



Blockchain Technology in Financial Transactions: Addressing Challenges in Security and Scalability

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Abstract:

Originally developed for use with bitcoin transactions, blockchain technology has quickly become a game-changing tool for improving the safety, openness, and effectiveness of a wide range of financial processes. It has great promise for resolving pressing issues in the financial industry, including as data integrity, transaction delays, and fraud, thanks to its cryptographic characteristics and decentralised structure. Despite blockchain's many advantages, security and scalability concerns have prevented its widespread use in the financial sector. financial transactions using blockchain technology, particularly its effects on scalability and security. blockchain technology's advantages, which include the capacity to facilitate quicker and more transparent cross-border transactions, the provision of secure, tamper-proof transaction records, and the reduction of fraud risk. In addition, blockchain faces significant obstacles that limit its scalability, including network congestion, high energy consumption, and transaction speed. Additionally, it delves into possible remedies for these scaling problems, including sharding, consensus methods, and second-layer technologies. While this research does acknowledge the need for additional development and integration to fully realise blockchain technology's promise of revolutionising the financial industry, it ultimately demonstrates the technology's promise of meeting the increasing demands of the sector.

Keywords: Blockchain Technology, Financial Transactions, Security, Scalability, Cryptocurrency, Decentralization

Introduction:

Blockchain technology has expanded well beyond its initial use as the foundation for digital currencies such as Bitcoin. The financial sector is only one of several that has taken notice of blockchain technology because to its decentralised, transparent, and secure nature. Modern economies rely on the ability to perform financial transactions securely, efficiently, and openly. This is vital for sustaining trust and stability in financial institutions. For years, financial transactions have struggled with issues including fraud, data manipulation, and inefficiencies. Blockchain technology offers a potential answer to these problems. One of the main selling points of blockchain is its distributed ledger technology, which eliminates the need for a trusted third party by recording transactions in real-time and making them secure, immutable, and impossible to alter. Blockchain technology eliminates the need for middlemen like banks or clearinghouses, which in turn lowers transaction costs, simplifies international payments, and increases transparency. To top it all off, blockchain's cryptographic properties make it impervious to fraud and hacking, making it a promising solution for protecting private financial



information and keeping records accurate. The major obstacles to blockchain technology's broad use in financial transactions are security and scalability, despite the fact that it offers many benefits. Smart contract flaws, assaults on consensus procedures, and the possibility of network splits are all security problems. Conversely, scalability is still a big problem because current blockchain systems can't handle the amount of transactions needed by international financial institutions. This includes popular platforms like Bitcoin and Ethereum. blockchain's function in revolutionising monetary transactions, with an emphasis on the advantages it offers in terms of security and scalability. Addressing issues like transaction speed, network congestion, and energy consumption, it delves into the advantages of blockchain technology, which include safe, transparent, and efficient transactions, as well as the disadvantages that prevent its broad use. To get around these scaling issues, the study also considers possible alternatives, including as sharding, second-layer technology, and enhanced consensus algorithms. This article examines the present status of blockchain in financial transactions and offers predictions about its potential future role as a foundation of contemporary financial infrastructure.

Security Benefits of Blockchain in Financial Transactions

When it comes to the safety of monetary transactions, blockchain technology has recently shown to be revolutionary. It is the perfect answer to the widespread security issues plaguing conventional monetary systems because of its distinctive features including decentralisation, immutability, and cryptographic security. Several major security benefits of blockchain technology are applicable to financial transactions, including the prevention of fraud, the assurance of data integrity, and the provision of a transparent and trustworthy system for financial operations.

1. Decentralization and Fraud Prevention

The decentralised nature of blockchain is one of its most notable benefits in financial transactions. Blockchain is based on a decentralised network of nodes (computers), as opposed to the centralised systems used by banks and other traditional financial institutions. Because the system is not centrally controlled, it is considerably more difficult for bad actors to manipulate it.

- **Reduced Risk of Fraud:** Due to the distributed nature of the blockchain ledger, a 51% attack—the control of more than half of the network nodes—would be necessary to alter a transaction or manipulate data. The likelihood of fraud or illegal modifications to transaction records is significantly reduced because this degree of control is extremely unlikely in the majority of public blockchain networks.
- **Transparency:** Every single transaction that has ever been recorded on the blockchain is accessible to everyone in the network. Since every participant has access to the whole, immutable record of transactions, this openness aids in the reduction of fraudulent activity. In addition, players can trust the system more because blockchain is transparent and they can check the integrity of the transaction data.

2. Cryptographic Security and Data Integrity

To protect the information kept in the distributed ledger, blockchain employs cryptographic methods. The security of financial transactions is greatly enhanced by these cryptographic methods, which guarantee that every transaction is authenticated, encrypted, and unchangeable.

- **Public and Private Keys:** Asymmetric encryption, used by blockchain, requires a set of keys—a public key and a private key pair. Every node in the network has two keys: one public key that represents their address in the blockchain and another private key that they use to sign transactions. This safeguards sensitive financial information by ensuring that only authorised parties can initiate transactions.
- **Immutable Ledger:** Changing or removing a transaction from the blockchain would require changing all blocks after it has been recorded. This immutability provides a high degree of data integrity by making it impossible to alter the records of financial transactions. Because all financial transactions are permanently recorded on the blockchain once they are done, it becomes extremely difficult to undo or change them.
- **Hashing:** The blockchain is structured such that each block includes transaction data, a timestamp, and a cryptographic hash of the block before it. As an extra safety measure, the blocks are linked in such a way that updating one will render all blocks after it useless. As a result, it is extremely difficult, if not impossible, for malicious actors to alter the transaction history of monetary transactions without raising suspicion.

3. Smart Contracts and Their Security Implications

A "smart contract" is an agreement whose terms are encoded in code and may be executed automatically. When certain criteria are satisfied, the provisions of the agreement are automatically executed and enforced by these contracts. The utilisation of smart contracts in financial transactions is made possible by blockchain technology. These contracts increase security by eliminating middlemen and guaranteeing that the terms are carried out precisely as agreed upon.

- **Automation and Reduced Human Error:** There is no longer any room for human mistake or fraud in smart contract enforcement because contracts are built to execute automatically when specific circumstances are satisfied. One use case for smart contracts is in financial transactions, where they can be set up to release payment upon receipt of products or completion of a specified service. This guarantees a safe and proper execution of the transaction and lessens the likelihood of payment disputes.
- **Security in Execution:** The immutability and cryptographic encryption of the blockchain are security qualities that smart contracts take on when executed on the network. This provides a foolproof method of conducting business by making sure the contract conditions cannot be changed.
- **Prevention of Counterparty Risk:** There is always an element of trust and the possibility that one side won't pay their share in conventional financial transactions. To avoid this, smart contracts use automatic execution to make sure all parties pay their bills before the deal closes. When dealing with financial markets, this is particularly helpful because counterparty risk is a major issue.

4. Privacy Protection and Regulatory Compliance

Financial transactions, particularly those involving sensitive financial data, necessitate privacy characteristics, which blockchain technology may provide. By using public addresses instead of participant personal information, public blockchain networks such as Ethereum and Bitcoin are able to keep user data private. By using pseudonyms, users are able to keep their identities hidden while yet enabling full visibility into their transactions.

- **Private Blockchain Networks:** If financial institutions want even more privacy and control over who can join the network, they can employ private or permissioned blockchains instead of public ones. To handle transactions involving parties with more strict privacy needs while yet enjoying the security benefits of blockchain, financial institutions can utilise private blockchains.
- **Compliance with Regulations:** Since authorities may access the blockchain to validate transactions without invading privacy, the transparency of the technology can also help with regulatory compliance. By adopting blockchain technology to record transactions and participant identities, financial institutions may guarantee that their operations comply with financial regulations including KYC and anti-money laundering (AML) requirements.

5. Distributed Denial of Service (DDoS) Attack Resistance

Distributed denial of service (DDoS) attacks are naturally difficult to execute on blockchain due to its decentralised structure. Distributed denial of service (DDoS) assaults bring down traditional financial systems, especially those with centralised infrastructure, since bad actors overwhelm a server or network with data.

- **Resilience to DDoS:** Due to its decentralised design, blockchain technology does not rely on a single server or any single point of failure. A dispersed network, on the other hand, makes it nearly impossible for a single attacker to bring down the entire system. By keeping the blockchain network running even when attacked, this resilience to distributed denial of service assaults adds another degree of protection for monetary transactions.

Many financial transactions can benefit from blockchain technology's security features, such as improved fraud protection, data consistency, and the ability to automate contract execution through smart contracts. Fintech transactions are made more efficient, transparent, and secure with blockchain technology, which uses decentralisation, cryptographic encryption, and immutability. With these security benefits, blockchain technology will be more widely used in the financial sector, which will increase confidence amongst players, decrease operational risks, and solve long-standing problems. Despite blockchain's many security benefits, there must be continuous work to resolve issues with scalability, regulatory compliance, and smart contract vulnerabilities. However, blockchain technology has the potential to revolutionise future secure financial transactions by fostering innovation and instilling more trust in all parties involved.



Conclusion

Because it greatly enhances the efficiency, transparency, and security of financial transactions, blockchain technology has become a revolutionary force in the banking industry. The immutability, cryptographic security features, and decentralised nature of it make it a perfect fit for fixing the inefficiencies, fraud, and data manipulation that have plagued conventional financial systems for a long time. Potentially lowering costs, streamlining cross-border payments, and improving confidence among participants, blockchain can securely record and confirm transactions without intermediaries. But there are also a lot of problems with blockchain technology, especially with security and scalability, so it's not without its flaws. The long-term dependability and integrity of financial systems built on blockchain technology depends on resolving security issues, such as smart contract vulnerabilities and the possibility of 51% assaults. Although blockchain provides robust safeguards against data modification and fraud, it is essential to keep these systems secure from new threats if they are to be widely used. Another major obstacle to blockchain's widespread adoption is its scalability. Bitcoin and Ethereum, two popular blockchain systems, aren't quite up to the task of processing the massive amounts of transactions that occur in the world's financial markets. While sharding, enhanced consensus mechanisms, and second-layer technologies are all potential solutions to these scaling problems, they need to be tested and innovated upon more. Notwithstanding these obstacles, blockchain's ability to transform monetary transactions is apparent. A more trustworthy, efficient, and open international monetary system could be built on top of blockchain technology as it undergoes further development and new solutions are introduced. In order to realise blockchain's full potential, which includes meeting the needs of contemporary financial systems without compromising on security or reliability, further research and development into the technology's scalability and security is necessary. To sum up, blockchain technology has come a long way in revolutionising financial transactions, but its future success will depend on how well it handles security and scalability. If these obstacles can be overcome, blockchain has the potential to become an integral part of the future of finance, benefiting both customers and financial institutions with increased transparency, lower costs, and better security.

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