at JPMorgan Chase has yielded several notable benefits:

- Improved Fraud Detection Accuracy: AI-powered fraud detection models have enhanced accuracy by over 50%, reducing false positives and improving response times.
- Stronger Transaction Security: Blockchain technology has significantly lowered the risk of fraudulent activities, ensuring greater transparency in financial transactions.
- Reduced Fraud-Related Losses: The integration of AI and Blockchain has helped JPMorgan save millions in fraud mitigation costs by proactively preventing fraudulent transactions.
- Faster Transaction Processing: The use of AI and Blockchain has streamlined banking operations, reducing delays in fraud investigations and transaction verifications.
- Regulatory Compliance Improvements: AI-driven compliance monitoring has enabled JPMorgan to meet global financial regulations with greater efficiency.

5. Implications for the Banking Indus

JPMorgan Chase's success in integrating AI and Blockchain for fraud detection serves as a model for other financial institutions. The case study highlights several key implications:

1. Scalability of AI and Blockchain for Global Banking: The success of JPMorgan's initiatives demonstrates that AI and Blockchain can be scaled across international banking systems to enhance fraud detection.
2. Real-Time Risk Monitoring: AI's ability to analyze transactions in real time offers a proactive approach to fraud prevention, reducing financial losses for banks.
3. Regulatory and Security Enhancements: Blockchain ensures compliance with AML and KYC regulations, making it a valuable tool for financial transparency.
4. Challenges and Future Research: While AI and Blockchain improve fraud detection, challenges such as data privacy concerns, regulatory complexities, and interoperability issues must be addressed. Future research should explore how AI and Blockchain can adapt to evolving cyber threats, including deepfake fraud and insider financial crimes.

Future Scope

1.A unified evaluated framework would be developed to detect fraud.

2.To design actionable ethical guidelines for implementing AI in banking.

3.Block chain will helps in assessing the credit risk and managing the financial resources with more transparency.

Conclusion

The integration of Artificial Intelligence and Blockchain in banking fraud detection presents a transformative solution to financial risk management. AI-driven models, particularly machine learning algorithms like Random Forest, Support Vector Machines (SVM), and deep learning frameworks, have demonstrated their efficiency in identifying fraudulent transactions with high precision. However, challenges such as ethical concerns, data privacy issues, and Blockchain's limited adoption persist.

This study highlights the importance of Blockchain in creating a secure, transparent, and tamper-proof banking environment. While AI enhances fraud detection capabilities, Blockchain ensures data integrity and security, reducing the risks associated with unauthorized transactions. The integration of these technologies has the potential to revolutionize banking operations by increasing customer trust, reducing operational costs, and improving regulatory compliance.

Future research should focus on bridging the gaps in Blockchain adoption, ethical AI implementation, and regulatory alignment to develop a more robust and resilient financial ecosystem. By leveraging the synergy between AI and Blockchain, the banking sector can move towards a more secure, efficient, and fraud-resistant future**.**

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