

**BLOCKCHAIN TECHNOLOGY IN INDIA: AN EVALUATION**

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**Abstract**

Blockchain technology can be considered a subset of distributed ledger technology in which multiple transactions are stored in 'blocks' and cryptographically linked to the previous block by a 'chain'. Blockchain is seen as a technology with the potential to transform almost all industries and economies. It is estimated that blockchain could generate USD3 trillion per year in business value by 2030. The World Economic Forum (WEF) anticipates that 10% of the global GDP will be stored on blockchain by 2025 and lists blockchain as one of 7 technologies that are anticipated to revolutionize various aspects of our lives. India has created a unique model of digital foundational infrastructure such as Aadhaar, UPI, e-Sign and Digi locker along with digitally enabled tax governance networks like GSTN or digitally enabled health coverage such as Pradhan Mantri Jan Arogya Yojana (PM-JAY). Blockchain solutions are appropriately suited for addressing several challenges of India and will also benefit from the infrastructure created already. NITI AAYOG Report 2020, states that implementation of the blockchain technology will improve ease of doing business, ease of governance and ease of living. In this context, this paper intends to study the economic benefits and cost of blockchain technology in India.

**Key words: blockchain technology, digital infrastructure, ease of governance, ease of doing business and ease of living.**

**Introduction**

Since 2017, blockchain technology has captured global attention. The application of blockchain technology has revolutionised various fields such as banking, retail and healthcare. Blockchain

is a new type of network infrastructure that create ‘trust’ in networks by introducing distributed verifiability, auditability, and consensus. Blockchain technology has the potential to transform almost all industries and economies. This frontier technology continues to evolve in its full potential in the coming days. Since India has a strong digital infrastructure, it can easily adapt this technology in various fields. So, it is important to understand the opportunities that blockchain technology offers, steps to leverage its full potential and to develop the requisite environment for its adoption. This paper is an effort to evaluate how the blockchain technology will help India to improve its ease of doing business, ease of governance and ease of living.

### **Review of Literature**

Blockchain is one of the most popular terms associated with the “fourth industrial revolution”. It is a continuous sequential chain of blocks containing information formed according to certain rules. As for economic processes, these blocks record information about transactions and their characteristics. Each transaction is registered as a block. A chain of blocks is formed by hash functions, a cryptographic technology that allows you to encode and embed information about transactions made in the previous block into each subsequent one. This principle of chain formation practically guarantees data protection. A hacker would have to make changes in all subsequent blocks by changing their hash-headlines. The blockchain users would easily notice these attempts, since the emerging block chain is fully available for their monitoring. In addition, it is extremely difficult to “rewrite” one block as significant processing power is required, which leads to high energy consumption. Blockchain technology reduces the costs associated with the verification of transactions and the creation of a distributed network (Catalini and Gans, 2016). This creates the potential for large-scale transformation of existing markets and the formation of new ones. Therefore, the blockchain can be considered as an example of a general-purpose technology, which is the fundamental factor of long-term economic growth (Denisova, Valeriia, 2019).

Blockchain technology is a decentralized cloud-based and open-sourced distributed database that links all records by consensus. It is a peer-to-peer cryptographic payment system, popularized through Bitcoin (Nakamoto, 2008), the benefit of blockchain is much more than just a cryptocurrency. Its facilitation of real-time transaction of digital assets on a distributed ledger makes it a compelling tool for private, secure and efficient contracts or data storage. Commercialization of blockchain has started with large firms recognizing its potential for real-world solutions. Blockchain technology has numerous potential cross-industry applications

that improve the supply chain, transportation, contracts, and payments (Andrei O. J. Kwok & Sharon G. M. Koh, 2019).

Blockchain technology can contribute to the circular economy by helping to reduce transaction costs, enhance performance and communication along the supply chain, ensure human rights protection, enhance healthcare patient confidentiality and welfare, and reduce carbon footprint. The challenges of adopting blockchain in a circular economy, is in terms of trust, illegal activities, potential for hacking and the need to address these through suitable legislation and policy development. However, the study observes that the benefits are likely to exceed the challenges (Kumar, Vikas and Kazancoglu, Yigit (2021).

Banks are currently focusing on blockchain technology to promote economic growth and accelerate the development of green technologies. Blockchain technology could bring good support to the financial system by addressing the current financial sector issues. (Luisanna Cocco , Andrea Pinna , and Michele Marchesi, 2017)

Blockchain is a concept that has received significant attention in financial technology (FinTech). Blockchain combines several computer technologies, including distributed data storage, point-to-point transmission, consensus mechanisms, and encryption algorithms. Blockchain is a major breakthrough in data storage and information transmission, it might fundamentally transform the existing operating models of finance and economy, which might lead to a new round of technological innovations and industrial transformation within the FinTech industry. Blockchains could revolutionize the underlying technology of the payment clearing and credit information systems in banks, thus upgrading and transforming them. Blockchain applications also promote the formation of “multi-centre, weakly intermediated” scenarios, which will enhance the efficiency of the banking industry. It is worth noting that the problems of regulation, efficiency, and security have always sparked extensive debate in the process of each new financial innovation. However, history is not stopped by current obstacles, as the technical, regulatory, and other problems of blockchain technology will ultimately be resolved. Hence, the prospect of integrating blockchain technology into the banking industry will most likely occur in the near future (Ye Guo and Chen Liang, 2016).

Blockchain offers a secure and tamper-proof tool for the storage of data and transaction of value; thus, it solves the trust problem at the mechanism level. The establishment of a trust mechanism could also promote economic growth. The establishment of a trust mechanism can

speed up value flow and thus speed up the growth of GDP. Blockchain can be applied to a certain application scenario provided the scenario has one of the following six properties: it needs multiparty interaction; it needs creditability; it needs disintermediation; it needs atomicity; it needs privacy; or its production relations need essential adjustment.

There are diverse eligible scenarios, including waste management, supply chain management, government management, culture and entertainment, and intelligent manufacture, as well as public welfare. The application field of blockchain is far beyond the financial sector. We use cryptographic technologies to guarantee the security of communication, and there are three major cryptographic technologies used in blockchain: encryption algorithm, digital signature technology and the hash function. Encryption algorithm can ensure the confidentiality of information and guarantee that a message cannot be seen by others. Digital signature technology can ensure authenticity, data integrity and non-repudiation. The hash function can guarantee that the data recorded on the blockchain cannot be tampered without detection. Moreover, the tamper-resistant property of the digital signature is also achieved with the help of the hash function. Tamper-resistance is a basic property of blockchain, so the hash function plays a central role in blockchain technology (Weijie Zhao,2018).

India has a unique strategy for the Government to take the lead in creating public digital infrastructure and allowing private sector innovation to leverage it for further development. Over the past decade, India has successfully created foundational digital infrastructure envisaged to enable private sector applications running on top of it – just as government builds the roads and sewage infrastructure in a city and private enterprise constructs buildings. We have created a uniquely Indian model of digital foundational infrastructure such as Aadhaar, UPI, e-Sign and Digilocker along with digitally enabled tax governance networks like GSTN or digitally enabled health coverage such as Pradhan Mantri Jan Arogya Yojana (PM-JAY). Blockchain presents the potential for achieving the vision of Hon'ble Prime Minister of less government and more governance (NITI AAYOG,2020).

## **Methods and Data**

### **Methodology**

This study uses a narrative literature review with the goals of summarizing the existing body of literature, identifying essential research gaps. Since the Blockchain technology is in a

nascent stage, only a small number of papers have been published in top-tier academic journals so far, which ruled out a systematic literature review. The study looks into a matching of benefits of blockchain technology with the indicators of ease of doing business, ease of governance and ease of living. The benefits of Blockchain technology are taken from review of literature.

### **1. Ease of doing business index**

A nation's ranking on the ease of doing business index was based on an average of 10 subindices:

- Starting a business – Procedures, time, cost, and minimum capital to open a new business
- Dealing with construction permits – Procedures, time, and cost to build a warehouse
- Getting electricity – procedures, time, and cost required for a business to obtain a permanent electricity connection for a newly constructed warehouse
- Registering property – Procedures, time, and cost to register commercial real estate
- Getting credit – Strength of legal rights index, depth of credit information index
- Protecting investors – Indices on the extent of disclosure, the extent of director liability, and ease of shareholder suits
- Paying taxes – Number of taxes paid, hours per year spent preparing tax returns, and total tax payable as a share of gross profit
- Trading across borders – Number of documents, cost, and time necessary to export and import
- Enforcing contracts – Procedures, time, and cost to enforce a debt contract
- Resolving insolvency – The time, cost, and recovery rate (%) under a bankruptcy proceeding.

To promote entrepreneurial development and involve premier research institutions, Blockchain technology stack may be collaboratively evolved by involving various stakeholders from Government, premier research institutes, startups and industry. To facilitate and evolve a mechanism for innovation, healthy competition and a platform

for industry, startups and academia to contribute for the National Blockchain Framework (NBF), the industry, startups and academia may be supported and incentivized to undertake application-oriented research and technological grand challenges in the domain of Blockchain Technology. To encourage Public Private Partnership (PPP), relevant joint initiatives may be explored wherever necessary in specific technology areas / applications. Mechanisms may be identified to incorporate feedback and involve industry and other stakeholders. To provide benefits or incentives for stakeholders, efforts should be made to utilize existing schemes of the Government, such as Make in India, for promoting Blockchain.

2. **e-Governance** is to ease government functioning in order to create Simple, Accountable, Responsive and Transparent governance. In the e-governance domain, usage of Blockchain technology ensures vigilance, transparency and possibly avoids insider attacks on the crucial data related to governance matters. The key features of e-governance are trust and accountability which are very well supported by the Blockchain technology. Since every data or transaction that is recorded in Blockchain is near impossible to tamper with and also due to consensus-based transaction data replication across Blockchain distributed nodes, this technology assures trust among its stakeholders in the digital world.

**The goals of e-Governance are:**

- a. Better service delivery to citizens
- b. Ushering in transparency and accountability
- c. Empowering people through information
- d. Improved efficiency within Governments
- e. Improve interface between business and industry

E governance parameters - Accessibility, Content Availability, Ease of Use, Information Security & Privacy, End-service Delivery, Integrated Service Delivery and Status & Request Tracking.

This kind of technology can bring significant changes in e-governance where several services have societal impact. For example, in educational system, student's certificates, scholarship details etc., can be stored in a Blockchain network. Various stakeholders such as educational institutions, different departments entrusted with

disbursement of scholarships and respective administrative boards can become partners and have student's records stored on consensus basis. Likewise, in supply chain domain, the track and trace capability of Blockchain network makes it possible to avoid any inadvertent mistakes or insider attack with regard to data maintenance across various stakeholders.

Thus, this technology can effectively be used in situations where multiple organizations or departments are involved in a particular workflow which not only makes the underlying system more efficient but also brings trust and transparency in the system. Blockchain can enable the officials to verify the proof of existence of documents by comparing the attributes of the provided copy of the document against the details of the original version stored in Blockchain. Storing the digital artefacts related to documents in a Blockchain makes it secure and immune to tampering.

National Blockchain Framework would be used for development and large-scale hosting of Blockchain applications in different areas such as agriculture supply chain, electronic health records, education certificate chain, drug supply chain, etc. This infrastructure will be used for providing Blockchain-as-a-Service.

The list of potential application of blockchain technology in e governance:

1. Transfer of land records / property
2. Digital certificates management
3. Pharmaceutical supply chain
4. e-Notary service
5. Blockchain enabled e-Sign solution
6. Farm insurance
7. Identity management
8. Duty payments
9. Automated customs enforcement and compliance
10. Agriculture / farm produce supply chains
11. E-Voting



12. Smart Grid applications include energy transmission, distribution, trading and marketing of energy
13. Authorized access to relaying in the substation protection system
14. Government crypto wallet platform for selling, buying and trading
15. Multiple layer and multiple level access Blockchain based cloud storage of health test records
16. Validation of Bill of Lading in cross-border transport
17. Ease of validation of documents at the customs at the ports of entry and exit
18. Electronic health record management
19. Digital evidence management system
20. Public service delivery
21. Blockchain for social good use cases (charity, donations)
22. Metering and settlement
23. Payment security mechanism
24. Authentication and authorization services
25. Automated control of decentralized power
26. Smart grid application and grid management
27. Microfinance for Self-Help Groups (SHG)
28. Customs and trade finance
29. Cross border trade
30. Renewable energy trading and management
31. Insurance underwriting and claims management
32. Aggrotech environment
33. Micro-financing, financing small businesses or individuals
34. Secured logistics document exchange (SLDE)
35. Cold chain for supply chain
36. National and state highways, toll collection, tracking of public infrastructure
37. Blockchain for urban development tracking through Public Private Partnership
38. Tracking the progress on climate agreement through Blockchain
39. Asset transfer across different government departments
40. Digital identities, verifiable credentials to secure privacy and enable new use cases
41. Safe and secure vaccine distribution and administration



42. IoT device management and security
43. Vehicle lifecycle management
44. Chit fund operation and administration.

Integration of the National Blockchain Framework with online Electronic Signatures (e-Sign), e Pramaan and Digilocker would be an added advantage.

3. Ease of Living is a framework to assess improved wellbeing of citizens, since the end goal of development is to improve liveability. The Index examines liveability of 114 Indian cities across a set of 3 pillars, which include a total of 14 categories and 50 indicators on the subjects of Quality of Life, Economic Ability and Sustainability. The evolution of Information and Communications Technology (ICT) has brought a whole new paradigm for governance by which we are heading towards ease of living through e-Governance.

Regarding, Warranty Receipts the blockchain solution uses a facebook messenger chatbot to store warranty receipts on the blockchain. It helps reduce disputes between retailers and customers for lost receipts and unreadable receipts and track history of ownership.

Digital Supply chain of blockchain-based tracking of asset through the entire supply chain, Immutable view of all events through the assets lifecycle, Smart contract-based lease execution and termination resulting in reduction in legal costs and enhanced financial management of a lease due to better transparency in the network are useful in retail business.

In healthcare, Patient Record Management is done through blockchain based record management system to enable companies, simplify claim processing, secure medical records, monitor the pharma supply chain and collaborate with network stakeholders.

In telecommunication, roaming Fraud Smart contract-based solution aimed at automatic triggering of roaming contract based on call/event data, near-instantaneous charging and reduction in roaming fraud, cost savings from eliminating the third-party clearing house and cost savings from eliminating the third-party clearing house.

## Conclusion

The Reserve Bank of India (RBI) has been closely monitoring developments related to Blockchain technology. It observes that the advantages of Blockchain technology, such as cost savings, efficiency, and transparency will boost the economic development. The unique infrastructure base of Indian economy such as Aadhaar, PAN, Digilocker, Jan-dhan account will be conducive for the adoption of blockchain technology in all realm. The application of blockchain technology will improve e governance, which in turn improve ease of doing business and ease of living. Improvement in these fields will accelerate economic growth and prosperity, however caution should be there to check issues of scalability, security, interoperability, data localization and disposal of records.

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