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| RESEARCH ARTICLE

The Role of Blockchain in Banking Fraud Detection: Enhancing Security and Transparency

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| ABSTRACT
The financial industry is becoming more concerned about banking fraud as cybercriminals use more advanced techniques to take advantage of weaknesses in conventional banking systems. This study investigates how blockchain technology can be used to identify and stop fraud in the banking industry. The decentralized and unchangeable characteristics of blockchain technology provide improved security, transparency, and fraud detection effectiveness. Banking organizations can develop strong fraud detection systems by combining blockchain technology with artificial intelligence (AI) and machine learning (ML). To examine the importance of blockchain as a new IT technology, this paper refers to "The Future of Banking Fraud Detection" and assesses the possible advantages, difficulties, and practical uses of blockchain in banking fraud detection.

| KEYWORDS
Blockchain, Fraud Detection, Cyber security, Digital theft, financial security.

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1. Introduction

Identity theft, money laundering, credit card fraud, and cyber fraud are all categorized as types of banking fraud that provide serious risks to both customers and financial institutions (Ahmed et al., 2025). In addition to having an effect on individual account holders, these fraudulent acts cause significant financial losses that burden banks, companies, and the overall economy (Md Ekrim et al., 2024). Beyond the financial repercussions, banking fraud raises doubts among investors and consumers by undermining public confidence in financial institutions (Ahmed et al., 2025; Akter, Kamruzzaman, et al., 2024). People may be reluctant to use digital banking services if they believe that banks are susceptible to fraud and cyberattacks, which would hinder the expansion and innovation of the financial industry (Ajayi, Emmanuel, et al., 2024).

Despite their value, conventional fraud detection techniques frequently depend on centralized databases and rule-based approaches to find questionable transactions (Akter, Nilima, et al., 2024). Although these techniques have been somewhat helpful in identifying fraud, they also have a lot of drawbacks. Because they are a single point of failure, centralized databases are vulnerable to data breaches, illegal access, and cyberattacks (Daraghmi et al., 2024). In order to circumvent traditional security measures, hackers and fraudsters are constantly creating increasingly complex methods to take advantage of system flaws. Furthermore, because rule-based fraud detection models rely on preset criteria and patterns that fraudsters can learn to avoid, they frequently find it difficult to adjust to changing fraud strategies (Mahmud et al.).

The reactive nature of conventional fraud detection is one of its biggest drawbacks (Al Mahmud, Dhar, et al., 2025). Many current solutions rely on retroactive analysis, detecting fraud only after it has already happened, rather than proactively avoiding fraudulent transactions (Srinivasan & Wahyuningsih, 2024). Significant harm can have been done by the time fraud is discovered, necessitating expensive investigations and corrective action (Dewan Arpita et al., 2025). Financial institutions are more vulnerable to financial risks and are less nimble in their response to threats as a result of this fraud detection delay (Mia Md Tofayel Gonee et al., 2020; Miah et al., 2025).

Distributed ledger technology, or blockchain, offers a revolutionary way to improve banking security to address these issues. Blockchain functions on a decentralized network, in contrast to conventional centralized systems, where each transaction is cryptographically stored and verified across several nodes (Khair et al., 2024). By removing the possibility of a single point of failure, this decentralized architecture dramatically lowers the likelihood of fraud and illegal data tampering (Al Mahmud, Dhar, et al., 2025). It is nearly hard to change or fabricate transaction data because each transaction is permanently documented on a tamper-proof ledger (Srinivasan & Wahyuningsih, 2024).

The capacity of blockchain technology to enable real-time fraud monitoring is yet another significant benefit (Kaur et al., 2023). Financial organizations can track transactions as they happen by utilizing blockchain's transparency and immutability, which enables real-time verification and anomaly detection (Haddad et al., 2024; Islam et al., 2025). By enforcing predetermined security measures and setting off alerts for questionable activity, smart contracts' self-executing agreements encoded into the blockchain can further automate fraud protection methods. This proactive strategy improves security and facilitates more effective threat response for financial institutions (Ajayi, Igba, et al., 2024).

Banks may greatly fortify their security infrastructure, increase operational effectiveness, and improve financial transaction transparency by incorporating blockchain technology into fraud detection systems (Al Mahmud, Hossan, et al., 2025). By analyzing how its decentralized structure might reduce financial risks, expedite security procedures, and promote more confidence within the banking industry, this study investigates the potential of blockchain as a revolutionary tool in fraud prevention (Goffer, 2025) (Khan et al., 2024).

2. Literature review

Blockchain technology and Artificial Intelligence (AI) are transforming the financial sector by enhancing security, transparency, and efficiency (N. N. Islam Prova, 2024b). Blockchain, a decentralized ledger, provides an unalterable record of transactions, making it an ideal choice for reinforcing financial systems against cyber threats and fraudulent activities (Ali Linkon et al., 2024). AI, on the other hand, contributes predictive analytics, machine learning, and automation to financial operations, enabling real-time data analysis, risk assessment, and decision-making (Raj et al., 2023). This integration enhances the precision and dependability of financial data, creating a more secure and transparent ecosystem (Arpita et al., 2025). Blockchain's decentralized nature allows secure storage of customer data, mitigating identity theft risks. AI algorithms analyze extensive datasets to identify suspicious activities, ensuring adherence to regulatory requirements (Begum et al., 2022). Smart contracts automate and enforce contractual agreements, reducing reliance on intermediaries and human error. Blockchain's transparency ensures all stakeholders have access to a singular version of the truth, fostering trust in financial transactions (Chowdhury et al., 2023). AI's integration in fraud detection and risk management enhances proactive identification of potential threats, safeguarding financial institutions and their clients (Rane et al., 2023).

Methods of comparative analysis brought to light this dual-technology approach's advantages and disadvantages (Bhuiyan et al., 2025b). The findings show that ML's data-driven fraud detection skills, combined with blockchain's immutability and transparency, provide a strong foundation for transaction security (Alzoubi, 2024). According to a report, machine learning (ML) and blockchain provide a strong foundation for transaction security, guaranteeing data transparency and integrity. However, acceptance in small and medium-sized institutions is hampered by issues including scalability, high energy usage, and implementation costs (Bhuiyan et al., 2025b). Blockchain and machine learning together have the potential to revolutionize the financial industry by improving risk management, regulatory compliance, and transaction integrity (Biswas et al., 2024). Future studies ought to concentrate on creating economical and energy-efficient solutions, and developments in blockchain technology powered by AI and quantum computing may be able to fix current security flaws while also increasing the platform's scalability and accessibility (Chowdhury et al., 2023).

The possibility of incorporating blockchain technology for improved security and transparency is highlighted in a study that investigates the application of supervised machine learning algorithms in credit card fraud detection (Chowdhury et al., 2023). The XGBoost algorithm was determined to be the most effective, achieving 97% accuracy, 94% precision, and 0.97 AUC. For ongoing monitoring and adaptive security against cyberthreats, the study recommends implementing these algorithms and utilizing blockchain technology (Das et al., 2023). Another study looks at the weaknesses in distributed ledger systems, such as blockchain networks, and offers a number of prevention and detection techniques. Digital forensics, reputation-based systems, game-theoretic solutions, statistical and machine learning approaches, and risk assessment methodologies are all covered (Ahmed et al., 2023). Along with highlighting new developments and issues in the sector, the report makes recommendations for future research and technical advancements (Debnath et al., 2024). To improve network security and dependability, the article attempts to give a technical overview of anomaly and fraud detection within blockchain networks (Almadadha, 2024).

The incorporation of blockchain technology into finance infrastructure to reduce fraud concerns is covered in a piece of writing. Blockchain provides a decentralized ledger system that offers transaction records that are safe, transparent, and unchangeable (Ferdousmou et al., 2025). For fintech companies moving from conventional systems to blockchain-based solutions, it offers thorough migration plans that include risk assessment, hybrid system deployment, and thorough planning stages (Jimmy, 2024). Adopting blockchain has several advantages, such as higher operational efficiency, better data security, and improved transaction integrity (N. N. I. Prova, 2024). In addition to highlighting best practices for infrastructure deployment, the article

emphasizes how well blockchain reduces fraud (Hasan, Biswas, et al., 2025; Syed Nazmul Hasan, 2025). Fintech businesses may protect their operations from fraud, build consumer trust, and guarantee long-term viability and expansion in the cutthroat financial sector by incorporating blockchain technology (Mohammad Abdul et al., 2024; Saimon et al., 2023).

Blockchain and artificial intelligence's potential to improve energy supply chain transparency is investigated in a study. While AI improves operational efficiency through asset management and predictive analytics, blockchain provides a decentralized ledger for transparency and data integrity (Hasan, Farabi, et al., 2025). These technologies provide integration of renewable energy, cost savings, and real-time tracking. Scalability, data integrity, and regulatory ambiguity are still issues, though (Olabanji et al., 2024). Another report highlights the necessity of precise legal frameworks to control the implementation of blockchain and AI in the energy sector, encouraging investment in digital infrastructure and innovation (Hossain et al., 2024).

Blockchain technology, a virtual ledger, is gaining traction in the global food supply chain as a solution to combat food fraud and enhance food safety. It provides an immutable ledger system and transparent record-keeping, offering unmatched traceability and accountability. However, challenges such as scalability, interoperability, and data accuracy need to be overcome (Beggat, 2024). A study aims to provide a comprehensive overview of how blockchain addresses food fraud and improves food safety (N. N. Islam Prova, 2024a). It analyzes existing literature and case studies to examine its role in enhancing transparency, traceability, and sustainability in the food supply chain (Chowdhury, 2024). A study highlights the transformative potential of blockchain, emphasizing the importance of collaborative efforts among stakeholders and the integration of innovative approaches like decentralized data adjustment and genomic information (Miah, 2025). Further research is needed to explore the synergy between blockchain and emerging technologies like the Internet of Things and Artificial Intelligence (Duan et al., 2024).

3. Blockchain for fraud detection

Blockchain is a decentralized digital ledger that securely, openly, and irrevocably documents transactions. It is made up of cryptographically connected blocks that guarantee data integrity and guard against unwanted changes (Imran et al., 2024; Mia Md Tofayel Gonee et al., 2022). Among the main characteristics of blockchain technology are:

- Decentralization: Blockchain runs on a distributed network, lowering the possibility of single points of failure in contrast to traditional banking systems, which depend on centralized databases.
- Transparency: Since all parties can see transactions recorded on the blockchain, fraudulent activity is reduced.
- Immutability: Data integrity is ensured by the inability to change or remove a transaction after it has been recorded.
- Smart Contracts: These self-executing, automated contracts lower the danger of fraud by enforcing predetermined rules.

Banking security and transparency are improved by using blockchain technology in fraud detection systems (Kamruzzaman et al., 2024).

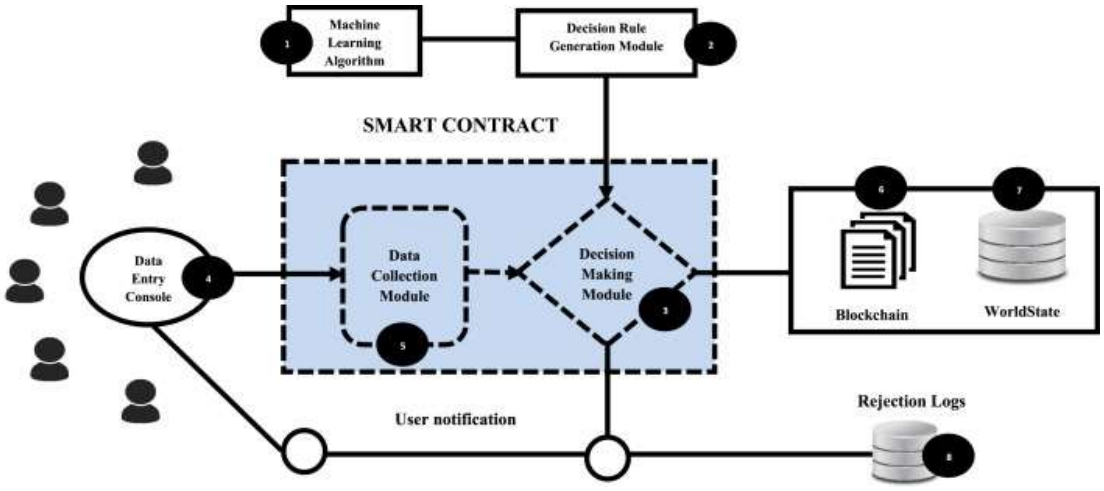

Fig. 1. Blockchain for Fraud detection (Amponsah et al., 2022).

KYC compliance and **identity verification** are two important applications (Manik et al., 2025). By safely storing client data on a decentralized ledger, blockchain can expedite Know Your client (KYC) processes. This lowers the danger of identity fraud by allowing banks to swiftly and effectively access confirmed customer identities. Furthermore, blockchain guarantees regulatory compliance and data privacy, enabling organizations to keep accurate client records while reducing their vulnerability to fraudulent activity (Md Habibullah Faisal 1, 2022). Figure 2 is a picture of end to end KYC process.

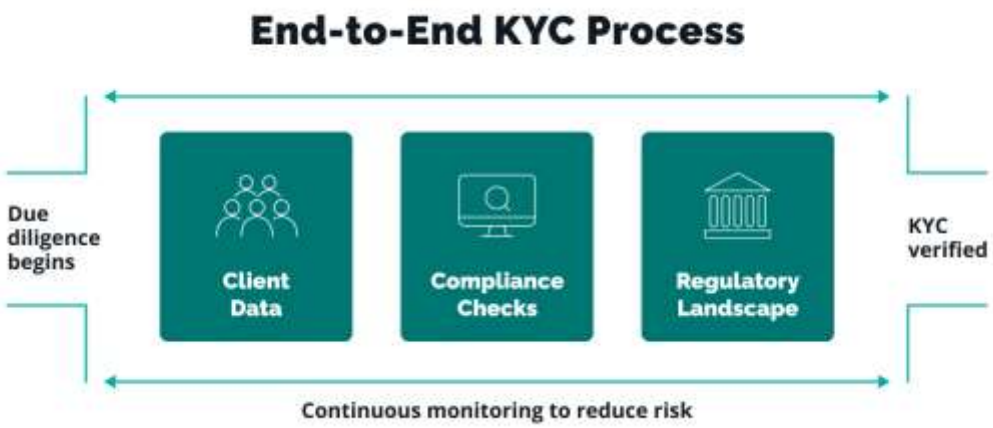

Fig. 2. End- to –End KYC process.

Real-time fraud detection and **transaction monitoring** are also crucial components. Financial activity may be continuously tracked because to blockchain's real-time transaction processing (Khair et al., 2025). Analytics driven by AI are able to identify irregularities in transaction patterns and flag questionable activity before it leads to monetary losses. Banks may create predictive models that foresee fraudulent activity and proactively reduce risks by fusing blockchain technology with artificial intelligence (Mahmud et al., 2025).

Blockchain also improves fraud detection in the areas of **interbank cooperation and secure data sharing**. Data silos and inefficient information sharing are common problems in traditional banking systems, which slows down and reduces the effectiveness of fraud detection. Blockchain uses cryptographic techniques to protect privacy while facilitating safe, smooth, and instantaneous data flow across financial institutions. By encouraging teamwork in detecting and stopping fraudulent activity, this lessens the likelihood that financial crime will evade systemic flaws.

Blockchain is also essential for lowering **chargebacks and payment fraud**. Banks face a serious problem with chargeback fraud, in which consumers fraudulently contest valid transactions in order to obtain money. All parties may confidently trace and validate transactions because to blockchain's transparent, verifiable transaction history. This openness enhances dispute settlement procedures and deters false chargeback claims.

Lastly, **smart contracts** and **anti-money laundering (AML)** help to prevent fraud. By identifying questionable transactions and sending out real-time alerts for more research, automated smart contracts can police AML requirements. These agreements give banks a proactive fraud detection system that doesn't rely entirely on human review procedures while also assisting in ensuring compliance with regulatory frameworks.

4. Benefits of blockchain in banking fraud detection

There are various advantages (Kamal et al., 2025) of using blockchain technology in banking fraud detection.

1. Improved Security: Unauthorized access and data breaches are prevented by blockchain's cryptographic features.
2. Increased Transparency: Since every transaction is documented on an unchangeable ledger, there is less chance of fraud and manipulation.
3. Lower Operational Costs: By using smart contracts to automate fraud detection procedures, manual interventions and related expenses are reduced.
4. Quicker Fraud Investigation: Real-time data exchange makes it easier to spot and stop fraudulent activity more quickly.
5. Increased Trust and Customer Confidence: Customers are more likely to trust banking organizations when financial transactions are transparent.

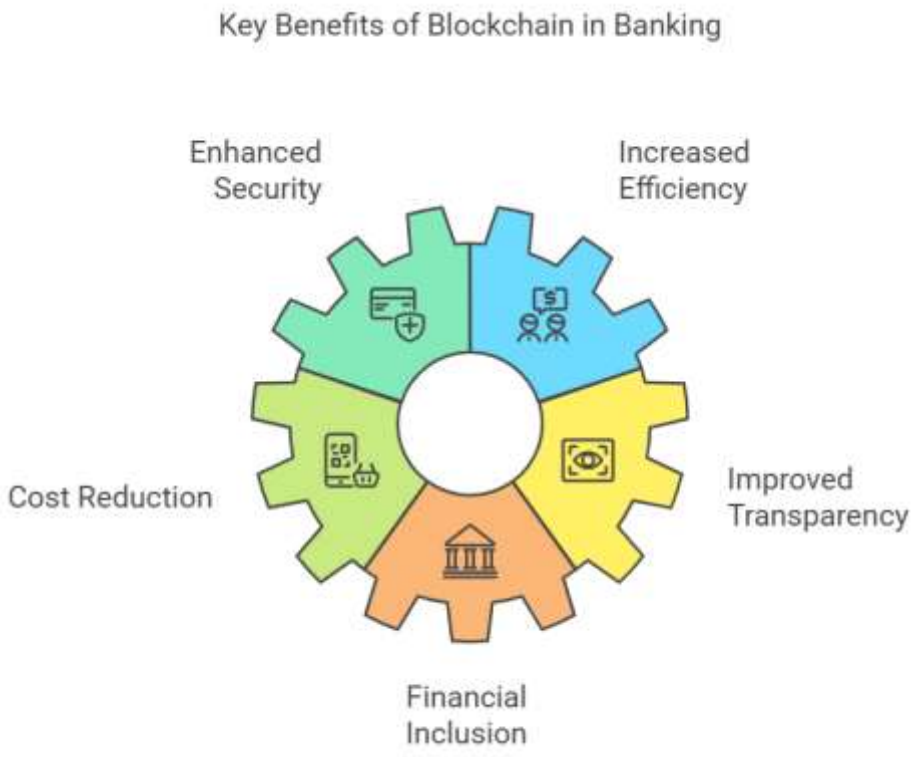

Fig. 3. Benefits of blockchain in banking (Johora et al., 2024).

5. Challenges and Limitations of blockchain in fraud detection

Despite its potential, blockchain technology has several obstacles (Goffer et al., 2025) when it comes to implementing fraud detection:

1. Scalability Issues: Blockchain networks may experience delays and higher expenses when processing high transaction volumes.
2. Regulatory Compliance: In order to incorporate blockchain technology into their current fraud detection systems, banks need to manage intricate regulatory frameworks.
3. Interoperability Issues: Smooth interoperability solutions are necessary for integrating blockchain with conventional banking infrastructures.
4. Adoption Barriers: Blockchain adoption in banking is hampered by a lack of knowledge and resistance to change.
5. Cybersecurity Risks: Despite blockchain's high level of security, smart contract and private key management flaws can be taken advantage of.

6. Real world applications

Blockchain has been successfully incorporated into the fraud detection systems of several financial institutions:

1. Quorum, a permissioned blockchain developed by JPMorgan Chase, improves transaction transparency and security in financial operations.
2. Ripple's xCurrent: A blockchain-based payment system that guarantees safe and impenetrable international transactions.
3. Financial institutions use IBM's Hyperledger Fabric to detect fraud and share data securely.
4. Estonia's e-Residency Program: This program uses blockchain technology to avoid fraud and securely verify identities.

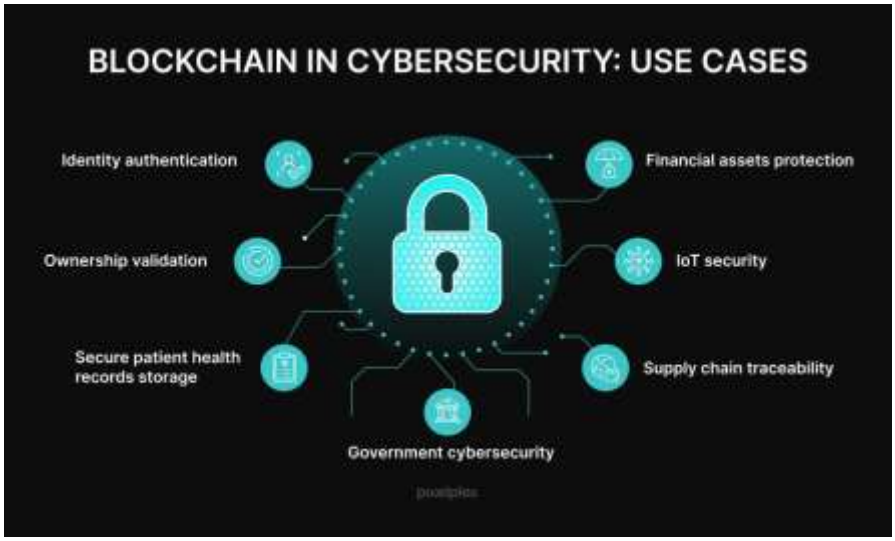

Fig. 4. Blockchain in cybersecurity (Bhuiyan et al., 2025a).

7. Future recommendations

Financial organizations should take into account the following in order to optimize blockchain's potential for banking fraud detection:

1. Cooperation and Standardization: Create industry-wide blockchain guidelines for regulatory compliance and fraud detection (Das et al., 2023).
2. Integration with AI and ML: Improve blockchain-based fraud detection capabilities by utilizing AI-driven analytics.
3. Regulatory Adaptation: To promote blockchain implementation in banking security, establish precise regulatory frameworks.
4. Scalability Solutions: To increase transaction processing speeds, use layer-2 solutions and blockchain improvements.
5. Customer Awareness: Inform clients about how blockchain technology helps to secure financial transactions.

8. Conclusion

Blockchain technology has the ability to drastically improve security, transparency, and operational efficiency, which could transform fraud detection in the banking industry. Conventional banking systems frequently depend on centralized databases, which are susceptible to internal fraud and cyberattacks. However, the decentralized and unchangeable ledger architecture of blockchain guarantees that every transaction is safely documented, making it very difficult for bad actors to change or manipulate financial data.

The usage of smart contracts, which are self-executing agreements with predetermined conditions, is one of the main benefits of blockchain in preventing fraud. By identifying suspicious transactions in real time and minimizing human participation, these contracts can automate fraud detection and cut down on mistakes and delays. Blockchain also makes it possible to monitor transactions in real time, which helps financial institutions identify and address fraudulent activity faster. All parties involved, including regulators and auditors, will have access to a verifiable and impenetrable transaction history thanks to this greater openness, which will boost public confidence in the financial system as a whole.

Blockchain adoption in banking fraud detection is not without difficulties, despite its revolutionary promise. Since blockchain networks need to manage a large number of transactions effectively without sacrificing speed, scalability is still a major challenge. Additionally, regulatory frameworks must change to accommodate blockchain technology's special features and make sure that compliance procedures match changing financial security guidelines. Proactive regulatory involvement, industry-wide cooperation, and ongoing technical improvements are necessary to meet these problems. In order to further improve fraud detection capabilities, future research should concentrate on integrating blockchain technology with artificial intelligence (AI). Large volumes of transactional data can be processed by AI-powered analytics to find trends and abnormalities suggestive of fraud. Blockchain technology and artificial intelligence (AI) together may produce a more sophisticated and robust fraud prevention system, lowering losses and bolstering banking organizations' integrity. The combination of these technologies may change the financial security environment as innovation advances, making fraud detection more dependable and efficient than ever.

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