Journal of Informatics Education and Research
ISSN: 1526-4726
Vol 6 Issue 1 (2026)

Evaluating the Role of Block chain in Modernizing the Indian Banking Infrastructure

Vora Nidhi Shaileshbhai

Research Scholar, GLS University, Ahmedabad, Gujarat

Dr Shreeda Shah

Assistant Professor, Faculty of Business Administration, GLS University, Ahmedabad, Gujarat

Abstract

This article explains how block chain technology can help improve the Indian banking system. Many banks in India face problems like delays, high costs, fraud, and old technology. Block chain is a new technology that stores data securely and allows people to make safe and fast transactions without needing a middleman. It can help banks work more efficiently, reduce paperwork, and improve trust between customers and banks. The article discusses how banks around the world and in India are starting to use block chain. Examples from Indian banks like ICICI, SBI, and YES Bank show how block chain is being used in areas like KYC, trade finance, and cross-border payments. The benefits of using block chain include better security, faster services, and lower costs. Even though block chain has many advantages, there are some challenges like high setup costs, lack of trained people, and unclear government rules. Still, the future looks positive. With the right support, block chain can make Indian banking faster, safer, and more modern. This article highlights how block chain can play a big role in changing how banks work in India.

Keywords: Block chain, Indian Banking Sector, Digital Transformation, Financial Technology, Smart Contracts, KYC, Trade Finance, Cross-Border Payments, RBI, Banking Innovation, Financial Inclusion, Distributed Ledger Technology (DLT)

Introduction

India's banking system is one of the largest and most diversified in the world, characterized by a robust network of public sector banks, private sector banks, regional rural banks, cooperative banks, and a growing number of small finance and payments banks. Governed by the Reserve Bank of India (RBI), the sector has historically played a pivotal role in driving financial inclusion, supporting industrial and agricultural growth, and maintaining monetary stability. Over the past few decades, the banking system has undergone significant reforms aimed at deregulation, improving governance, and strengthening prudential norms to align with global standards. The post-liberalization era, particularly since the 1990s, witnessed a wave of transformation in India's banking sector. Private and foreign banks introduced competitive practices, customer-centric models, and a culture of innovation, compelling public sector banks to modernize their operations. This shift was further accelerated by initiatives such as the Financial Sector Legislative Reforms Commission (FSLRC), banking sector consolidation, and digitalization drives under programs like Digital India and Jan Dhan Yojana, which collectively aimed to widen the reach and efficiency of banking services.

India’s current banking technology landscape is shaped by rapid digital transformation. The emergence of core banking solutions (CBS), mobile banking apps, internet banking, and real-time payment platforms like UPI (Unified Payments Interface), IMPS (Immediate Payment Service), and NEFT (National Electronic Funds Transfer) has revolutionized customer experience. Banks have increasingly integrated Artificial Intelligence (AI), Robotic Process Automation (RPA), data analytics, and cloud computing to optimize backend operations, detect fraud, and offer personalized financial solutions. Despite these advances, several systemic challenges remain. Legacy IT infrastructure in many public sector banks, cybersecurity vulnerabilities, operational inefficiencies, and compliance burdens continue to hinder optimal performance. Furthermore, as cyber threats grow more sophisticated and customer expectations rise, the need for secure, transparent, and interoperable technologies has become paramount. In this context, emerging technologies such as block chain are being explored to modernize banking infrastructure, reduce inefficiencies, and enhance trust in financial transactions. According to Falwadiya, Dhingra, & Gupta (Falwadiya, Dhingra, & Gupta, 2022) Block chain offers the potential to fundamentally reshape how Indian banks process data, execute contracts, and maintain records—making it a compelling frontier in the next phase of digital banking evolution.

Literature Review

As per researcher (Joseph & Karunan, 2021), The paper proposed a block chain-based decentralized transaction settlement system for the Indian banking sector to address the limitations of the current centralized infrastructure. Block chain technology can reform existing business processes in the banking sector by making them more democratic, transparent, secure, and efficient. The current Indian banking system is slow and cumbersome due to its centralized architecture, necessitating a shift to block chain technology. A novel system based on the Ethereum block chain platform is proposed to provide security, confidentiality, and decentralized money lending mechanisms in banking.

According to (Kour, 2023) research explored that Block chain technology is expected to revolutionize the Indian banking industry by improving customer experience. The study investigates the application of Block chain technology to improve customer experience in the Indian banking industry. Block chain technology is highlighted as a key factor in redefining the Indian banking industry scenario. The study analyses how Block chain technology will change the banking landscape for the better.

According to (Sharma & Damle, 2022), Block chain technology can reinvent the security and efficiency of the Indian banking system by addressing issues like financial fraud and centralization. The study explores the potential of Block chain technology in preventing financial fraud in the Indian Banking System by transitioning to a decentralized network. Block chain can address issues such as double taxation and poor documentation in the Indian Banking System. The paper outlines the impact of Distributed Ledger Technology (DLT) on financial institutions and applications.

As per (Mehrotra, Sharma, Bagrecha, & Thakare, 2020), Block chain technology can be used in the Indian banking system to overcome issues with the traditional centralized database. Block chain technology can be used to overcome issues in traditional banking systems by transferring the burden from centralized databases to decentralized networks. The technology offers immutable and permanent records, which are beneficial for bank transactions. The paper demonstrates the use of algorithms like RSA and Verhoeff for key generation and user verification in the block chain platform.

From the view point of (Jena, 2022), The study examined the key factors affecting the adoption of block chain technology in the Indian banking sector. Facilitating conditions, performance expectancy, and initial trust are significant predictors of bankers' intention to use block chain technology. Initial trust plays a significant mediating role in predicting usage intention. The proposed model explains a significant proportion of variance in initial trust and usage intention, with government regulation and perceived risk having moderation effects.

As per (Kulkarni & Patil, 2020), Block chain technology adoption in Indian banking services is influenced by factors like compatibility, cost, security, firm scope, management support, and government policies. Block chain technology offers innovative solutions for banking services, including asset traceability and digital identity. The study identified significant factors affecting block chain adoption, including perceived compatibility, cost, relative advantage, security, firm scope, learning culture, top management, competitive pressure, government policies, and consumer readiness.

According to (Naik, Pejawar, Singh, Aher, & Kanchan, 2020), Block chain technology can be used to create a decentralized banking infrastructure in India to improve security and avoid banking scams. Block chain technology is proposed as a solution to enhance security and decentralize banking systems, reducing vulnerability to frauds. The authors suggest integrating block chain into the National Electronic Fund Transfer (NEFT) process using Indian Financial System Code (IFSC) and RBI protocols. The model involves computing processes in Java microservices and interconnecting ledgers using consensus algorithms.

In Opinion of (Garg, Yadav, & Haryana, 2021), Block chain technology has the potential to transform government, industry, and citizen relationships in India, but challenges in implementation remain. Block chain technology has the potential to transform government, industry, and citizen relationships significantly. The paper identifies implementation challenges and suggests areas for further investigation by governments and companies. Block chain is evolving into a stable infrastructure with potential for major impact on future technical developments.

According to the researcher (Ramchandra, Kumar, Sarkar, Mukherjee, & Agarwal, 2022), Block chain technology provides several benefits to the banking sector, but issues around scalability and consensus remain. Block chain technology is considered revolutionary and provides several benefits to the banking sector. It ensures transparency and a secure system for business solutions. Challenges include scalability issues and time consumed for transactions and consensus.

According to (Khanna & Haldar, 2023), The paper identifies five key challenges for the Indian banking industry in adopting block chain technology. The study identified five challenges in the adoption of block chain technology by the Indian banking industry. These challenges relate to technology, organisation, operation, regulator, and environmental context.

As per (Saripalli, 2021), Block chain technology can address issues in the Indian government banking ecosystem by enabling efficient collaboration, disintermediation, and decentralized last-mile delivery. The financial health of the government is dependent on the efficiency of its banking management. Block chain technology can improve efficiency and collaboration among stakeholders in government banking. Block chain can facilitate peer-to-peer transactions and decentralize delivery channels, benefiting unbanked populations.

According to Researcher (Reddy & Aithal, 2020), The paper examines the role of block chain technology in the Indian banking infrastructure and the potential for the Reserve Bank of India to adopt distributed ledger technology. The paper illustrates the potential and application of distributed ledger technology and block chain in India, focusing on digital transactions and innovation. The Reserve Bank of India and government support are instrumental in guiding the growth of block chain technology through regulatory sandboxes. Block chain technology is being integrated by Indian banks and has potential applications across various sectors, including banking and healthcare.

Research Methodology

The present study adopts a descriptive research design to evaluate the role of block chain technology in modernizing the Indian banking infrastructure. The research is primarily based on secondary data sources, including scholarly articles, industry reports, white papers, case studies, and regulatory publications related to block chain applications in banking. Information has also been gathered from the official websites of leading Indian banks, Reserve Bank of India (RBI) reports, fintech organizations, and block chain consortia to analyse current initiatives and technological advancements. A qualitative approach has been used to examine the existing literature, identify key trends, challenges, and benefits associated with block chain integration. Additionally, select case examples of Indian banks implementing block chain solutions have been reviewed to provide real-world context and support the analysis. The study also considers global best practices and regulatory developments to offer strategic insights into future prospects.

Current Challenges in Indian Banking Infrastructure

- Many banks, especially public sector ones, still rely on outdated core banking systems that are not scalable or compatible with modern technologies.
- Increasing digitization has exposed banks to data breaches, hacking, phishing, and ransomware attacks.
- High dependency on manual processes leads to delays, errors, and increased costs in banking operations.
- Limited internet connectivity and digital literacy hinder the adoption of modern banking services in remote and rural regions.
- Banks face increasing regulatory burden related to KYC, AML, and data protection, often managed with inefficient manual systems.
- Poor risk management and delays in identifying bad loans have led to a rise in NPAs, especially in public sector banks.
- Different banking platforms and databases often don’t communicate effectively, leading to inefficiencies and duplication of effort.
- Traditional banking infrastructure involves high costs for operations, documentation, and transaction handling.
- Bureaucratic structures and risk-averse culture in many banks restrict the pace of innovation and technology adoption.
- Inadequate digital interfaces and service delays impact customer satisfaction and retention, especially compared to agile fintech competitors.

Applications of Block chain in Indian Banking

Block chain technology is increasingly being explored by Indian banks as a solution to long-standing inefficiencies and trust-related issues in financial operations. One of the most impactful applications of block chain in Indian banking is in Know Your Customer (KYC) processes. Currently, banks perform KYC independently for each customer, often leading to duplication of efforts, increased costs, and delays. With block chain, banks can share encrypted and verified customer data

on a common distributed ledger, ensuring real-time updates, eliminating redundancy, and reducing onboarding time while maintaining data privacy and compliance with regulations. This collaborative model can also streamline Anti-Money Laundering (AML) checks by enabling secure and consistent data sharing across institutions. (Gupta & Gupta, 2018)

Another transformative use case is in cross-border payments and remittances, where block chain can replace the traditional SWIFT-based messaging system that involves multiple intermediaries and takes several days to process. Block chain-powered remittance systems facilitate real-time settlement of funds with minimal transaction costs, while providing complete transparency and traceability. This is especially relevant for India, which is one of the largest recipients of remittances globally. Banks like ICICI and Yes Bank have already conducted pilot projects to demonstrate the efficiency of block chain in executing international transactions in seconds rather than days.

Block chain is also revolutionizing trade finance, a domain historically plagued by paperwork, manual verification, and the risk of fraud. Using block chain platforms such as Contour and Trade Lens, Indian banks can digitize trade documents like letters of credit, bills of lading, and invoices. These documents, once uploaded on a block chain network, can be verified in real time by all parties involved—including exporters, importers, banks, customs, and shipping agencies—without the need for repetitive checks. This enhances transparency, reduces processing time, and minimizes the chances of fraud or disputes. The automation of such workflows through smart contracts further boosts efficiency by triggering actions (like payments or goods release) automatically upon meeting predefined conditions.

Loan and credit management is another area where block chain holds substantial promise. Through distributed ledgers, banks can create immutable records of loan agreements, repayment histories, and collaterals. This not only reduces the risk of loan duplication and fraud but also helps in creating a comprehensive credit profile of borrowers that can be securely accessed across institutions. This can support faster lending decisions and improved risk assessment, especially for small businesses and informal sector borrowers who lack traditional credit scores.

Fraud detection and audit compliance also benefit significantly from block chain's immutable and time-stamped ledger. Unlike traditional databases where data can be altered without detection, block chain ensures that once information is recorded, it cannot be tampered with. This makes audit trails more reliable and simplifies the regulatory reporting process. It also increases confidence in financial records, as every transaction is verifiable and permanent, reducing the scope of internal fraud and accounting manipulation.

Key Block chain Initiatives by Indian Banks

In recent years, Indian banks have begun experimenting with and adopting block chain technology to address inefficiencies in traditional banking operations. Several leading banks have launched pilot projects and collaborative platforms aimed at exploring real-world block chain use cases in areas such as trade finance, cross-border payments, KYC verification, and vendor financing. These initiatives mark the beginning of a broader transformation in the Indian banking landscape toward greater transparency, security, and operational efficiency. (Kaushik, Kukrety, & Saxena, 2023)

One of the earliest and most notable initiatives came from ICICI Bank, which in 2016 conducted India's first successful international trade transaction using block chain technology. In collaboration with Emirates NBD, ICICI used a custom block chain application to execute a cross-border remittance and a trade finance transaction involving a letter of credit. The block chain solution enabled real-time, authenticated data exchange between parties, significantly reducing turnaround time from several days to a few minutes. This marked a major step in demonstrating how block chain could be used for secure and swift international transactions.

State Bank of India (SBI) has taken a collaborative approach by launching the Bank Chain consortium in 2017, in association with fintech firm Prime chain Technologies. The consortium includes over 30 banks and aims to build and implement block chain-based solutions for common banking operations such as KYC, loan syndication, and fraud detection. Through Bank Chain, SBI and other member banks have worked on applications like “Clear Chain,” a shared KYC/AML system, and “Do Know Your Customer” (DoKYC), a block chain platform designed to facilitate secure and efficient customer onboarding.

YES Bank has also leveraged block chain for vendor financing. The bank implemented a block chain-based solution to digitize the disbursement of vendor payments for large corporates. This initiative, which involved collaboration with fintech startup Cateina Technologies, helped automate and streamline the process of fund disbursement based on purchase orders,

reducing the time and paperwork traditionally involved. It also improved transparency and reduced disputes between corporate clients and vendors.

Private sector giant Axis Bank has partnered with overseas banks such as Standard Chartered and Ripple to explore block chain for cross-border remittances. Using Ripple's block chain network, Axis Bank has been able to facilitate instant payment settlements between India and countries like Singapore and the UAE, which are key remittance corridors. The use of Ripple's xCurrent platform has enabled real-time messaging and settlement capabilities, improving the customer experience and reducing costs.

Additionally, Kotak Mahindra Bank has joined global block chain networks such as Ripple Net and R3's Corda to pilot cross-border remittance and trade finance solutions. These engagements reflect the bank's intent to future-proof its operations and offer next-generation banking services. Other banks such as HDFC Bank and IndusInd Bank are also exploring block chain technology through consortium participation and partnerships with fintech innovators.

Beyond individual bank initiatives, the Reserve Bank of India (RBI) has taken significant steps to explore block chain applications at the policy and infrastructure level. Most notably, RBI has launched pilot projects for a Central Bank Digital Currency (CBDC)—the Digital Rupee—using block chain and Distributed Ledger Technology (DLT). These pilots aim to assess the feasibility, scalability, and security of using block chain for sovereign digital currency issuance and interbank settlements.

Benefits of Block chain Integration

- All transactions are recorded on a shared ledger, visible to authorized participants, reducing the scope for manipulation. (Garg, et al., 2021)
- Cryptographic encryption and decentralized data storage reduce risks of fraud, hacking, and unauthorized access.
- Real-time settlement of payments and processes eliminates delays caused by intermediaries and manual verification.
- Automation and direct peer-to-peer transactions reduce operational and administrative costs.
- Shared KYC platforms enable banks to access verified customer data, reducing duplication and onboarding time.
- Immutable records make it easier to detect and prevent tampering, double-spending, or fake documentation.
- Self-executing contracts automate compliance, loan disbursement, and payment processes, reducing human errors.
- Tamper-proof audit trails and real-time reporting simplify monitoring and compliance with regulatory norms.
- Transparent, fast, and secure services boost consumer confidence in digital banking systems.
- Digital documentation and tracking of transactions reduce paperwork, delays, and fraud in trade finance.
- Block chain enables secure, low-cost banking solutions, reaching underserved and remote populations.
- A shared block chain network allows seamless data exchange and collaboration among multiple banking institutions.

Challenges to Block chain Adoption in Indian Banking

- Lack of clear and consistent regulations around block chain and digital assets creates hesitation among banks.
- Initial setup of block chain infrastructure requires significant investment in hardware, software, and training.
- Existing core banking systems are often incompatible with block chain, making integration complex.
- Public block chain networks can be slow and struggle to handle high transaction volumes typical in banking.
- Sharing customer data across a decentralized ledger raises questions about compliance with data protection laws.
- Absence of common protocols and platforms hampers interoperability between different banks and systems.
- Shortage of block chain-skilled professionals in the banking sector affects implementation and maintenance.
- Traditional banking culture and bureaucratic processes create inertia against adopting new technologies.
- While block chain is secure, poor implementation or compromised endpoints can still be vulnerable.
- Banks may be unsure about the financial returns and benefits of investing in block chain in the short term.
- Smart contracts and block chain records are not yet fully recognized or enforceable under Indian law.
- Block chain's effectiveness depends on widespread adoption; isolated implementation yields limited benefits.

- Certain block chain consensus mechanisms (like Proof of Work) are energy-intensive and not environmentally sustainable. (Pakenaite & Taujanskaite, 2019)

Future Prospects and Conclusion

The future of block chain technology in the Indian banking sector appears promising, with growing interest from both public and private institutions. As the financial ecosystem becomes increasingly digital and interconnected, the need for secure, efficient, and transparent systems becomes even more critical. Block chain, with its decentralized and immutable nature, offers a strong foundation for addressing these evolving demands. With global trends moving towards open banking, real-time transactions, and smart automation, Indian banks stand to gain significantly by integrating block chain into their core operations.

In the coming years, block chain is expected to be more than just a supporting tool—it is likely to form the backbone of digital banking infrastructure. As banks become more comfortable with the technology and regulatory frameworks begin to take shape, applications such as block chain-based digital identity management, decentralized finance (DeFi), tokenized assets, and Central Bank Digital Currencies (CBDCs) may become mainstream. The Reserve Bank of India's pilot projects on the Digital Rupee have already laid the groundwork for block chain-driven currency systems, signalling a major shift in monetary operations and interbank settlements.

Fintech collaboration will play a key role in accelerating block chain adoption. Startups that specialize in block chain development can partner with traditional banks to offer tailored solutions that solve specific problems, such as automated loan disbursement, fraud detection, and secure document management. Additionally, block chain consortia such as Bank Chain can act as platforms for knowledge-sharing, experimentation, and collective innovation, minimizing risks while maximizing impact. Integration with other emerging technologies—like artificial intelligence, machine learning, and IoT—will further expand the functional capabilities of block chain-based systems in banking.

Despite the significant potential, widespread implementation will require overcoming certain challenges, including interoperability issues, data privacy concerns, scalability limitations, and resistance to change. Banks must invest in technical training, change management, and robust pilot testing to ensure a smooth transition from traditional systems to block chain-based platforms. At the policy level, regulators will need to create a clear legal framework that promotes innovation while safeguarding consumer rights and financial stability.

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