European Economic Letters
ISSN 2323-5233
Vol 15, Issue 3 (2025)
http://eelet.org.uk

Transforming Banking In India: Applications And Challenges Of Blockchain Technology

Aakansha Sharma
Ph.D. Research Scholar, School of Commerce & Business Management, Geeta University, Panipat

Dr. Neeraj
Associate Professor, School of Commerce & Business Management, Geeta University, Panipat, (Corresponding Author)

Abstract
Blockchain technology is a ground-breaking invention that might fundamentally alter India's banking sector. Its decentralized and immutable structure offers significant advantages, including as enhanced security, operational efficacy, and financial transaction transparency. The several uses of blockchain technology in Indian banking, including trade finance, digital identity management, smart contracts, fraud prevention, cross-border payments, and KYC processes, are examined in this paper. These real-world examples show how technology may improve customer happiness, cut costs, and expedite procedures. In particular, this study investigates whether these elements affect banking staff members' inclination to embrace blockchain technology. Considering that many bank workers, especially those who are older, can be resistant to new technologies, the study aims to assess innovation adoption models in Indian banks. Apart from private sector banks such as HDFC, ICICI, Kotak Mahindra, Axis, and IndusInd, it also emphasizes public sector banks like Union Bank, Punjab National Bank (PNB), State Bank of India (SBI), Bank of Baroda, and Canara Bank. This study aims to bridge the knowledge gap about blockchain's adoption in banking and financial services by investigating the technology's potential for online banking. The primary objective is to evaluate how perceived ease of use, perceived utility, perceived security, perceived danger, trust, cost savings, and strategic value have an impact on employees' intentions to adopt blockchain technology.

Keywords: KYC, Cross border payment, Financial Transactions Cyber security, Blockchain Technology

1.1 Introduction
It is anticipated that the revolutionary technology known as blockchain will completely transform the realm of trustworthy transactions. Consensus validation of transactions, a distributed, shared, and immutable ledger, cryptographic techniques, and blockchain technology are all set to accomplish for businesses what the Internet did for communication. Businesses worldwide are increasingly considering making the switch to blockchain versions of themselves because to its promise of lowering costs, time, friction, and fraud in commercial transactions as well as guaranteeing trust, identity management, and reputation management.
The adoption of blockchain technology has the potential to revolutionize both the financial and non-financial sectors. Blockchain has emerged as the foundational technology in recent years to address a number of financial issues, including asset digitization, interoperability, accelerating payments, reducing transaction costs, and double spending. The potential of blockchain technology to support digital money is among its most talked-about uses in both academia and industry. The introduction of Bitcoin, the first digital money, marked the

beginning of the revolution. One financial innovation that has the potential to upend financial services is digital currency, whose advancement could have a significant effect on the financial industry and business. Digital currency has many advantages, including efficiency increases, programmability, security, and resistance to manipulation. Digital currencies come in three main varieties: stablecoins, cryptocurrencies, and CBDCs (Central Bank Digital Currency). Because of these many advantages, global corporations like Microsoft, Paypal, and Starbucks take payments in digital currencies like cryptocurrency. At hotel companies like The Pavilions Hotels & Resorts, customers have the option to pay in over 40 digital currencies when making reservations. Digital currency research, development, and piloting are being undertaken by central banks around the world.

1.2 Background

Blockchain is a cutting-edge technology with significant promise for controlling financial performance while preserving data security. Block chain is regarded as a significant modern invention with the aim of enhancing the analytical process in financial resource management, according to Zhang et al. (2020). Blockchain offers several benefits to financial analysis, including enhanced security, lower analysis costs, information traceability, and support for individual data control. According to data, about 60% of Indians believe that block chain payments are quick, secure, and economical (Statista, 2022). Blockchain technology protects and analyses financial data using unique code languages. When it comes to managing financial performance and safeguarding the financial assets of any organization or individual, this approach is quite successful. To manage cost-efficiency and secure financial transactions, block chains employ peer-to-peer digital asset transfer technology, which makes the transfer safe and efficient (Monrat et al. 2019). As a result, blockchain technology and digital currency are becoming more and more popular in financial asset management to ensure seamless financial performance.

1.3 Meaning Of Blockchain

Emirates NBD and ICICI Bank announced the pilot launch of a blockchain network for trade finance and international remittances. IBM, a multinational IT solutions provider, and the Mahindra Group announced plans to develop a supply chain finance system supported on blockchain technology program that has the ability to completely revamp the nation's system for financing transactions between manufacturers and suppliers. Bajaj Electricals revealed the use of blockchain technology in smart contracts related to financing suppliers and vendors.

A blockchain pilot was recently launched by the Andhra Pradesh government's Land Records Department and Transport Department. Blockchain technology is being used by the Telecom Regulatory Authority of India (TRAI) to restrict annoying spam phone calls and messages. This may be the first time the technology has been used in the telecom industry. Although we haven't made any significant progress in either area, initial coin offerings (ICOs) and cryptocurrency are crucial for Blockchain firms looking to raise capital. Leading institutions have only recently begun to offer Blockchain courses, indicating the urgent demand for a competent workforce in India. Interoperability, energy consumption, the legal framework, etc. are further areas where blockchain presents difficulties.

According to Chang et al. (2020) and Zheng et al. (2018), blockchain ensures immutability and security because data cannot be changed. This might affect the way banks create their banking systems. By generating new business models and rendering many outdated ones

obsolete, this technology has the potential to drastically alter the financial sector (Sun et al., 2016). Therefore, the financial sector is the one that stands to benefit the most from blockchain. Bitcoin and other cryptocurrencies have previously been the subject of blockchain study (Guo and Liang 2016; Nerurkar et al. 2021; Zheng and Lu 2021; Xu et al. 2022). They also draw attention to technological features. Scalability, security, and privacy concerns in technology, for instance, have been studied (Mohanta et al. 2019; Butt et al. 2019; Taylor et al. 2020).

1.4 Blockchain in India

The blockchain network was implemented for trade financing and international remittances by ICICI Bank and Emirates NBD in a formal pilot program. The Mahindra Group and IBM, a leading global provider of IT solutions, are working on a blockchain-based supply chain finance application that might drastically change the arrangement of financial transactions between the country's manufacturers and suppliers. Bajaj Electricals will employ a blockchain-based smart contract to manage contractor and supplier financing. Yes Bank, Cateina Technologies, a financial start-up, and IBM provided support. For the first time in the telecom sector, the Telecom Regulatory Authority of India (TRAI) is introducing blockchain technology to cut down on annoying spam calls and messages.

A blockchain pilot has been launched by the Andhra Pradesh government's Land Records and Transport ministries. Unquestionably, the largest application of biometric and demographic technologies by a government organization to date is the UIDAI Aadhar project. Without a well-defined plan for profit or commission, it is challenging to build a standalone Blockchain system in India. Cryptocurrencies and initial coin offerings (ICOs) are necessary for blockchain firms to generate capital, however none of these have substantially addressed the study's problem statement.

1.5 Types of Blockchain

Blockchain technology has advanced significantly in recent years and can be divided into numerous types based on its different features.

1.5.1. Public Blockchains

Although anyone can join a public blockchain as a node and take part in decision-making, individuals could not gain anything from doing so. All network users can access the ledgers; no one owns them. Blockchain users employ distributed consensus to make decisions and keep a copy of the ledger on their local nodes.

1.5.2. Private Blockchains

These kinds of blockchains are only accessible by a select few individuals or groups, and the ledger is only shared with participants.

1.5.3. Blockchains with semi-private access

While some parts of a semi-private blockchain are private and run by a group or organizations, the majority of the blockchain is open to the public and anybody can participate.

1.5.4. Sidechains

European Economic Letters
ISSN 2323-5233
Vol 15, Issue 3 (2025)
http://eelet.org.uk

These blockchains are often called pegged sidechains due to the ability to transfer money between them. Sidechains come in two different varieties: one-way and two-way pegged chains. Movement on both sides of two sidechains is possible with two-way pegged side chains, but one-way pegged side chains only permit movement from one side chain to another.

1.5.5. Permissioned Ledger

Users of this kind of blockchain are already familiar and trustworthy. An agreement protocol, as opposed to a consensus process, is used in a permissioned ledger to preserve a common understanding of reality.

1.5.6. Distributed Ledger

All blockchain users have access to the ledger in a distributed ledger blockchain, which can be divided among multiple businesses. A distributed ledger, as opposed to sorted blocks, is used to gradually store both public and private records.

1.5.7. Shared Ledger

One term for a program or database that is available to the public or an organization is a shared ledger.

1.5.8. Fully Private of Proprietary Blockchains

The concept of decentralization is different for these types of blockchains, which are not utilized in any well-known applications. When data authenticity and exchange within an organization are necessary, these kinds of blockchains are useful. Private or proprietary blockchains are used by government agencies to facilitate departmental information sharing.

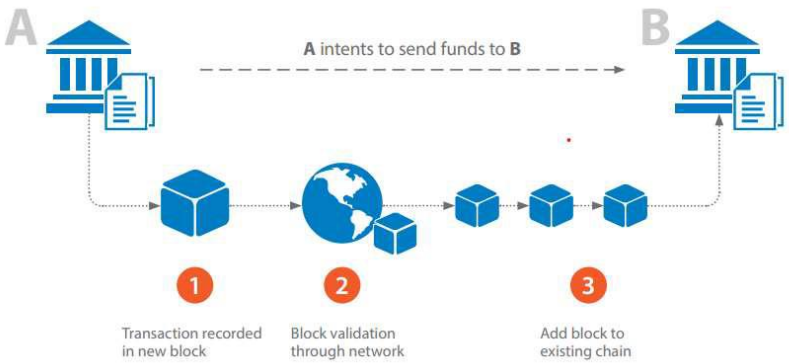
1.5.9. Tokenized Blockchains

These are well-known blockchains that generate income by mining for consensus or by distributing content early.

1.5.10. Token less Blockchains

Since these blockchains are unable to transmit values, they are not true blockchains. However, when data exchanges between parties that have already established trust are all that is needed, they might be helpful.

1.6 Working Mechanism



1.7 Is Blockchain Technology Necessary for Banks?

The banking industry is one of the primary forces behind the world economy. The biggest and most reputable financial institutions in the world are banks. The financial industry has seen substantial changes as a result of digitalization.

After commodity money destroyed the barter system, fiat money took its place, and now there is digital currency and digital payments. Eventually, the technology enabled automated teller machines (ATMs), debit-credit cards, online and mobile banking, electronic cash transfers, electronic clearing services, and real-time gross settlement. The banking sector, which already relies heavily on technology, could undergo a transformation thanks to blockchain.

Blockchain technology makes it possible to record transactions in an immutable block. Third parties are no longer present. Blockchain has the ability to drastically change the banking and financial sectors, at least in theory. It might lead to significant disruptions and changes in the financial industry.

In 2018, Gupta & Gupta The use of digital currencies and wallets is becoming more and more common. Additionally, companies such as Apple give their clients access to a virtual wallet via which they may make payments and borrow funds. In 2021, Facebook plans to introduce Libra, which will simplify payments. As Fintech becomes more popular and legitimate, banks will likely face fierce competition. Thakor (2020).

2. Research Objectives

1. To investigate potential blockchain uses in the Indian banking industry.
2. To identify the primary barriers keeping Indian banks from adopting blockchain
3. To look into the readiness and openness of Indian banks to blockchain technology.
4. To make recommendations on how blockchain technology might be successfully incorporated into the Indian financial sector.

3. Literature Review

Blockchain technology is one ground-breaking invention that is transforming the global financial industry (BCT). Blockchain would become a disruptive force in the Indian banking sector, the report concluded, by improving the speed, security, transparency, and cost-effectiveness of financial transactions. Secondary data was employed by the authors in this study. Prospective research endeavors may furnish factual proof of the evolution of Bitcoin technology in India relative to other developing countries. Gupta and colleagues (2018).

Mr. Abhishek Gupta's (2018) book Blockchain Technology: Application in India Banking Sector covers the history of the banking sector, the number of banks that employ blockchain technology, its benefits, challenges, and possible future developments, as well as the technology's sluggish adoption of digitalized systems.

In his 2017 book Banking on Blockchain: Charting the Progress of Distributed Ledger Technology in Financial Services, John McLean made an effort to describe the characteristics, applications, and possible benefits of distributed ledger technology apart from its widespread use.

The 2017 article "Blockchain-Based Process Innovation in Banking," authored by Jenitha Thavanatha. This study looks at the stages of technology adoption in the banking sector, such as security, private and public blockchain, IPO, and KYC.

Analysing this technology in depth as well as future financial, networking, and hardware systems. Michele Marchesi, Andrea Pinna, and Luisanna Cocco (2017), "Banking on Blockchain: Cost Savings Thanks to the Blockchain Technology."

This study illustrates how greenhouse gas emissions, climate change, and sustainable development are impacted by the expansion of IT. The impact of this technical innovation on the environment, the power consumption of Bitcoin, and the Ozone effect. It also contrasts conventional and modern financial institutions and showcases the world of cryptocurrencies on blockchain. Although blockchain technology is technologically superior to banks as credit intermediaries, Guo and Liang (2016) contend that it is yet too early to totally overhaul the current financial system.

Consequently, a "multi-center, weakly intermediated" scenario is likely to transpire. In this case, banks employ blockchain technology to strengthen their positions, simplify their payment clearing processes, and get over some barriers to information exchange. As new technology is adopted, the banking and fintech sectors in China are evolving. Chinese Blockchain Technology and Its Uses, 2016.

The financial industry will become more efficient as a result of blockchain applications' ease of creating "multi-centre, weakly intermediated" situations. Blockchain's self-governance and decentralization challenge the idea of regulation and significantly alter the current system.

Companies like UBS, ING, and Nasdaq appear to be investigating the technology's potential and are able to overcome the remaining obstacles, like security and regulatory issues (Barnes, 2015). Bitcoin's underlying technology has the power to revolutionize the market. It has the power to revolutionize practically every facet of business and render conventional online transactions obsolete. With a blockchain, we have considered the memory of money. Although it would be a little later, we would really like to delve deeper into that idea.

Could this take the place of current technology for payments, transfers, or security? Financial institutions are using a real-time, round-the-clock payment system that offers instant business and instant payments. Choosing between the new, unproven, but extremely promising blockchain technology and the tried-and-true database technology is an intriguing conundrum. To properly examine the uptake of the new technology, TAM must be used. Wilner, A., and Ducas, E. (2017). The impact of blockchain on finance and security: Canada's new technology law. Blockchain technology, the foundation of Bitcoin, is a technical advance that has the ability to completely transform financial services and upend established security, financial, and public safety standards.

Canada's challenge is to strike the right balance between innovation and regulation. Chiu, J. and Koeppl, T. V. (2019). blockchain-based asset trading settlement system. A proof-of-work protocol necessitates that the blockchain set a speed limit on transaction processing in order to generate transaction fees, which fund mining. According to Financial Studies, the primary advantage of a blockchain is faster and more flexible settlement; however, users must disregard settlement failures that occur when they disrupt the chain in an attempt to undo transaction losses.

We calculate that a blockchain would have a net advantage of 1 to 4 basis points for the corporate loan market in the United States, even if mining is a deadweight expense. Wang et al. (2021) discussed blockchain technology, investment, and macroeconomic concerns. The risk management capabilities of blockchain technology are superior than those of conventional financial systems. Businesses may be able to lower systemic risks and boost investment efficiency by utilizing blockchain technology as macroeconomic uncertainty rises. G. Gayathri (2022). To increase investment in a decarbonized economy, the factors impacting the approval of blockchain-enabled green bond issuance should be examined. To find out how likely financial professionals are to engage in such activity, the study conceptualizes blockchain-enabled green bond issuance. Numerous studies on the adoption of blockchain

have looked at the value of employing it in a variety of industries, such as database administration, supply chain management, and healthcare.
Better management systems, credit data, and payment clearing methods are also available, all of which could contribute to the development of a more effective banking system. Remittance fees account for 5–20% of the traditional banking system itself. The cost of remittance can be lowered to 2-3% using blockchain technology. Current research aims to address these issues while utilizing the technology's promise to revolutionize financial services, as banks explore the implementation of blockchain technology. Hybrid blockchain solutions are becoming more and more popular as a way to balance security, efficiency, and regulatory compliance by combining the advantages of public and private blockchains.

4. Methodology

4.1 Research Design

The implementation of blockchain technology in the Indian banking sector was examined through a mixed-approaches research approach that integrated both qualitative and quantitative methodologies. Structured surveys, case study research, and semi-structured interviews made it possible to fully understand the primary organizational perspectives, challenges, and motivations behind blockchain implementation.

4.2 Research Instruments

- **Structured Questionnaire.** The primary tool utilized to collect quantitative data was a structured questionnaire. The tool had multiple sections that addressed the following constructs: perceived benefit, security concerns, ease of use, and intention to adopt blockchain technology. Using a 5-point Likert scale, which goes from "strongly disagree" to "strongly agree," the replies were recorded. To increase the questionnaire's reliability and clarity, twenty banking professionals took part in a pilot study. With Cronbach's alpha scores ranging from 0.78 to 0.89, the main structures showed acceptable internal consistency.
- **Semi-Structured Interviews.** Semi-structured interviews were conducted with a select group of stakeholders, including IT managers, compliance officers, and digital transformation leads from both public and private banks, in order to get qualitative insights. Interview topics included strategy alignment, organizational preparedness, perceived value, and execution challenges. Each interview, which lasted between thirty and forty-five minutes, was videotaped and transcribed with the participants' consent.
- **Case Study Analysis.** Three case studies were developed to show how blockchain technology may be applied in Indian banking. The instances focused on three banks that have taken part in blockchain operational initiatives or pilot projects: the State Bank of India, Yes Bank, and ICICI Bank. The case studies examined a variety of data sources, including annual reports, press announcements, technological white papers, and internal stakeholder interviews (where available).

4.3 Study Subjects and Sampling

The target population consisted of workers in Indian banks' digital transformation departments or roles related to blockchain. Using a purposive sample technique, individuals with relevant experience and knowledge were selected. Experts in a variety of roles provided one hundred valid responses:

- Information technology accounts about 40%.
- Compliance and Risk (25%).
- Finance and Operations (20%)

- Innovation and Strategy (15%)

A variety of public and private sector banks were represented by the participants, including State Bank of India, Bank of Baroda, and ICICI Bank, HDFC Bank, and Yes Bank.

4.4 Secondary Data Sources

Variables	Code	Direction(H0)	Coefficient	t-count	Sig.	Results	Impact
Perceived usefulness	H01	No Effect	.171	1.301	.196	Insignificant	No
Perceived ease of use	H02	No Effect	.601	4.107	.000	Significant	Positive
Perceived Security	H03	No Effect	.538	3.635	.000	Significant	Positive

Secondary data was collected from a variety of trustworthy sources to support the primary results, including:

- Policy guidelines and reports from the National Payments Corporation of India (NPCI) and the Reserve Bank of India (RBI).

Questionnaire	Number	Percent (%)
Distributed amount	110	100.00
Returned amount	105	95.45
Incompletely filled	5	4.55
Total	100	90.90

- Peer-reviewed journal articles and conference proceedings on blockchain in financial services; industry research from consulting organizations such as NASSCOM, PwC, and Deloitte.
- News stories and updates on Indian regulations pertaining to blockchain technology use.

4.5 Data Analysis

Quantitative data were analyzed using SPSS Version 26 to examine the relationships between constructs through descriptive statistics, regression analysis, and reliability testing (Cronbach's alpha). To identify recurring themes and ideas, thematic analysis was applied to data from qualitative interviews. The integration of data sources enabled triangulation, which enhanced the validity and depth of the conclusions.

Table 4.5.1: Examination of the returned questionnaires

Table 4.5.2: Test Results That Are Descriptive

Table 4.5.3: Results of Multiple Linear Regression Test, Regression Models 1

Variables	N	Minimum	Maximum	Sum	Mean	Std. Deviation

Perceived usefulness	100	21.00	64.00	5573.00	55.7300	12.11048
Perceived ease of use	100	21.00	64.00	5539.00	55.3900	12.57454
Perceived security	100	21.00	64.00	5546.00	55.4600	12.39373
Intension to use blockchain technology	100	9.00	28.00	2394.00	23.9400	5.16558

Dependent Variable: At alpha 0.0, the intention to deploy blockchain technology * is critical.
Next, a standard assumption test was performed, which comprised tests for normality and multicollinearity. The value for the model was significant, according to the findings of the normalcy test using the log (10) transformation. It was discovered that the data had a regular distribution. Additionally, tolerance thresholds for each independent variable in the multicollinearity test were greater than 0.1 and VIF values were fewer than 10. Therefore, it may be said that none of the independent variables exhibited multicollinearity.

4.3. **Perceived Utility's Effect on Blockchain Technology Intention**

According to Table 4.3, the regression coefficient (beta) for the perceived usefulness variable is -.171 with a sig value of 0.196. Perceived usefulness was found at a significant level greater than alpha (α) 0.05. Therefore, one could argue that perceived utility has no bearing on the desire to adopt blockchain technology. As a result, the initial hypothesis, H01, was not verified.

4.3.2 **The Influence of Perceived Usability on Blockchain Technology Intentions**

Table 4.3 shows that the variable perceived ease of use has a regression coefficient (beta) of 0.601 at a significance level of 0.000. A significant threshold of less than alpha (α) 0.05 is found for perceived ease of use. Thus, one may conclude that perceived ease of use had a positive effect on the intention to use blockchain technology. Thus, the second hypothesis, or H02, was confirmed. It proved that as customers' opinions of blockchain technology's usefulness grew, so did the number of bank workers utilize it.

4.3.3. **The Effect of Security Perception on Intentions for Blockchain Technology**

The felt security variable has a regression coefficient (beta) of 0.538 and a sig value of 0.000, as shown in Table 4.3. The significance level for the perceived security measure was less than alpha (α) 0.05. Therefore, it would seem logical to believe that perceived security had a favorable influence on the propensity to embrace blockchain. The third hypothesis, or H03, was thus confirmed. It shows that customers think the system is safer the more employees banks have utilizing blockchain technology.

5. Blockchain Adoption Hurdles

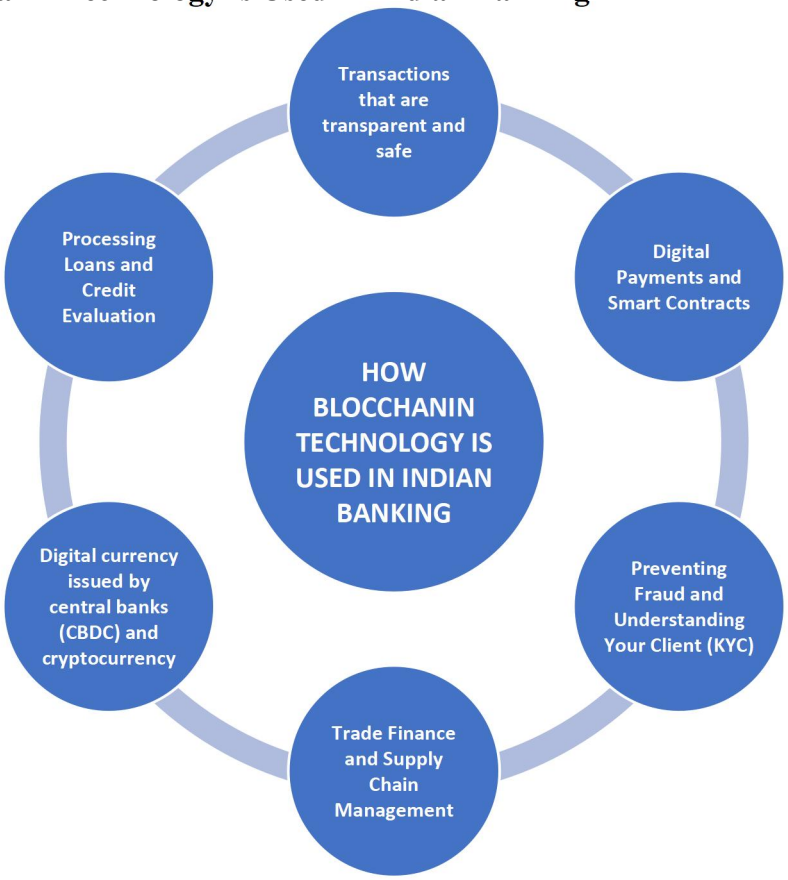
According to a 2019 Kot research, scalability problems, governance problems, and regulatory flaws still prevent blockchain from being used in financial services. According to Holotik and Moormann (2018), these elements can be categorized into five dimensions: project

European Economic Letters
ISSN 2323-5233
Vol 15, Issue 3 (2025)
http://eelet.org.uk

management (Bottom-up and Top-down approaches, motivation, and responsibility); people (partnerships, distributed knowledge, mindset, and the need for developers); organization (integration, formal and informal exchange, cross-functional teams, and attitude); technology (prototyping, efficiency, implementation, IT role, and business interaction); and environment (standardization, access to use-cases, and uncertainty).

Some of the barriers preventing blockchain systems from being widely implemented in conventional financial services include the notion that blockchain technology is still in its infancy (Radanovi & Liki la, 2018) and the potential risks of integrating such a radical new technology (Beck & Müller-Bloch, 2017).
Since consumers will be depending on the Blockchain ecosystem to safeguard their data and legitimize their online transactions, blockchain alters current practices and culture (Beck, Stenum Czepluch, Lollike, & Malone, 2016; Crosby, Nachiappan Pattanayak, Verma, & Kalyanaraman, 2016; Lindman et al., 2017). A new culture will always be needed for process transformation (Bossavit, 2002). Due to the drastic nature of the change, blockchain adoption will encounter opposition and possibly rejection until it is generally embraced (Mougayar, 2016).
Benbunan-Fich and Castellanos (2018), for example, describe how blockchain goes against the status quo in public services and the need for tactics to overcome resistance.

6. How Blocchanin Technology Is Used In Indian Banking



6.1. Transactions that are transparent and safe

Thanks to a decentralized ledger made possible by blockchain systems, transactions are secure and transparent. For cross-border remittances, Indian institutions such as ICICI and Axis Bank have implemented blockchain-based systems, which reduce transaction costs and time (Gupta et al., 2020). In order to facilitate secure financial transactions, the RBI is also looking at the possible application of blockchain technology (RBI, 2021).

6.2. Digital Payments and Smart Contracts

Smart contracts eliminate the need for middlemen by enabling automated and self-executing transactions. Blockchain technology can streamline digital payments, leading to faster and more cost-effective transactions, according to a 2019 study by Sharma and Patel. Blockchain technology is being used by Indian fintech companies to improve payment security and decrease fraud (NASSCOM, 2022).

6.3. Trade finance and supply chain management

Blockchain improves trade financing by reducing paperwork and facilitating real-time trade document verification. Blockchain technology is being used by Indian banks to improve trade finance efficiency, particularly for importers and exporters, according to Mukherjee et al. (2020). The banking sector is also looking into blockchain-based supply chain solutions to reduce the risk of fraud and increase transparency (NITI Aayog, 2021).

6.4. Digital currency issued by central banks (CBDC) and cryptocurrency

The RBI is looking into blockchain technology in order to create a Central Bank Digital Currency (CBDC). According to the RBI (2022), a digital rupee might promote financial inclusion and lessen the need for cash transactions. However, regulatory obstacles remain a major worry (Mishra & Reddy, 2021).

6.5. Processing Loans and Credit Evaluation

Blockchain's decentralized credit score and processing time reductions have the potential to revolutionize loan processing. Verma & Das (2020) claim that because blockchain technology provides immutable records of borrowers' financial histories, it can increase the accuracy of credit ratings. Indian banks are experimenting with blockchain-based lending platforms in an effort to boost productivity and reduce default rates (FICCI, 2022).

7. Obstacles To Blockchanin Implementation In Indian Banking

- **Interoperability**: There isn't currently a single, globally accepted standard for blockchain systems that are in use everywhere. It is therefore not being included in the interoperability protocols that are in place at the moment. As a result, many parties will be unable to use the same blockchain system, which will cause a number of interoperability issues.
- **Security**: Multilevel security covering authorization for parties utilizing the system is necessary for safely accessing the system using BCT in order to protect transaction security against malicious insiders or cyberattacks.
- **Legal framework**: Because of its applications, BCT has a user base that is geographically diversified. As of right now, no national nor international regulations address the jurisdiction question. Therefore, nations should have a clear mandate in case of disputes arising in cross-border transactions.

8. Discussion

1. **Enhanced Security and Trust through Decentralization:** By eliminating the need for intermediaries and reducing the likelihood of single points of failure, the decentralized structure of blockchain enhances security and confidence in financial transactions. Data integrity is ensured and modification is nearly impossible when cryptographic techniques are used. For example, smart contracts may reduce fraud and human error—two issues that still beset India's traditional banking systems—by protecting and automating complex transactions. Theories such as the Technology Acceptance Model (TAM) suggest that customers' perceptions of security have a significant impact on their acceptance of new technology, especially in sensitive sectors like banking.
2. **Scalability and Integration Challenges:** Blockchain has several operational and technological obstacles, despite its potential. Because existing consensus methods (such as Proof of Work) can be time-consuming and resource-intensive, scalability is a major concern. The problem is much more critical in Indian banks, which process millions of transactions every day. Many institutions might not be able to make the significant organizational and financial changes needed to integrate blockchain into older banking systems.
3. **Regulatory and Legal Uncertainty:** India's unclear legal system is preventing blockchain from being widely used in banking. The Reserve Bank of India (RBI) has expressed interest in blockchain for digital currency initiatives; nevertheless, issues with data privacy, the legality of smart contracts, and compliance with cross-border transactions still exist. Banks are deterred from investing in large blockchain initiatives by the uncertainty surrounding continued legal support.

Balanced Viewpoint

Even while blockchain technology has many benefits in terms of efficiency, security, and transparency, the Indian banking industry will not be able to properly implement it unless major issues like scalability, regulatory clarity, and system integration are resolved. An approach that is cautious yet proactive can assist maximize the advantages while decreasing the risks through the creation of regulatory sandboxes, experimental projects, and public-private collaboration. Although it is not a cure-all, blockchain can be a useful tool in India's transition to a strong digital financial system if used properly.

9. References:

1. Mahdi H. Miraz, Mrrauf 2018, “Application of blockchain Technology beyond cryptocurrency” Annuals of Emerging Technology in computing (AETiC), Vol 2, No.1, 2018.NASSCOM. (2022). Blockchain: The India Strategy.
2. White paper, application of blockchain technology to banking and financial sector in India an Institute for Development and Research in Banking Technology (IDRBT) publication 2017 by RBI.
3. Mr. Abhishek Gupta, “Blockchain Technology: Application in India Banking sector” 2018 paper presented in International conference held on 5th the broad them “Managing digital Revolution: Investing Future India” . http:/blockchainmadesimple.blogspot.com
4. Technological Change and Financial Innovation in Banking: Some Implications for Fintech W. Scott Frame, Larry Wall, and Lawrence J. White Working Paper 2018-11 October 2018.
5. Bentov, I., Lee, C., Mizrahi, A., Rosenfeld, M.: Proof of activity: Extending bitcoin’s proof of work via proof of stake [extended abstract] y. ACM SIGMETRICS Performance Evaluation Review 42(3), 34–37 (2014).

6. Christidis, K., Devetsikiotis, M.: Blockchains and smart contracts for the internet of things. IEEE Access 4, 2292–2303 (2016).
7. Devine, P.: Blockchain learning: can crypto-currency methods be appropriated to enhance online learning? In: ALT Online Winter Conference (2015).
8. Peters, G.W., Panayi, E.: Understanding modern banking ledgers through blockchain technologies: Future of transaction processing and smart contracts on the internet of money. Social Science Research Network (2015).
9. Zheng, Z., Xie, S., Dai, H., Chen, X.,Wang, H.: An overviewof blockchain technology: Architecture, consensus, and future trends. In: Proceedings of the 2017 IEEE BigData Congress. pp. 557–564. Honolulu, Hawaii, USA (2017).
10. Baraniuk, C. 2019. Bitcoin' s energy consumption equals that of Switzerland. Available: https://www.bbc.com/news/technology-48853230 . Accessed on July 6, 2020.
11. Brown, C. 2020. More than a third of the world's largest banks use Ripple. Available: https://www.crypto-news-flash.com/mehr-als-ein-drittel-der-groessten-banken-der-welt-nutzen-ripple/. Accessed on July 5, 2020.
12. Dragonchain. 2019. What different types of blockchains are there? Available: https://dragon-chain.com/blog/differences-between-public-private-blockchains/. Accessed on July 15, 2020.
13. Gupta, A. & Gupta, S. 2018. Blockchain technology: Application in Indian banking sector. Delhi Business Review, 19(2), 75-84. Available: https://search.proquest.com/docview/2247499893?accountid=10007. Accessed on April 12, 2020.
14. Thakor, A.V.2020. Fintech and banking: What do we know? Journal of Financial Intermedia-tion, volume 41. Available: (http://www.sciencedirect.com/science/article/pii/S104295731930049X). Accessed on May 18, 2020.
15. Khan D, Jung LT, Hashmani MA (2021) Systematic literature review of challenges in blockchain scalability. Appl Sci 11(20):9372.
16. Kulkarni M, Patil K (2020) Block chain technology adoption for banking services-model based on technology-organization-environment theory. In: Proceedings of the international conference on innovative computing & communications (ICICC), DOI: https:// doi. org/ 10. 2139/ ssrn. 35631 01.
17. Mohammad Saif AN, Islam MA. (2022) Blockchain in human resource management: a systematic review and bibliometric analysis. Technol Anal Strateg Manag 1–16.
18. Casey, M., Crane, J., Gensler, G., Johnson, S. & Narula, N. 2019. The Impact of Blockchain Technology on Finance: A Catalyst for Change. London: Centre for Economic Policy Re-search.
19. Chang, V., Baudier, P., Zhang, H., Xu, Q., Zhang, J., & Arami, M. (2020). How Blockchain can impact financial services–The overview, challenges and recommendations from expert interviewees. Technological Forecasting and Social Change, 158, 120166.
20. Chawla, D. (2020). The impact of digital technologies on the Indian banking sector: Challenges and opportunities. Journal of Indian Business Research, 12(2), 78-91. https://doi.org/10.1108/JIBR-01-2020-0090
21. Chowdhury, M.J.M., Colman, A., Kabir, M.A., Han, J. and Sarda, P. (2018), "Blockchain versus database: a critical analysis", Paper Presented at the 2018 17th IEEE International Conference On Trust, Security And Privacy In Computing And Communications/12th IEEE International Conference On Big Data Science And Engineering (TrustCom/BigDataSE).

22. Dai, J., & Vasarhelyi, M. A. (2017). Towards blockchain-based accounting and auditing. Journal of Information Systems, 31(2), 1-21. https://doi.org/10.2308/isys-51792
23. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340. https://doi.org/10.2307/249008
24. Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", MIS Quarterly, Vol. 13 No. 3, pp. 319-340.
25. Dewi, & Susanti. (2019). Perception of Permanent Lecturers in West Jakarta and Tangerang Regions Against the Use of E-filing. Journal of Economics, 24(1). [Indonesian]
26. Dragonchain. 2019. What different types of blockchains are there? Available: https://dragon-chain.com/blog/differences-between-public-private-blockchains/ . Accessed on July 15, 2020.
27. Guo, Y. & Liang, C. 2016. Blockchain application and outlook in the banking industry. Finan-cial Innovation 2, 24. Available: https://doi.org/10.1186/s40854-016-0034-9. Accessed on April 10, 2020
28. Guo, Y., & Liang, C. (2016). Blockchain application and outlook in the banking industry. Journal of Digital Banking, 1(2), 94-100.
29. Islam, A. (2012). Factors affecting user satisfaction in the Malaysian income tax e-filing system. African Journal of Business Management, 6(21), 6447–6455. https://doi.org/10.5897/ajbm11.1689
30. Kamble, S. S., Gunasekaran, A., & Sharma, P. (2020). Blockchain technology in the banking industry: A systematic review and future research agenda. Journal of Financial Services Marketing, 25(1), 1-14. https://doi.org/10.1057/s41264-020-00063-2
31. Kumar, S., Singh, A., & Jain, A. (2021). Blockchain technology in the financial sector: Adoption and challenges. International Journal of Blockchain and Cryptography, 2(1), 15-28.
32. Muhammad, I. (2001). Taxation and Technology: Technology Readiness of Malaysian Tax Officers in Petaling Jaya Branch. Journal of Financial Reporting & Accounting, 4(1), 147-163.
33. Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. https://bitcoin.org/bitcoin.pdf
34. Nakamoto, S. 2008. Bitcoin: A peer-to-peer Electronic Cash System. Available: https://bitcoin.org/bitcoin.pdf. Accessed on May 20, 2020.
35. Pilkington, M. (2016). Blockchain technology: Principles and applications. Edward Elgar Publishing. Porter, M. E. (1980). Industry structure and competitive strategy: Keys to profitability. Financial Analysts Journal, 36(4), 30–41.
36. Schwab, K. (2016). The Fourth Industrial Revolution. Crown Business.
37. Sheel, A., & Nath, V. (2019). Effect of blockchain technology adoption on supply chain adaptability, agility, alignment and performance. Management Research Review, 42(12), 1353–1374.