Journal of International Commercial Law and Technology
Print ISSN: 1901-8401

Website: https://www.jiclt.com/

Article

The Role of Blockchain Technology in Banking Business-an Overview

Article History:

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How to cite this article: Gurumurthy K H. The Role of Blockchain Technology in Banking Business-an Overview. *J Int Commer Law Technol.* 2025;6(1):178–184.

Received: *28-07-2025*
Revised: *13-08-2025*
Accepted: *29-08-2025*
Published: *12-09-2025*

Abstract: Technology has emerged as a revolutionary innovation with the potential to transform the banking industry. By enabling decentralized, secure and transparent transactions, blockchain reduces fraud, enhances efficiency and lowers operational costs. This article explores the role of blockchain in banking covering its applications in payments, remittances, smart contracts, identity verifications, and compliances. A review of existing literature highlights the benefits, challenges of blockchain adoption. blockchain can truly revolutionize India's financial sector. it may be seen very well that market is overwhelmed by a gathering of huge organizations uncommon in the tech area, where - Amazon, Google, Apple etc. overwhelm. Along these lines, if any new start-up needs to utilize the blockchain in their plan of action, they can do so easily and without any problem. The findings suggest that blockchain offers significant advantages, regulatory and technological barriers must be addressed for widespread implementation. This article aims to analyze how blockchain reshaping banking operations, its benefits, challenges, future prospects, enhance security and foster financial inclusion.

Keywords- Blockchain technology, Decentralization, Cryptocurrency, Smart Contracts, Security.

INTRODUCTION

The banking sector has undergone significant digital transformation over the past decade, with technologies like artificial intelligence (AI), big data, and cloud computing reshaping financial services. Among these innovations, blockchain technology stands out due to its ability to provide decentralized, tamper-proof, and transparent transaction records. Originally developed as the underlying technology for Bitcoin, blockchain has evolved into a versatile tool with applications across multiple sectors, particularly banking.

Banks face challenges such as fraud, high transaction costs, slow cross-border payments, and regulatory compliance burdens. Blockchain addresses these issues by enabling peer-to-peer (P2P) transactions, reducing intermediaries, and enhancing security. A Blockchain is a technology that allows digital data to be stored in a public, shared database. It is essentially a series of immutable blocks. Blockchain has the potential to change the banking process to a secure and efficient process which will be a completely transparent procedure compared to traditional regular processes. The significance of the paper is to help the decision-makers of the banking sector and government to make them understand blockchain technology and its potentiality in the banking sector.

REVIEW OF LITERATURE

Several studies have explored blockchain's impact on banking:

Nakamoto (2008) introduced Bitcoin and blockchain, emphasizing decentralization and cryptographic security.

Tapscott & Tapscott (2016) discussed how blockchain could disrupt traditional banking by enabling trustless transactions.
World Economic Forum (2016) predicted that blockchain would become the backbone of global financial systems by 2025.

Deloitte (2020) highlighted blockchain's role in reducing settlement times, improving KYC (Know Your Customer) processes, and preventing fraud.
PwC (2021) reported that 77% of financial institutions are expected to adopt blockchain by 2025 for payments and identity management.

Melanie Swan (2015) explains that the "blockchain is a decentralized public ledger that can be used for the registration, inventory, and the transfer of all assets in finances, property as well as in intangible assets such as votes, software, health data, and idea" further. He considered the theoretical, philosophical, and societal impact of cryptocurrencies and blockchain technologies.

Svein Ølnes (2015) studied the "potential use of the blockchain technology to enable governments to utilize the secure, open, distributed and inexpensive database technology". It was emphasized that Bitcoin could be a promising technology for validating many types of persistent documents in the public sector.

Yli-Huumo J, Ko D, Choi S, Park S, Smolander K (2016) studied the current research, drawbacks and the future perspective of blockchain technology from the technical point of view. The statistics shows that 80-percent of the research is only on Bitcoin as compared to other blockchain applications. Most of the studies are focusing on benefits of blockchain technology. However, many of the Blockchain scalability related challenges have been left unstudied.

J. Leon Zhao, Shaokun Fan and Jiaqi Yan (2016) gave an overview of blockchain technology research and development. The study showed that the widespread use of Bitcoin in the financial and business sector will open new ways for business innovations and research.

The Institute for Development and Research in Banking Technology (IDRBT), established by the Reserve bank of India (2017) has conducted extensive research to explore the applicability of blockchain technology in Indian Banking and Financial Industry. The paper explains all the aspects of blockchain like concepts, advantages, applications, challenges and future of blockchain technology in Indian Banking Sector. The Benefits of Blockchain is an emerging technology which can radically change the banking and financial sector, providing ample opportunities for growth and innovation, capable of reducing risk and cost.

Objective of the study

- To Examine the role of blockchain in modern banking operations.
- To Analyze the benefits of blockchain adoption in banking services
- To Explore the key mechanism and challenges of Blockchain technology

Source of data- my study based on secondary data
Analysis of the study/Discussion- to understand in a better way the outcomes of the study presented in table and charts with explanations. Analysis of the study begins with objective wise

Analysis of the study start with first objective
To examine the role of Blockchain technology in modern banking operation

How Blockchain Works: Core Mechanisms

Chart showing Blockchain Architecture-A blockchain consists of:

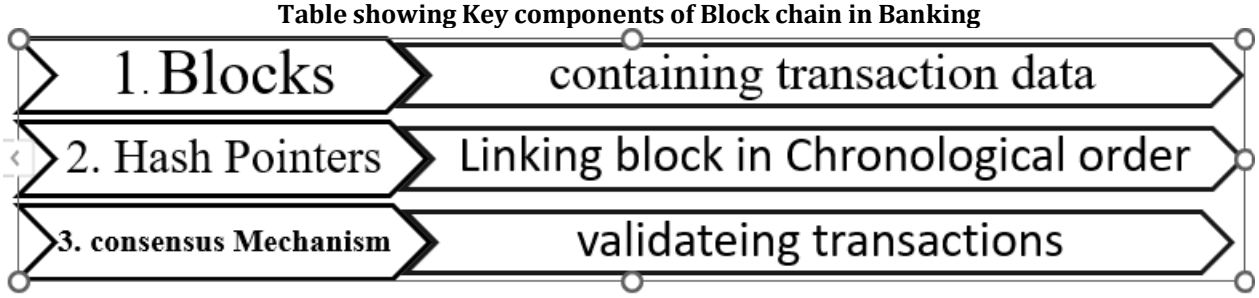


Table showing Key components of Block chain in Banking

Component	Function	Banking Application
Decentralized Ledger	Records all transactions across nodes	Prevents single-point failures
Cryptographic Hashing	Secures data with SHA-256 encryption	Protects against tampering
Smart Contracts	Self-executing agreements	Automates loans, trade finance

Consensus Algorithms	Validates transactions (PoW, PoS)	Ensures trust in payments

Table showing Consensus Mechanisms in Banking

Different blockchains use various consensus models:

Mechanism	How It Works	Banking Use Case	Energy Efficiency
Proof of Work (PoW)	Miners solve complex puzzles	Bitcoin transactions	Low (High energy use)
Proof of Stake (PoS)	Validators stake crypto	Ethereum 2.0, CBDCs	High
Delegated Proof of Stake (DPoS)	Elected nodes validate	Fast payments (EOS)	Very High

From the above chart-A. i and Table A. ii & A. iii showing the working method of the blockchain in banking operation. In banking operation Block chain consists of 1. Block- create Transaction details, 2. Hash pointer- linking block (transactions) in chronological order. 3.Consensus mechanism - then linked chronological order block sent to every node (every participant-(Device-computer) in a blockchain) for validating the transactions. If the information of the newly created node is wrong or altered, then it will not match with other blocks of the nodes in the blockchain. Then the validation will fail, and the transaction will not be recorded. If validation is passed, then the transaction is complete. And the updates will be distributed to all the nodes in that particular blockchain network. And the block is appended to the blockchain. For the Proof of Work, the nodes receive a reward (charges), usually in cryptocurrency.

Chart-2 showing the working method of Blockchain in banking system

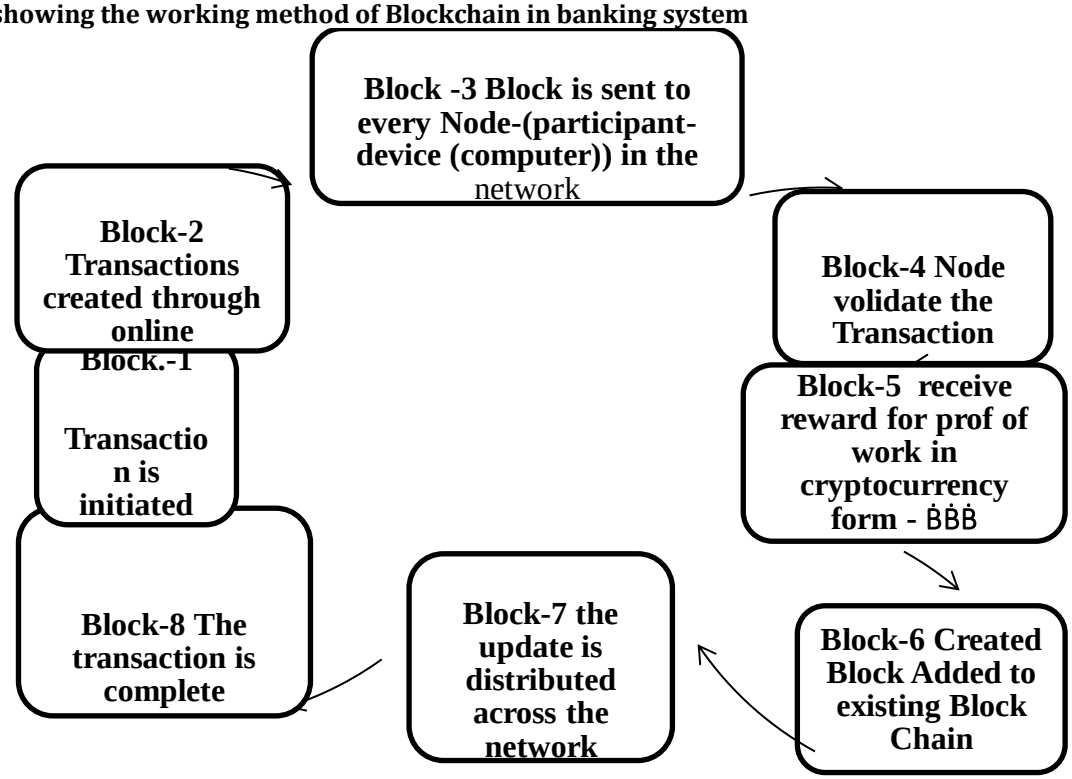
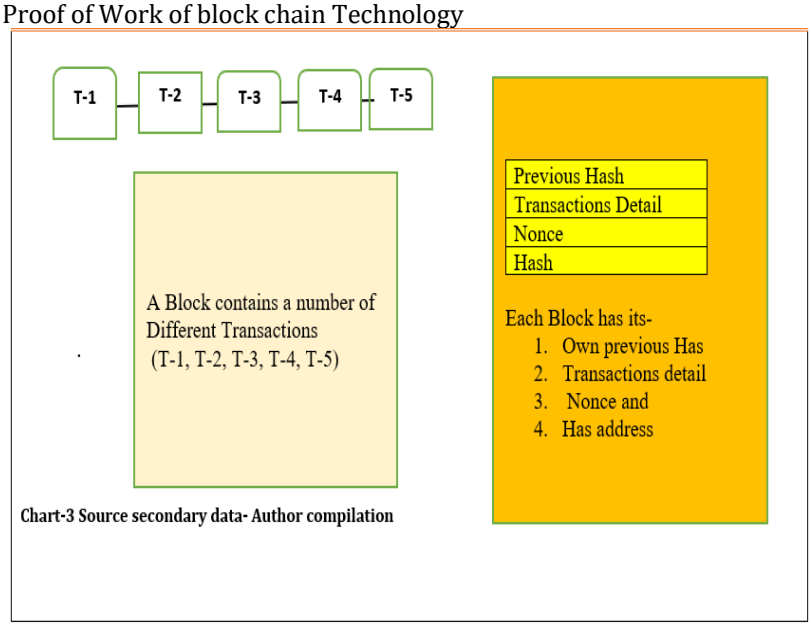


Chart-2-Source secondary data- Author compilation

Cryptographic keys used to perform the transactions- Blockchain verifying the exchange validation by utilizing cryptographic keys. Cryptographic keys consist of two keys namely (1) Private key and (2) public key. Every client has their own private key and a public key that everybody can see. At the point when these two keys are utilized, they make a protected advanced character to tie down computerized personality to confirm the client through computerized marks and for opening the exchange they need to perform.

Agreement-Client agreed and approved the exchanged transaction by agreement- when the clients have agreed on the exchange, it should be approved before being added to a block in the chain. Then the exchange agreement added to a public blockchain. The arrangement of rules by which a blockchain network works and approves the data in the block is known as a "agreement". the exchange should be considered as substantial by dominant part of the hubs or Personal Computers in the organization before added to the blockchain.

Chart-3 showing the Proof of Work of block chain Technology



Block- is a distributed database that maintains a continuously list of orders records. These blocks are linked using cryptography. Each block contains a cryptographic has of the previous block and Each block has details transactions data. Every Blockchain has four elements (heads) -namely Distribution, encryption, immutability, tokenization and decentralization. the details of these elements discussed are as follows

Previous hash— Hashing in blockchain-transaction details in a block is converted into a fixed length string of characters. this unique digital fingerprint ensures data integrity and immutability. The previous has block is situated at this hash address in each block. This Blocks have a reference to the previous block and also is mentioned in the preceding hash.

Transaction details—All the transactions details which need to occur are stored in the block. The block is created to store this information.

Nonce—For separating the block's hash address, a numerical number is given in cryptography. This Number can be used only once. Miners adjust this number to make a valid number for the hashing value. With the perfect Nonce the hash value is calculated again which makes the hash more difficult to break.

Hash address of the block—An output is found for all of above when communicated through a hashing calculation. A 256-digit, 64-character length esteem is contained in that yield. That is what is known as the hash address of the block.

Mining- It enables banks to analyses customer data and extract meaningful insights by using advanced algorithms and techniques. process Mining enhances various areas of banking such as Know your customer (KYC), Credit application, customer relationship management (CRM) and Regulatory Reporting.

Second objective of the study

To Analyze the benefits and challenges of blockchain adoption in banking services

Recently, there have been significantly changes in banking business on account of the Blockchain. As the Blockchain technology permits untrusted gatherings to concur on the condition of a data set, individuals don't have to depend on agents for an exchange. Blockchain innovation offers multiple monetary types of assistance, for example, instalments, without utilizing any outsider like a bank. Blockchain can give quicker instalments and lower expenses than traditional banks, with the decentralization record for instalments. On open blockchains, protections like stocks, bonds, and elective resources are set. This makes more productive capital business sectors. The key benefits of Application of Blockchain in banking are given below-

Chart-4 showing benefits of Application of blockchain in banking

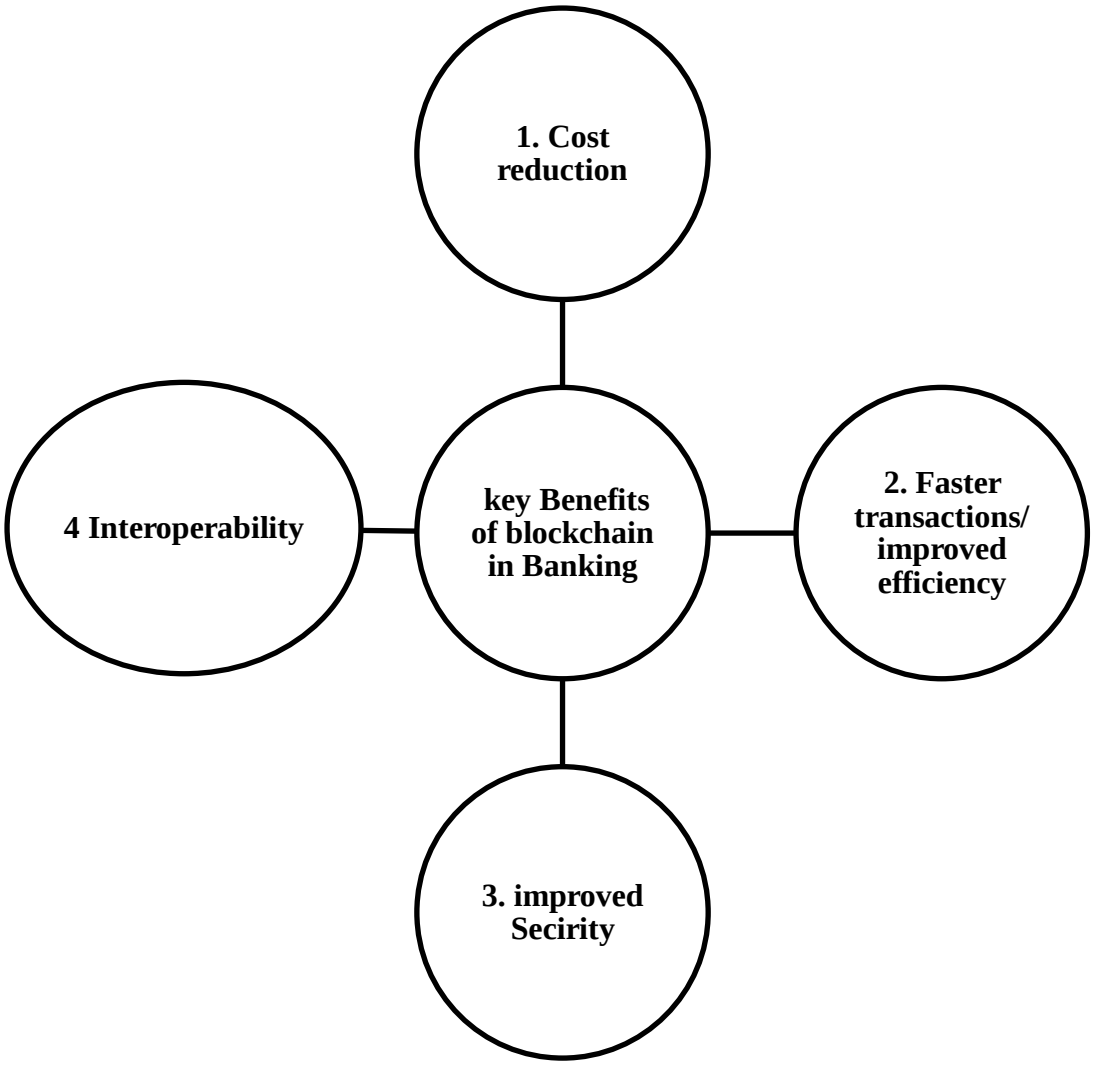


Chart-4 Source: secondary data- Author compilation

Cost reduction— reducing the exchange costs between bank-to-bank exchanges by utilizing the Blockchain in the banking sector. It was found that Blockchain reduces up to 70% cost in central finance reporting. Block chain also reduce operational cost up to 50% by eliminating intermediaries in the banking process and streamline the process. this leads to significant cost savings for banks and customers

Chart-5 showing cost reduction by using Blockchain technology in banking sector - Global Annual cost savings equal to US $12 billion

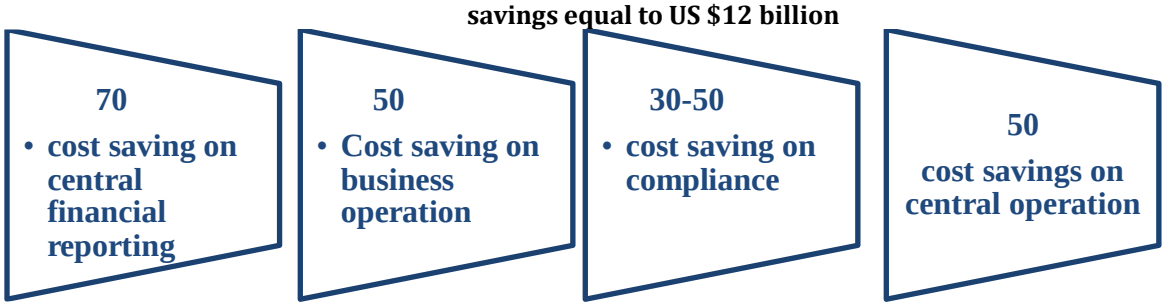


Chart-5 Source: secondary data- Author compilation

Faster transactions/Improved efficiency—Banks by Utilizing blockchain technology, exchanges can be made inside the space of seconds, which is quicker than most customary financial strategies. Blockchain keep away from agents, and enables the clients the creation of self- executing smart contact which can automate and streamline financial transactions. clients can make exchanges at a faster speed. This will bring about clients and banks ready to finish and handle more exchanges faster than traditional banking

Improved security—Blockchain technology used by banks to maintain transparent records of transactions, ensuring compliance with regulatory requirement such as anti-money laundering and Know-your-customer procedure and to have a better secure exchange data utilizing the assistance of shared records. Blockchain technology provides robust security features, including cryptography and decentralized network, which make it difficult to tamper with or falsify records this reduces the risk of data breaches and fraudulent activities It also generates credit reports and credit scores gives protection with monitoring and alert. Most of the banks worldwide trusted blockchain security in banking business

Interoperability-in Banking Blockchain used to connect different systems and net woks, enabling seamless communication and data sharing between different organizations and systems

The third objective of my study

To Explore the key mechanism and challenges of Blockchain technology

Mechanism

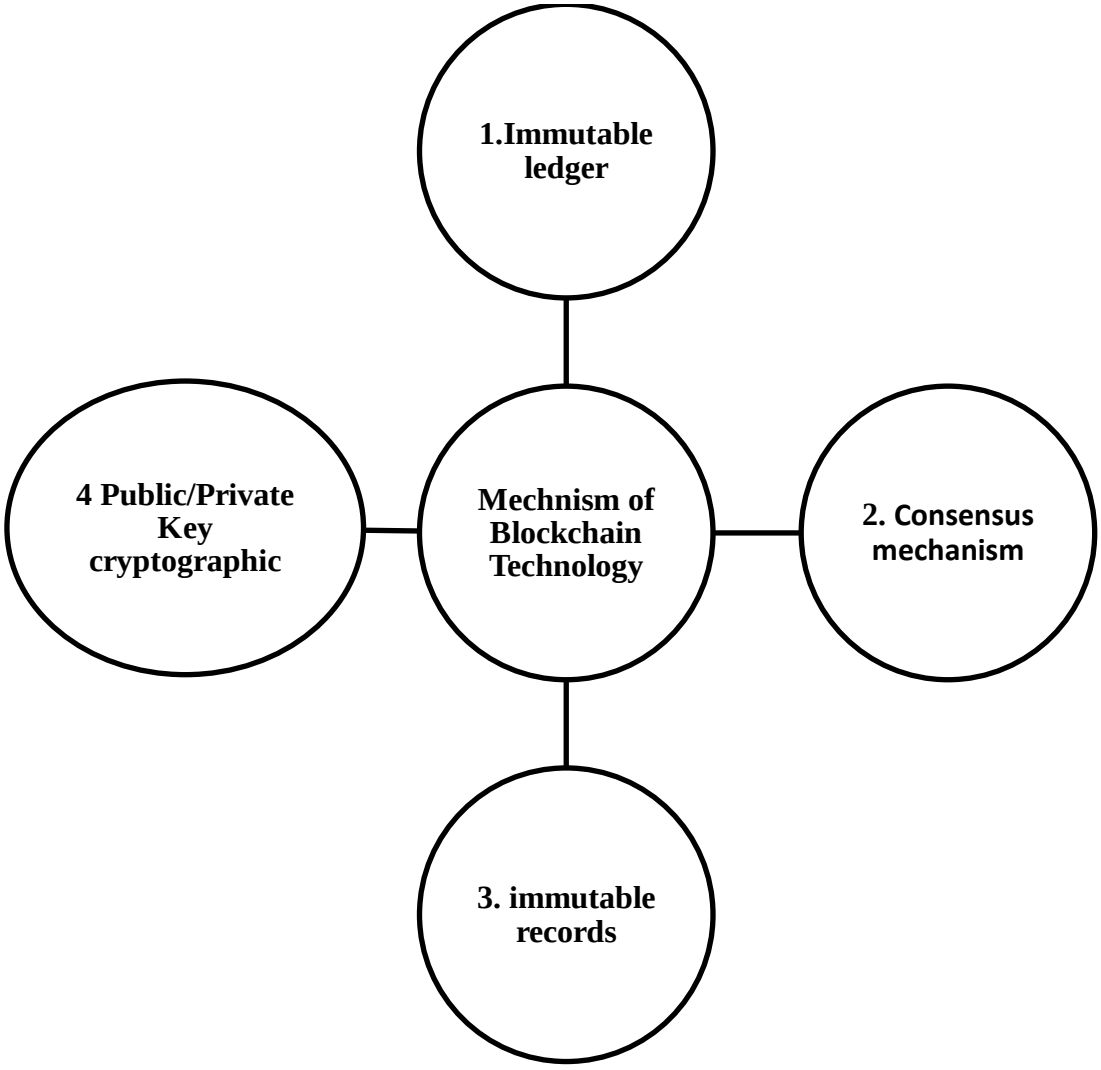


Chart-5 Source: secondary data- Author compilation

Immutable ledger- Blockchain operates on a distributed ledger, where multiple copies of the ledger are maintained across node (network of computers). Each node has a complete copy of the ledger, ensuring transparency as any changes made to the ledger are visible to all participants

Consensus mechanism-Blockchain relies on consensus mechanism such as proof of work to validate and verify the transactions. This ensures that all the participants agree on the validity of transactions

Immutable records- once the transaction is recorded on the blockchain it becomes virtually impossible to alter or delete. It ensures that transaction history remains transparent. Any modification of the records would require a consensus from the majority of participants

Public/Private Key Cryptography- blockchain utilizes cryptographic techniques to secure transactions. Each participant has a unique pair of keys (public and private). Where public keys is used to verify transactions and the private key is used to sign transactions. It adds and extra level of transparency and security to the blockchain.

CHALLENGES

Regulatory Compliance: Ensuring that blockchain-based financial transactions comply with existing regulations is a significant challenge.

Privacy Concerns: Blockchain technology raises concerns about privacy, as sensitive data (e.g., personal identities) is stored on a public blockchain. Solutions like zero-knowledge proofs balance transparency with privacy.

Scalability and Performance: Blockchain networks face scalability and performance challenges, particularly in public networks, which can impact the efficiency of financial transactions.

Security Risks: Blockchain technology is not immune to security threats, such as smart contract vulnerabilities and hacking attempts, which can compromise the integrity of financial transactions.

Interoperability: Achieving seamless interoperability between different blockchain networks is a complex task, requiring standardized protocols to enable efficient and transparent financial transactions across multiple platforms.

Current scenario- several public and private banks have started to leverage the benefits of blockchain by partnering and investing in the fintech sector. For example, the State Bank of India tied up with JP Morgan to utilize its blockchain technology, and Axis Bank, ICICI Bank, and Yes Bank joined the Interbank Information Network launched by JP Morgan.

CONCLUSION

Blockchain technology has the potential to revolutionize banking by enhancing security, reducing costs, and improving efficiency. While challenges remain, ongoing advancements in scalability, regulation, and interoperability will drive adoption. Banks that embrace blockchain early will gain a competitive edge in the digital economy.

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