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Metamorphosing Indian Blockchain Ecosystem

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ABSTRACT

A blockchain is a decentralised database that is shared across computer network nodes. A blockchain acts as a database, storing information in a digital format. The study primarily aims to explore how in the future, block chain technology will alter several areas of the Indian economy. The current study aims to obtain a deeper understanding of blockchain technology's idea and implementation in India, as well as the technology's potential as a disruptive financial technological innovation.

Secondary sources such as reports, journals, papers, and websites were used to compile all the data. Current and relevant information were utilised to help understand the research goals. All the information is rationally organised to fulfil the objectives. The current research focuses on recommendations for enhancing India's Blockchain ecosystem so that it may become one of the best in the world at utilising this new technology.

***Keywords*—** Blockchain, Ecosystem, Banking Industry

I. INTRODUCTION

The functionality and complexity of Distributed Ledger Technology (DLT) and blockchain have grown significantly to provide solutions to a variety of industries, including the financial sector. Some of the banks have started pilot initiatives to understand more about DLT and see how it may help their operations and financial systems. Most of these projects have been experimental in nature so far, with the goal of determining the viability of performing inter-bank settlements, digital asset and token settlements, and cross-border payments over DLT platforms using existing system functionality. In the Indian context, boosting support for innovations and evolving technologies from the Reserve Bank of India and the Government of India through regulatory sandboxes and other initiatives will pave the path for a new economic system to emerge for a new economy enhanced with technology-centric growth. The present research study focuses on ideas for transforming India's Blockchain ecosystem so that it may become one among the most developed countries in terms of leveraging the benefits of this emerging technology.

II. RESEARCH QUESTION

The present study addresses the research questions mentioned below:

1. How will Block Chain technology transform different sectors of Indian economy in future?
2. What challenges India will face for adoption of Block Chain Technology and steps the government of India have taken to implement the Block Chain Technology?

III. OBJECTIVES

The study is fundamentally aimed at understanding the following:

1. To understand the blockchain's technical architecture and how it works.
2. To have a better understanding of the technological and administrative aspects of implementing Block Chain in India.
3. To study Opportunities and threats of Block Chain Technology.
4. To understand transformation of India's Blockchain ecosystem

IV. REVIEW OF LITERATURE

(Guo and Liang,2016)[1] asserted that blockchain technology has a bright future ahead of it in the banking industry. It has the potential to improve and improve the efficiency of the banking sector's payment clearing and settlement system, as well as the credit information system. *Abou (Jaoude, J., & Saade, R. G.,2019)*[2]identified that BCT originally conceived as a mechanism to enable a frictionless cryptocurrency, Bitcoin, blockchain has since unbound itself from its original purpose as an increasing number of industries and stakeholders see the technology as an appealing alternative to solve existing business problems and disrupt mature industries. The blockchain's unique characteristics, such as privacy, security, anonymity, decentralisation, and immutability, help a wide range of disciplines and subjects. The exploration of blockchain's application has barely begun with a few small studies in domains including the Internet of Things, energy, banking, healthcare, and government, all of which stand to gain disproportionately from its deployment. (*Yang, X. M., Li, X., Wu, H. Q., & Zhao, K. Y., 2017)* [3] regarded that the underlying technology of bitcoin, blockchain technology is not only applied in the field of finance, but

also has potential in education. According to the experience and enlightenment from the application of blockchain in the financial field, the blockchain in education is mainly embodied in the six application modes: establishing individual knowledge big data, creating intelligent educational platform of Taobao, developing degree certificate system, constructing new ecology of open education resources, achieving "self-organization" operation of network learning community and developing the decentralization of education system. (*Gupta and Gupta 2018)* [4] have stated that Indian banking system can drastically change with the help of blockchain technology. It has the ability to make transactions to be more secured, transparent and cost effective and to evolve towards digitizing the Indian monetary system. *(MM Queiroz and SF Wamba, 2019)* [5] identified that blockchain technology can reshape the future of the banking. Banks need to process and store enormous data and therefore enhanced security and transparency can be achieved by this technology. *Sharma (2020)*[6] stated that blockchain can bring in a revolution in the Indian banking. A secured and distributed database of clients helps in reducing the time and cost in interbank transactions, KYC of customers, and reduction in NPA of the banks. *Hsani and Sherimon (2021)*[7] have also noted that blockchain technology helps in quickly completing complex clearing and settlement system and make the process of authentication easier through shared KYC infrastructure. *Madaan, L., Kumar, A., & Bhushan, B. (2020, April)*[8] investigated blockchain and its current scenario, it first focuses on the emergence of blockchain and its working and also briefly explains the characteristics and challenges faced by technology.

The review of literature highlights that BCT have been studied from different perspective by different authors but very few studies focus on essential ecosystem required to implement the BCT. Therefore the current research focuses on ideas for transforming India's Blockchain ecosystem so that it may become one of the top countries in terms of leveraging the benefits of this emerging technology.

V. RESEARCH METHODOLOGY

The current research focuses on gaining a better knowledge of the concept and application of blockchain technology in India, as well as the technology's prospects as a disruptive financial technological advancement. By focusing on the technological and administrative aspects of block chain technology implementation in India, the study also provides insight into the strategies for metamorphosing the Indian Blockchain ecosystem to make India one of the leading countries in terms of harnessing the benefits of this emerging technology. The current research is exploratory and descriptive. All the information was gathered from secondary sources such as reports, journals, papers, and websites. To comprehend the research aims, tables were used. All the data is logically organised to meet the given goals.

VI. RESULTS AND DISCUSSION

6.1 *Understanding Block Chain Technology*

"A blockchain is a distributed ledger that records transactions in near real time and is digitally unchangeable." The respective consensus of the network participants (called nodes) is required for each future transaction to be added to the ledger, hence generating a continual process of control regarding manipulation, errors, and data quality." Simply explained, Blockchain is a technology for trading value without the use of a middleman over the internet.

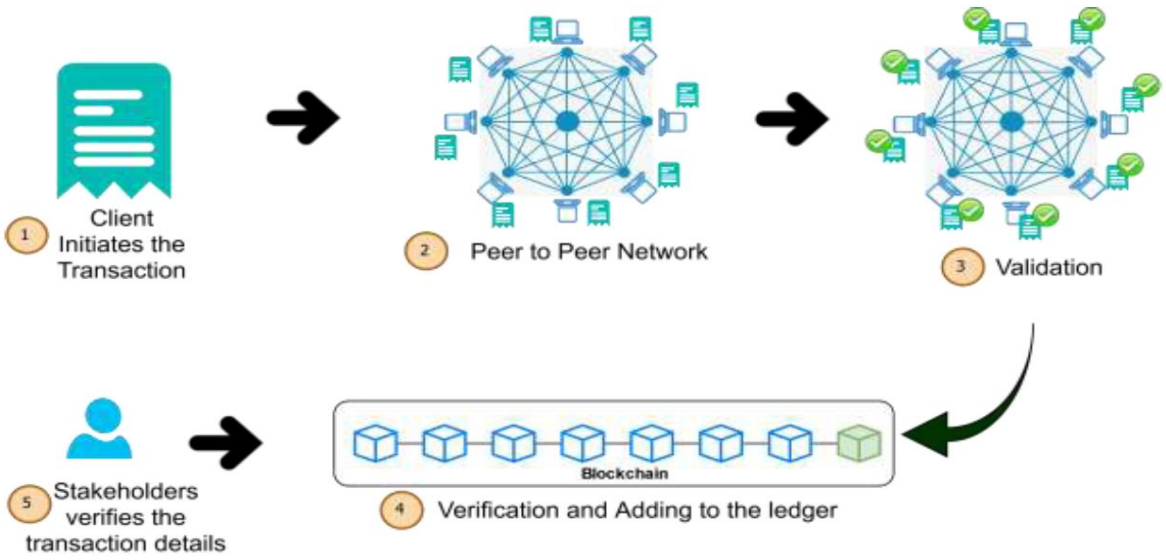

Figure 1: Blockchain Network and the process of adding new transaction to ledger (Source: National Strategy on Blockchain, NISG, https://www.nisg.org/blockchain)

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The immutability of a Blockchain makes it nearly impossible to make changes after it has been formed, increasing data integrity, and reducing fraud potential. The basic data structure of a Blockchain, known as a Merkle tree or Hash tree, provides immutability and irreversibility.

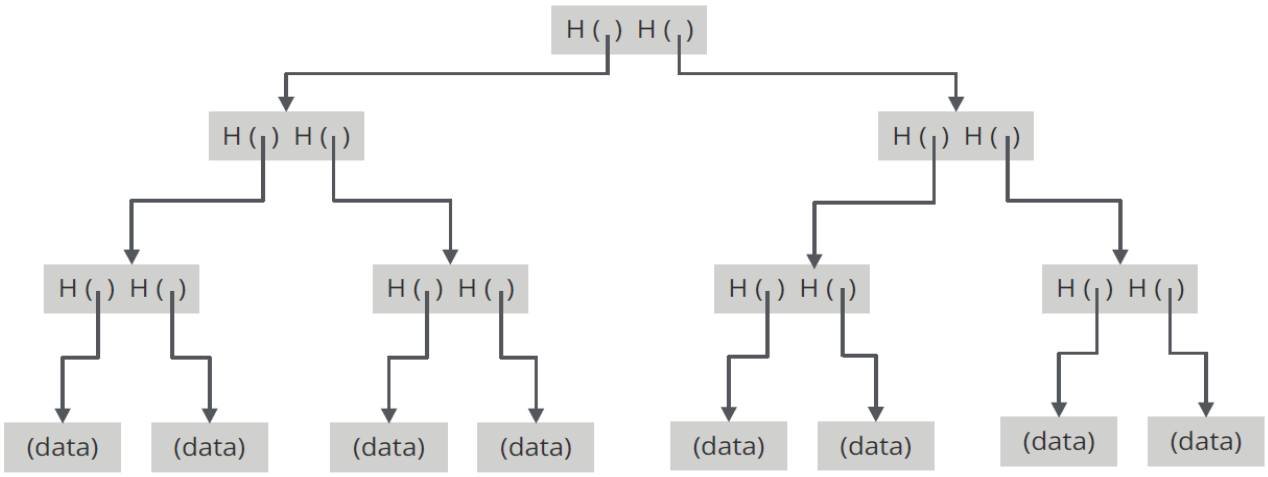

Figure 2: Merkle Tree Structure ((Source: National Strategy on Blockchain, NISG, https://www.nisg.org/blockchain)

6.2 Merkle Tree Structure at the heart of Block Chain

Blockchain's cryptographic security is provided by a binary data structure with hash pointers. Merkle tree, also known as hash tree, is a distributed data structure that groups data blocks into pairs and stores the hash of each pair in a parent node. The hash codes are grouped together until they reach the root node. The immutability of a Blockchain is derived from the fact that tampering of any block will result in manipulation of all preceding hashes until the root node, which is tamper proof. Another benefit of the Merkle tree is that it provides proof of membership/ownership because knowing the root member is sufficient to know all of the tree's members.

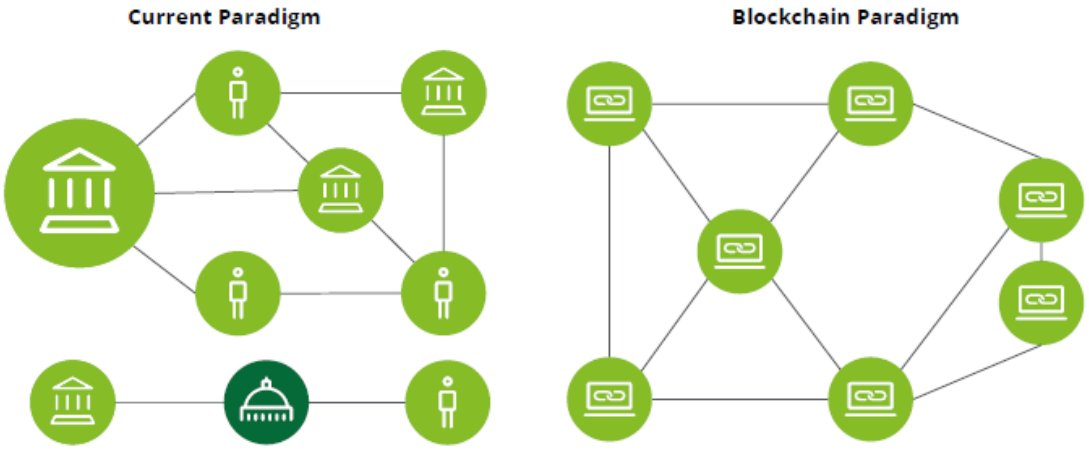

Figure 3: Traditional database vs. Blockchain base distributed ledger
(Source: National Strategy on Blockchain, NISG, https://www.nisg.org/blockchain)

Traditional Database

In traditional database actual value is transferred between two parties by central authorities. To facilitate the transfer of assets and establish trust, multiple intermediaries are required.

Blockchain Database

In Blockchain database distributed nodes that maintain a shared source of Information. Trust enabled by cryptographic algorithm

6.3 Types of Block Chain:

Blockchain can be set up in two ways: public / permissionless or private / permissioned, each with its own set of benefits and drawbacks. Figure 4 demonstrates the various architecture possibilities for

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Blockchain deployments, illustrating that private Blockchains allow only known entities to join the network, whereas public Blockchains do not have a central authority (Brant et al 2018) [9].

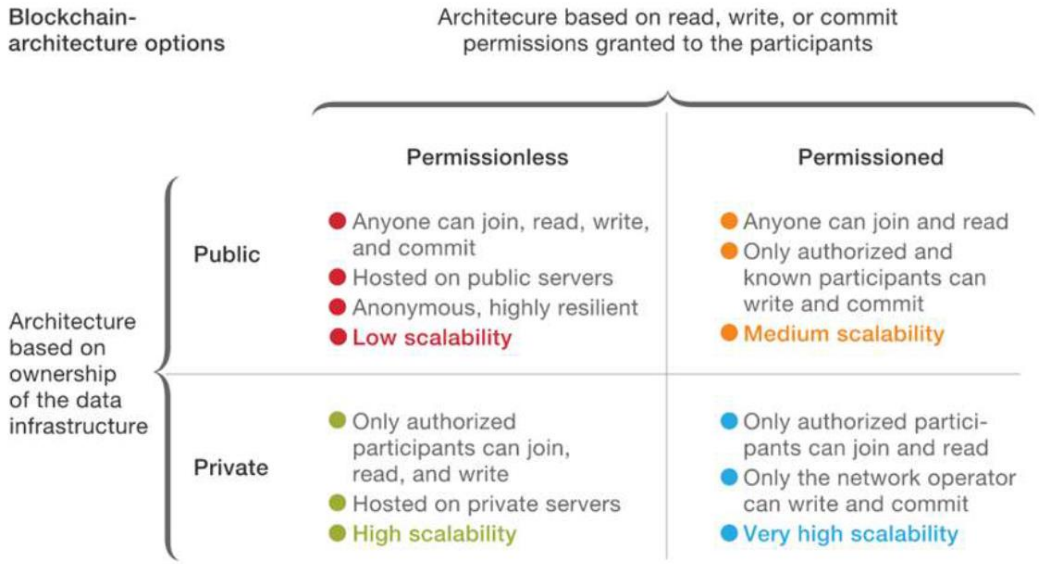

Figure 4: Block Chain Architecture Options
(Source: National Strategy on Blockchain, NISG, https://www.nisg.org/blockchain)

Public Block Chain

Fully decentralized and Transparent - Anyone can read, send transactions & participate in the consensus process.

Permissioned Block Chain

Quasi-decentralized, with a pre-selected number of nodes controlling consensus and read permission restricted to participants.

Private Block Chain

Centralized–requires a 'high trust' entity with centralised Write access for one entity and Read permissions for all participants.

6.4 Blockchain Applications of National Importance

In corporate operations, blockchain technology enables transparency, security, and efficiency. It creates a unique layer of trust across the Internet, which was initially explored with the cryptocurrency Bitcoin. The functionality of B2B, G2C, G2G, and B2G services related to diverse application fields will be revolutionised by Blockchain Technology. As shown in Figure 5, it has applications in healthcare, governance, cyber security, autos, media, travel, logistics & hospitality, education, legal, energy, and smart cities.

Figure 5: Application of Block Chain Technology
(Source: National Strategy on Blockchain, NISG, https://www.nisg.org/blockchain)

Potential Block Chain Applications of National Interest includes:

- Transfer of Land Records (Property Record Management)
- Digital Certificates Management (Education, Death, Birth, Agreements, and Sale deeds...) are two potential Blockchain applications of national relevance.
- e-Notary Service is a service that allows you to sign documents electronically (Blockchain enabled e-Sign Solution)
- Supply chain for pharmaceuticals
- Agricultural Insurance
- Managing your identity
- Distribution of power
- Payments of duties
- Supply networks in agriculture and other industries
- eVoting (Electronic Voting)
- Management of Electronic Health Records (EHR)
- System for Managing Digital Evidence
- Providing Public Services
- IoT Device Security and Management
- Vehicle lifecycle management
- Managing the operations of a chit fund
- Microfinance for Self-Help Organizations (SHG)

6.5 Value addition through Blockchain in E-Governance

1) In e-Government, blockchain may provide a lot of value by improving transparency and accountability, building trust with citizens, speeding up transactions, protecting sensitive data, and lowering costs and improving efficiency.
2) In order to provide service to residents, government procedures necessitate the involvement of numerous agencies. Data communication between departments must be seamless if efficient service delivery is to be achieved. Smart contract workflows and shared ledgers can be used to track cross-departmental procedures. As a result, through utilization of Block Chain, the system becomes more transparent and accountable.
3) Because blockchain is a single source of truth, it may be used to authenticate and verify all transactions and data generated by various government agencies.
4) Smart contracts, supply chains for various government procedures, trusted inter-departmental communication, and tamper-evident storage are all possible with blockchain.
5) By comparing the submitted document copy to a version kept in a Blockchain, officials will be able to validate the proof of existence of papers. Storing digital artefacts / documents in a Blockchain ensures that they are secure and unaffected by alteration.

6.6 Global initiative in implementation of Block Chain

Many governments have implemented Blockchain-based platforms and services, and many vendors are already delivering Blockchain as a service to their clients.

1) China's Blockchain-based Service Network (BSN) programme intends to make it easier for businesses and people to deploy Blockchain applications more quickly and affordably. The BSN includes components that provide application development developer tools and focuses on standardising them across public networks, regions, and business sectors. The goal is to assist efforts in the digital economy and smart cities.
2) Another initiative of China has launched a Blockchain-based identification system for smart city infrastructure that was developed independently. This technology will issue Chinese smart cities a unique, global digital ID in order to promote communication and data sharing between them. The Blockchain-based notary application has been operational in China's offices since April 2019.
3) The European Blockchain Partnership (EBP) aims to use blockchain and distributed ledger technologies to build a trusted, secure, and resilient European Blockchain Services Infrastructure (EBSI) that meets the highest standards in terms of privacy, cybersecurity, interoperability, and policy implementation, among other things.
4) The Estonian-developed Keyless Signature Infrastructure (KSI) is a Blockchain technology. In Estonian government networks, blockchain is being used to mathematically guarantee the legitimacy of electronic data (records). They used X-Road, a "centrally managed distributed Data Exchange Layer (DXL) connecting information systems." Organizations can use X-Road to share information over the Internet while maintaining confidentiality, integrity, and interoperability.
5) United Arab Emirates has “Smart Dubai” initiative, which aims to become the first city fully powered by Blockchain by 2021,” and enhance everything from health care and education to traffic management and environmental sustainability.
6) In the United States, the Food and Drug Administration is utilising Blockchain to address the issue of lack of openness and security in the processing of health data. The Food Standards Agency in the United Kingdom is utilising Blockchain to track the circulation of meat in order to improve food traceability.

7) The Brazilian government has declared that applications and popular voting would be migrated to Ethereum. Brazil is also concentrating on public bidding for government contracts, on-line bid solutions to provide secure and transparent negotiations for farm applications, and student credentials and performance tracking.
8) Chile uses Ethereum to track data and finances from the energy infrastructure in order to combat corruption and exploitation by making data transparent and immutable for all citizens to see. In 2017, Switzerland began offering and registering digital IDs on Ethereum.
9) To alleviate voters' concerns about corruption, Canada is adopting Ethereum to offer transparency to the usage of government grants.
10) Sweden is concentrating on real estate transactions, while Ghana is working on a blockchain-based land registry and cadastral record to collect property taxes.
11) Samsung Blockchain Wallet, which is powered by COSMOCHAIN Blockchain, has created CosmeeDApp, which allows users to purchase content with bitcoin. If a corporation uses information provided or developed by customers, the information sources are rewarded in a completely transparent manner utilising Blockchain.
12) LG Blockchain is a company that specialises in digital authentication, community tokens, and enterprise supply chain management.
13) Some of the Blockchain services available include Amazon Managed Blockchain, Microsoft Azure Workbench, IBM Blockchain, Oracle Blockchain, and BlockappsStrato.
14) Cosmos, Polkadot, Aion, Ark, Wanchain, Atomic Swap, and Chainlink are just a few of the global Blockchain Interoperability research projects.

6.7 National Scenario in implementation of Block Chain

Blockchain Technology has been selected by the Ministry of Electronics and Information Technology (MeitY) as one of the significant research fields with application potential in several domains such as governance, banking and finance, cyber security, and so on. With C-DAC, IDRBT, and VJTI as executing agencies, MeitY has financed a multi-institutional project dubbed Distributed Centre of Excellence in Blockchain Technology.

Agencies have conducted research on the application of Blockchain Technology in designated domains, built Proof-of-Concept solutions, and piloted them as part of this programme. A blockchain-based property registration solution has been successfully built and is being tested in Telangana's Shamshabad District. Proof-of-Concept solutions for Cloud Security Assurance, CKYC, and trade financing are being developed. A generic blockchain-based Proof-of-Existence (PoE) Framework is being created to enable PoE for digital artefacts, such as academic diplomas, sale deed documents, and memorandums of understanding.

A method for authenticating academic certificates has been built utilising the PoE framework, and it is currently being tested at C-DAC Advanced Computing Training School. In order to encourage the growth of the Blockchain ecosystem, the team has showcased the developed solutions to a number of additional states and successfully conducted capacity building programmes for user agencies. C-DAC is also a founding member of Telangana State's Blockchain District programme.

In collaboration with NICSI, NIC developed a Centre of Excellence (CoE) in Blockchain technology. The goals of the CoE are to speed up the adoption and deployment of Blockchain technology in government, to execute projects focused on various use cases, to pilot deployment, to offer Blockchain-Platform as a Service to speed up the design and development of solutions, and to provide consultancy and capacity building. The Center of Excellence is focusing on collaboration between the government, the public sector, and the business sector. Blood Bank, Digidhan, Public Distribution System, Land Registration, GST Backoffice, Excise Management System, and other application areas discovered and developed by CoE.

Blockchain has been identified by the National Institution for Transparency and Accountability (NITI Aayog) as a promising technology that enables features such as decentralisation, transparency, and accountability. NITI Aayog has piloted a number of Blockchain use cases in collaboration with various government departments and private organisations. Land records, pharmaceutical supply chains, fertiliser subsidy disbursement, and educational diplomas are some of the use cases.

C-DAC has completed successful proof-of-concepts and pilot deployments, demonstrating that Blockchain Technology will play a disruptive role in the industry 4.0, government, and public sectors. One of the mission areas specified by C-DAC is Blockchain Technology. C-mission DAC's is to create Blockchain Technology solutions that enable a trusted and auditable shared infrastructure for cross-domain application development and large-scale deployment. The top level components of C-mission DAC's in Blockchain Technology are as follows:

Unified Blockchain Framework: A cross-domain blockchain platform that addresses performance, scalability, interoperability, security, and privacy concerns.

Block chain services: e Sign has related to a blockchain-based Proof-of-Existence system (PoE).

Blockchain Applications for different domains: Security for IoT Deployment, Blockchain for Electronic Health Record (EHR), Blockchain based Digital Evidence Management System, Blockchain for

Track and Trace, Blockchain for Electronic Health Record (EHR), Blockchain for Electronic Health Record (EHR), Blockchain for Electronic Health Record (EHR), Blockchain for Electronic Health Record (EHR), Blockchain for Electronic Health Record Self-Sovereign Identity on the Blockchain APEDA Trace Net, Government e-Marketplace (GeM) Platform, Blockchain Technology for Voting, and Blockchain based Property Record Management System all use blockchain technology.

RBI & other initiatives: The Reserve Bank of India (RBI) is investigating the use of Blockchain technology in the banking sector. Mahindra and IBM are working on a supply chain management system together. For a Blockchain-based application trial, SBI has partnered with commercial banks and financial institutions. Blockchain is also being used by Yes Bank, Axis Bank, and ICICI Bank in their financial operations.

NASSCOM: According to the NASSCOM Avasant India Blockchain Report 2019, various states throughout India have begun to implement Blockchain-based use cases. The top three use cases are land registry, farm insurance, and digital certificates.

6.7 Legal Challenges for implementation of Block Chain Technology

1) The Reserve Bank of India (RBI) has imposed restrictions on virtual currencies based on Blockchain technology, and a circular has been issued to prohibit crypto-currency transactions in India. However, the feature of tokenization-related actions is unclear.
2) In banking legislation, in-person verification is required to satisfy non-repudiation standards, and implementing technical solutions for such requirements, particularly for crypto-currency based on Blockchain, is difficult.
3) Blockchain networks and applications rely heavily on digital signatures. There are currently no specifics in Schedule I of the Information Technology Act, 2000 in relation to transactions involving immovable property, wills, or negotiable instruments, hence this clause excludes the technology's applicability to such operations.
4) When it comes to Blockchain, Section 43A of the IT Act currently does not have any precautions indicated in terms of privacy. The 'Right to be Forgotten,' which is a common aspect of data protection law such as the Draft Personal Data Protection Bill, 2019, clashes with Blockchain's intrinsic feature of data not being able to be removed and data history being constantly available.
5) Localization: Because the Blockchain automatically stores data redundancy across all nodes on a network, localization requirements may pose a problem for the system, even if they are limited to only important personal data, as the Ministry of Electronics and Information Technology is considering (MeitY).

6.8 Privacy, Security, and regulation Challenges for implementation of Block Chain Technology

1) Privacy: Because data on the blockchain is kept on every node in the network, privacy is not an intrinsic characteristic of the blockchain. This is an active research subject, with numerous solutions being presented and evolving. Data should be maintained in a way that does not jeopardise an individual's privacy, and proper permission methods should be implemented in accordance with data protection legislation.

2) Regulations: The situation of Blockchain application legislation and compliance is still unclear. The restrictions primarily concern the privacy of information transferred via Blockchain, which might include health data or user identity documents, among other things. When the regulations are well-defined, adoption will speed up.

3) Use of CA's: Every entity in Blockchain, including nodes and users, has public keys, private keys, and certificates. The utilisation of existing certificate authorities (CAs) is a crucial integration point. The type of CA to use would be determined by the application's nature. Applications that require transaction signing with certificates from a licenced CA should be considered as part of the implementation from the start.

*(*The above challenges have been adopted from report National Block Chain Strategic Report by NIC)*

6.9 Technological Challenges for implementation of Block Chain Technology

1) ***Performance & Scalability:*** The decentralised architecture of Blockchain, in contrast to old centralised systems, indicates that it will be slower than traditional systems. As a result, it's critical to create a system that allows for speedier synchronisation. While extensive research is being done in this area, the initial use-cases should be carefully chosen such that real-time processing and results are not required. The architecture and configuration of the Blockchain platform, as well as variable computing power, network bandwidth, block size, consensus, transaction validation processes, privacy needs, file system, and data storage, all impact the scalability of Blockchain systems. These scalability needs should be addressed in the architectural architecture of the Blockchain network and platform.
2) ***Storage:*** Blockchain is regarded as an append-only data storage system. Because data saved in the Blockchain cannot be changed, it becomes eternal and is duplicated across all network nodes. This necessitates a lot of storage space

and may become an issue if the chain of blocks grows.

3) ***Transaction details and interoperability:*** For high performance gains, a design choice on what part of the application data flows offchain and what part goes onchain is critical. The number of transaction details that must be stored should be limited to a bare minimum, and this may vary depending on the application. Transaction standardisation for a certain class of applications must be developed in order to reap the benefits of interoperability across comparable applications.
4) ***Resource Allocation:*** Due to the dispersed nature of the network and node infrastructure, resource allocations would vary and rely on the cost of network maintenance, peripheral security, and other critical criteria. In such instances, lower resource allocations may have a performance impact on the overall system. Furthermore, problems associated with establishing Blockchain Infrastructure across the country must be addressed.

6.10 Skill Set Challenges for implementation of Block Chain Technology

1) ***Awareness:*** A fundamental difficulty is a lack of understanding of the nature of Blockchain systems. There are a lot of open source Blockchain platforms available, but many of them lack well-documented features like as the ability to add new components, security, scalability, and speed. This need experienced people in a variety of technologies in order to comprehend and alter their performance to meet specific needs.
2) ***Underlying Technology:*** The underlying technology that powers Blockchain is still in its infancy and is just now approaching the point where it can be used in production. The benefits of technology should be communicated to users, as well as how it might be used to solve issues in a certain domain of national relevance.
3) ***Supply Chain:*** Blockchain may be used to trace supply chains, which is a useful and significant use. Due to a lack of understanding and trust concerns in technology, a lot of domain experts are hesitant to accept the technology. As a result, quicker Blockchain use necessitates increased digitalization and knowledge.
4) ***Proof of Concept:*** Users must pay blockchain professionals or data scientists to execute a successful large-scale PoC (Proof of Concept), which is more expensive than hiring software engineers, making adoption challenging.
5) ***Manpower:*** It's difficult to locate people who are both domain and technology experts. Many projects that have begun to adopt Blockchain-based applications are running into a skilled labour shortage. India's scale and needs (including catering to global needs) would be significantly bigger, and if human requirements are not met in a timely and adequate manner, the nation's journey to adopt Blockchain will be severely hampered.

6.11 Challenges in terms of security, privacy, and legislation

Privacy: Because data on the blockchain is kept on every node in the network, privacy is not an intrinsic characteristic of the blockchain. This is an active research subject, with numerous solutions being presented and evolving. Data should be stored in a way that does not jeopardise an individual's privacy, and proper consent methods should be implemented in accordance with data protection legislation.

1) ***Existing CA's can be used:*** Every entity in Blockchain, including nodes and users, has public keys, private keys, and certificates. The utilisation of existing certificate authorities (CAs) is a crucial integration point. The type of CA to use would be determined by the application's nature. Applications that require transaction signing with certificates from a licenced CA should be considered as part of the implementation from the start.
2) ***State Regulations:*** The state of Blockchain application legislation and compliance is still unclear. The restrictions primarily concern the privacy of information transferred via Blockchain, which could include health data or user identity documents, among other things. When the regulations are well-defined, adoption will speed up.

6.12 Legislation challenges for adopting in India

1) The Reserve Bank of India (RBI) has imposed restrictions on virtual currencies based on Blockchain technology, and a circular has been issued to prohibit crypto-currency transactions in India. However, the feature of tokenization-related actions is unclear.
2) In banking legislation, in-person verification is required to satisfy non-repudiation standards, and implementing technical solutions for such requirements, particularly for crypto-currency based on Blockchain, is difficult.
3) Blockchain networks and applications rely heavily on digital signatures.
4) There are currently no specifics in Schedule I of the Information Technology Act, 2000 in relation to transactions involving immovable property, wills, or negotiable instruments, hence this clause excludes the technology's applicability to such operations.
5) When it comes to Blockchain, Section 43A of the IT Act currently does not have any precautions indicated in terms of privacy. The 'Right to be Forgotten,' which is a common aspect of data protection law such as the Draft Personal Data Protection Bill, 2019, clashes

with Blockchain's intrinsic feature of data not being able to be removed and data history being constantly available.

6) Localization: Because public Blockchain automatically stores data redundancies across all nodes on a network, localization requirements may pose a challenge for the technology, even if they are limited to only critical personal data, as the Ministry of Electronics and Information Technology is considering (MeitY).

6.13 SWOT Analysis

The SWOT analysis is taken from the Gartner Trend Insight Report "Practical Blockchain." Considering the SWOT analysis, it's critical to identify and deploy Blockchain to the proper application that can take advantage of the technology's advantages. Multiple untrustworthy stakeholder engagement, such as regulatory bodies, smart contracts that do not change frequently, data that requires permanent storage, and so on are all considerations to consider while developing a blockchain application.

Strength	Weakness
Decentralized approach Speed and 100% transparency Open Source Security and modern cryptography Native Asset Creation No reliance on third party Low cost and risk Dynamic and fluid exchange value	Access challenge Change Management Integration With Legacy Systems Lack of Standards Low capacity and processing speed Ownership challenge Recent technology (not 100% developed) Scalability Security against cyber criminals Storage Technology Maturity
Opportunities	**Threats**
Automations Business Process Optimisation Elimination of trust necessity Faster (international) payment transfer Improved customer experience Increased quality of products and services Innovation In Almost Every Industry Especially Banking Instantaneous settlements KYC database New Intermediaries No reliance on rating agencies Opportunities In IoT Programmable control mechanisms Smart contracts in insurance Speedup bank processes	A lot of research needs to be done Disappearance of existing bank jobs Govt. willingness to adopt High investments for implementations Huge regulatory impact Hype Legal/regulatory and compliance Privacy and security Time-consuming negotiations Uncertainty about the impact

6.14 Block Chain Adoption Road Map

Because Blockchain Technology is still in its infancy, it faces a number of obstacles that must be overcome in order for it to be adopted and used efficiently in a variety of applications. Figure 1 shows a road map for blockchain technology adoption, as well as data on key milestones.

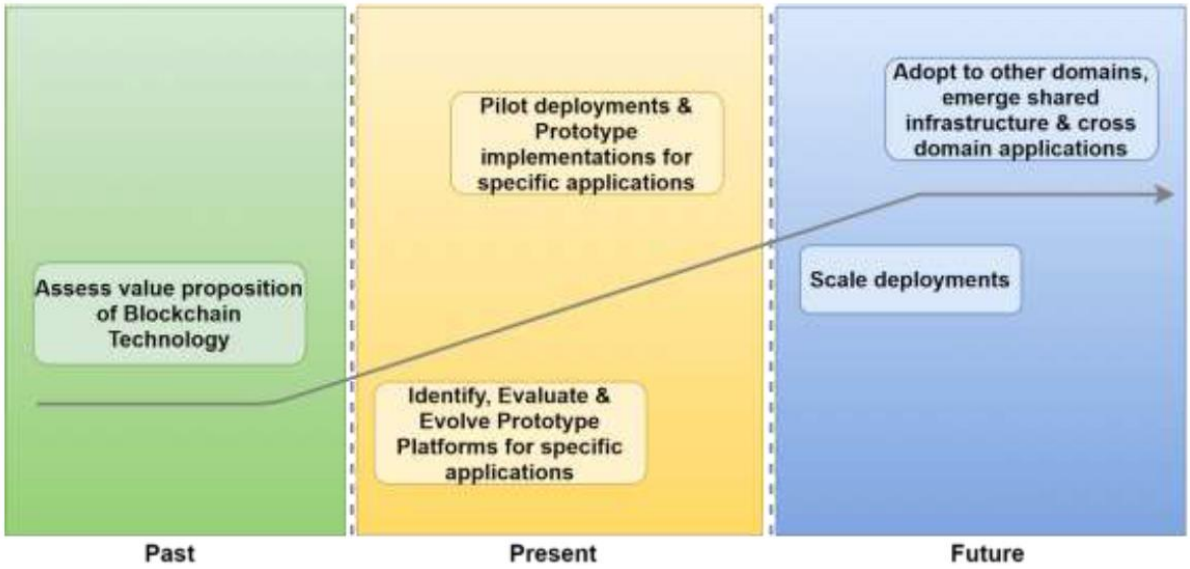

Figure 6: Block Chain Technology Adoption Road map (National Strategy on Blockchain, NISG, https://www.nisg.org/blockchain)

Patient health records, for example, can be kept on National Level Blockchain in a tamperproof way in the health care arena. Patient data stored on Blockchain can be granted role-based privacy enabled access. This allows doctors at any hospital in India to view a patient's medical history when the patient comes to them for treatment. Shared Blockchain architecture prevents asset data duplication and ensures that asset transaction histories are consistent. Potential Roadblocks in the Evolution of Shared Blockchain Infrastructure and Cross-Domain Applications:

- Transaction Speed and Scalability (achieving higher number of transactions per second)
- Interoperability and standardisation of data security and privacy (cross-platform and cross-chain protocols)
- Regulatory Aspects of AI and Data Analytics
- Ecosystem and enabling environment
- Infrastructure that is not centralised

VII. CONCLUSION

DLT and blockchain have evolved in functionality and complexity to give solutions to a range of industries, including the financial industry. Some central banks have begun pilot projects to learn more about distributed ledger technology and evaluate how it may benefit their operations and financial systems. So far, the majority of these initiatives have been experimental, with the purpose of assessing the practicality of completing inter-bank settlements, digital asset and token settlements, and cross-border payments through DLT platforms utilising current system capabilities. In the Indian context, increasing Reserve Bank of India and Government of India support for innovations and emerging technologies through regulatory sandboxes and other efforts would pave the way for a new economy based on technology.

In the Indian context, increasing Reserve Bank of India and Government of India support for innovations and emerging technologies through regulatory sandboxes and other efforts would pave the way for a new economy based on technology-centric growth. The present study focuses on proposals for improving India's Blockchain ecosystem so that it may become one of the best in the world at reaping the benefits of this new technology.

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