BLOCKCHAIN ADOPTION: GLOBAL AND INDIAN SCENARIO

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Abstract : The objective of this article is to assist readers and academics understand blockchain adoption in the global scenario and India, together with the opportunities and challenges present for adoption of this nascent technology. Blockchain, one of the most significant breakthroughs of the contemporary world, is poised to help us achieve new heights of development in nearly every industry in the world of globalization, where automation and technology have altered our lifestyles and the way businesses conduct business. However, Blockchain, like all other technology, presents several problems that must be overcome before widespread adoption happens internationally. Mitigating these challenges and removing barriers to Blockchain adoption will have a favorable impact on the economy. The aim of the research is to explore the opportunities and challenges India may encounter when it comes to implementing blockchain technology.

Introduction

Blockchain is a relatively new technology that is based on decentralization, encryption, and distribution. It has recently attracted a lot of attention from researchers in a range of domains. Several important studies on blockchain adoption have been published in a variety of international publications. This literature review depicts extant blockchain adoption studies that employ individual adoption models or ideas. This collection of papers and articles shows how to implement blockchain technology in a variety of ways. The application of blockchain technology by numerous industries and businesses has been investigated. The findings, in terms of theory, serve as a road map for other academics to better structure their study and, as a consequence, contribute to a better understanding of the relevant blockchain adoption difficulties that need to be researched further.

Blockchain technology was originally used in financial applications such as decentralized digital money (Bitcoin). Blockchain usage is growing in a variety of sectors as technology progresses. Due to its exciting benefits, such as decentralization, trust, and no exchange transaction fee, blockchain is also changing several commercial applications. Blockchain is characterized by decentralization, immutability, and transparency. Thus, companies in a variety of industries are experimenting with novel techniques to:

- accelerate transactions for improved customer service,
- assure operational cost-effectiveness,
- maintain consumer and regulatory transparency.

Many non-financial service businesses, for example, such as healthcare telecommunications, and travel, energy, life sciences, and hospitality are closely monitoring the potential for Blockchain to disrupt their existing business models. Furthermore, due to record digitalization, enormous volumes of data are created every day, it is vital for all businesses to effectively manage security concerns and save money. Blockchain is drawing the attention of C-suite executives due to its promises of decentralized ownership, immutability, and cryptographic data protection. As everyone understands the disruptive potential of this technology, several application cases are being investigated across sectors.

The major purpose of the current research is to investigate and comprehend the many difficulties and possibilities associated with the adoption of Blockchain Technology in India. This current article is divided into three major portions. First, the broad concept of blockchain is introduced along with a global overview of the major sectors adopting blockchain. Second portion talks about Indian scenario for blockchain adoption with the challenges and opportunities and finally third portion presents the market projection and emerging industries for blockchain adoption.

How Blockchain Technology Works

Blockchain is a data storage approach that makes changing, hacking, or manipulating data difficult or impossible. A digital transaction log that is replicated and disseminated over the whole Blockchain network of computers. Each block on the chain contains many transactions, and each time the Blockchain is visited, a new transaction is recorded in each participant's ledger. DLT (Distributed Ledger Technology) is a distributed database managed by a large number of users (DLT). Blockchain is a distributed ledger system that uses hashes, which are irreversible cryptographic signatures, to record transactions.

To overcome classic distributed database synchronization concerns, blockchain applications use encryption, mathematics, algorithms, economic models, peer-to-peer networks, and distributed consensus methods. In domains such as peer-to-peer energy trading, peer-to-peer ridesharing, peer-to-peer insurance, and others, blockchain might be used to sign a digital contract. Banks, for example, have realized that they may develop a permission-based blockchain that can conduct safe transactions using Blockchain as a distributed ledger technology. This permission-based blockchain validation is carried either by consortium members or different companies within the same company. Following are some important terms related to Blockchain-

1. Address:
These are typically used to receive and send network transactions. The address for an associatedegree may be a string of alphanumeric characters, but it can also be restricted as a scannable QR code.

2. Ledgers of Agreement
These are the area unit distributed ledgers used to barter and strike an agreement between two or more people.

3. Altcoin
This is an abbreviation for "alternative to Bitcoin." Most altcoins are Bitcoin forks with minor changes to the Bitcoin blockchain's proof of work (POW) mathematical process. Litecoin is the most well-known altcoin.

4. Node
A node is the basic unit of a data structure such as a linked list or a tree. Nodes are data storage devices that may also link to other nodes. Pointers are commonly used to link nodes together.

5. Bitcoin
This might be a verified cryptocurrency that runs on a proof-of-work blockchain.

6. Block Cyphers
These are the area units of a technique of encrypting text (to generate ciphertext) that applies a cryptanalytic key and algorithmic rule to a block of data as a whole rather than one bit at a time.

7. Height of the Block
This refers to the number of blocks in the Blockchain that are linked together. For example, Height 0 is the first block, also known as the Genesis Block.

8. Block Rewards
This reward is provided to a mineworker who has successfully hashed a dealt block. Block rewards will be a mix of coins and transaction fees, depending on the cryptocurrency's policies where all of the coins have already been successfully strip-mined. The Bitcoin network's current block reward is twenty-five bitcoins per block.

9. Cypher
This algorithmic rule is used for secret data writing and decoding. In everyday English, the term 'cypher' is sometimes used to refer to a personal writing communication, also referred to as a 'code.' 18. Encryption

10. Cryptocurrency
This sort of digital currency relied on arithmetic, in which secret writing techniques are used to control and create currency units and verify the movement of monies. Furthermore, cryptocurrencies function independently of a financial institution.

11. IoT (Internet of things)
The Internet of Things (IoT) is a system of connected objects—"things"—embedded with sensors, software, and other technologies that use the internet to communicate and exchange data with other devices and systems.

Types of Blockchain

Blockchain technology is divided into three categories, Public, Permissioned, and Private Blockchains. Anyone with proof of work can read or write on a public Blockchain. A permissioned Blockchain provides selective transparency by allowing only specific nodes to see and confirm transactions. The third form of Blockchain is a private Blockchain, which establishes a closed-loop environment by allowing only selected players to join the network.
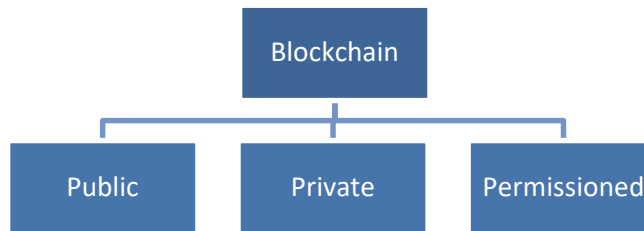

Figure 1. Types of Blockchains

Emerging Sectors in Blockchain Technology Adoption

According to a study published by Cambridge Judge Business School banking and finance sector was found to be having highest percentage of use cases of blockchain implementation globally followed by government sector and public goods. Apart from these two major sectors the other sectors reported by the study included insurance, media entertainment and gaming, healthcare, technological services, professional services, energy and utility, professional services along with some generic services (Table 1). Apart from the sectors noted by this study, there were other sectors such as supply chain and cyber security where blockchain implementation have been initiated. Some of these applications in different sectors are mentioned below-

Table 1: Global Blockchain use cases reported (Source: Garrick and Michel, 2017)

Sector	Percentage	Sector	Percentage
Banking and Finance	30%	Technological Services	6%
Government & Public Goods	13%	Generic	6%
Insurance	12%	Professional Services	4%
Media, Entertainment & Gaming	8%	Manufacturing	3%
Healthcare	8%	Energy & Utilities	3%
Others	7%		

Banking: By providing a low-fee peer-to-peer payment mechanism with high-security, blockchain disrupts the conventional banking system. There is no need to pay to a central authority due to complete absence of the later. This eliminates the need for a third party for cryptocurrency transaction, whether it's Bitcoin or another cryptocurrency. Every transaction is recorded in a ledger that any bitcoin user can see and study, giving complete control over it.

Supply Chain: In a supply chain, the blockchain greatly aids in tracking a product's journey from a raw material source to a customer. This will assist in the elimination of counterfeit products by allowing the origin of the items to be traced. In a normal supply chain, data mistakes are common, and they almost always happen at the inputting step. Data input mistakes are reduced since there are fewer people involved in a blockchain.

Cyber security: Blockchain protects our data against unauthorized access and modification. It's a distributed system that's perfect for high-security settings. A cryptographic approach checks and encrypts every data on a bitcoin or equivalent blockchain network, ensuring that a large-scale assault has no single point of entry. In peer-to-peer networks where data cannot be modified or updated, dangerous data breaches may be promptly identified with blockchain. Additionally, by eliminating the need for a central authority, Blockchain allows for a secure and transparent method of recording transactions without disclosing personal information to third parties.

Healthcare: In this context, blockchain technology obliterates the requirement for a central authority while also allowing for instant data accessibility. A hacker cannot modify the data since each block is related to the next and dispersed among the blockchain nodes. Information from personal medical files must always be kept private. The issue is that distinguishing between genuine and counterfeit drugs might be difficult at times. This challenge is solved by blockchain technology, which uses supply chain management protocols to track the origins of medications.

Government: Blockchain technology has the potential to eradicate voting fraud. Consequently, blockchain technology is the best option. People can vote anonymously online without revealing any personal information. Because each ID can only be connected to one

vote, officials can count ballots properly using Blockchain. Due of blockchain technology's near-impossibility of fraud. Once a vote has been entered in a ledger, it cannot be changed or removed.

Insurance: The decentralized architecture of blockchain technology allows insurers to detect false claims and avoid forgeries.

Transportation: In the transportation industry, blockchain technology enables for traceability and simple tracking of cargo shipments.

Cloud Storage: Storj is a decentralized cloud storage service built on the blockchain. It stores data in the cloud via Blockchain, obviating the requirement for servers. Users may make money by sharing storage on Storj, which has a fast speed and inexpensive cost.

Purchasing Real Estate: In real estate, the adoption of blockchain technology speeds up the transaction process and eliminates the need for currency exchange.

Usage of Blockchain in the Financial Service Sector

1. **Capital market**
   Trade settlement - By eliminating intermediaries, securities and payments may be transferred faster, and trading costs can be decreased.
   Commercial paper issuance and trading - Issuance and distribution of commercial paper to investors based on smart contracts, as well as delivery and payment settlement
2. **Banking Industry**
   Trade Finance - Streamline and shorten the trade financing procedure with the least amount of middleman interaction possible.
   Regulatory reporting and compliance - To prevent mistakes associated with manual auditing, decrease reporting expenses, and maybe assist future operations, save financial data.
3. **Insurance Industry**
   Underwriting - Verify identities, check application completeness, assess risk, and complete quotation and binding.
   Claim processing - The administration of flood claims has been made easier thanks to smart contracts.
4. **Public sector**
   Digital Identity - Using Blockchain-based digital identity management, near-real-time contract management for onboarding partners/customers is possible.
   Customer Onboarding - Enhance client onboarding by utilizing digital IDs via Blockchain.

Usage Of Blockchain Technology in The Non-Financial Sector

Following table presents the usages of blockchain under various application areas of different sectors apart from financial services-

Table 2: Sector-wise applications and usages of Blockchain for non-financial services industries

SECTOR	APPLICATION AREA	USAGES
RETAIL & CPG-	Receipts for Warranties:	Warranty receipts are stored on the Blockchain via a Facebook Messenger chatbot. It helps to: • Reduce conflicts between shops and customers over missing or illegible receipts • Track ownership history
OIL & GAS	Digital supply chain	Oil(asset) is tracked based on Blockchain in the entire supply chain. • A complete record of all occurrences throughout the asset's lifecycle. • Lease execution and termination based on smart contracts, resulting in lower legal expenses • Improved financial management of a lease owing to improved network transparency.
HEALTHCARE AND LIFE SCIENCES	Patients' data management	Record management based on Blockchain enables companies • Simplify claim processing • Simplify claim processing • Protect medical information • Keep track of the pharmaceutical supply chain • Work with network stakeholders
TELECOMM	Fraudulent Roaming	Smart contract-based solution targeted at:

		• Automatic initiation of roaming contracts based on call/event data • near-instantaneous pricing and decrease in roaming fraud • Eliminating the need for third-party clearinghouse results in cost savings.
PUBLIC SECTOR	Land Registry	A blockchain-based land registration system is being investigated to see how it might decrease the possibility of manual mistakes while also establishing more secure mechanisms for transferring document ownership.

Blockchain Adoption in India

Many firms, including many new startups, are attempting to embrace the technology by implementing it into their daily operations. Blockchain technology have piqued the interest of India's banking, financial services, and insurance businesses. The government has aggressively implemented this technology for a number of applications, including land title registration, vehicle lifecycle management, agriculture insurance, and electronic health record management. In addition, India is the second-largest cryptocurrency user in the world.

One of the factors that stimulates the usage of blockchain in India is digitization. India has successfully established foundational digital infrastructure that allows private sector applications such as Aadhaar, UPI, e-Sign, and Digi locker to run on top of it, as well as digital tax governance networks such as GSTN and health coverage digital platforms such as the Pradhan Mantri Jan Arogya Yojana (PM-JAY). These provide a solid framework for assessing the technology's potential in many industries.

Strength & Weaknesses of Blockchain Technology in the Indian Market

Strength

- With India's telecoms administration deploying Blockchain, the country's phone spam problem is solved. This reduces telemarketing spam by allowing only registered users to engage and the appropriate agencies to monitor and find them.
- Major organizations currently present in Kerala, such as Ernst & Young and DLT ledger, may expand in the future, and numerous job opportunities connected to Blockchain and IT may be on their way to India.
- They are developing their Blockchain, similar to how multinational corporations invest. Tech Mahindra, a two-year-old Indian company, collaborates with a blockchain technology incubator in the Netherlands to develop QUANTOZ, which will deliver BaaS.
- Multinational corporations have expressed interest in Indian blockchain companies.
- Binance paid 10-15 million for Wazir X, a Mumbai-based crypto trading network.

Weakness

- External parties can corrupt or distort encrypted data.
- The image of blockchain legislation and its implementation remains hazy. The Indian government has failed to enact legislation governing blockchain technology.
- Many supply chain providers are hesitant to embrace blockchain technology due to a lack of trust and knowledge.
- If blockchain data validation is required (Proof-of-stake systems are needed)

Blockchain Adoption Challenges

While blockchain use and activities are now limited to a few tech-savvy groups, the following are the most significant barriers to wider adoption and implementation:

- Blockchain is largely unknown, and the unregulated cryptocurrency industry has tarnished its reputation. Businesses interested in Blockchain could potentially build up an internal team to learn about its implications and potential applications.
- Blockchain is thought to be a full technology that would eventually replace existing ones. This misunderstanding has also hampered its implementation. People must realize that Blockchain is a technological component that will be integrated into the existing system to enable new business applications and methods. To showcase Blockchain in a realistic setting, a professional services firm has shown a small model of blockchain infrastructure.
- Financial services based on the Blockchain are being developed. Many Indian banks have begun to integrate blockchain technology into their banking systems. Another problem is the lack of legislation and a designated regulatory agency to standardize and approve mainstream implementation.
- Another complication is the early-stage development's integration of current technologies with Blockchain and data security.

- To make the situation worse, India has banned cryptocurrency. Rather than using standard funding methods, Indian blockchain firms use an ICO (initial coin offering) to raise capital. The restriction on cryptocurrencies has hurt them, and now startups are looking for money outside India.
- As the Blockchain grows in popularity, the blocks it contains grow in size, requiring more time to execute each transaction. The blockchain scalability issue stems from the size and frequency of records (or blocks) on the Blockchain being restricted.
- Because blockchain transactions are published on a public database and can be viewed by anyone, it creates an environment where privacy issues arise.
- Endpoint vulnerabilities, vendor risks, untested at full scales, untested code, etc.) can have a negative impact on the implementation of Blockchain in the public sector.
- Inadequate skills among executives and employees to manage blockchain technology would impact how Blockchain is projected to be adopted and used in the public sector.
- The initial expense of installing, maintaining, and securing Blockchain has a negative impact on its adoption and use in the public sector.
- Legal issues (smart contracts, data protection rules, litigation, and dispute resolution) can stymie blockchain adoption and use in the public sector.

Opportunities for Blockchain Adoption in India

- India has established a progressive attitude toward digitization after demonetization and is aware of the benefits. Blockchain provides its potential in good governance.
- Many proofs-of-concept (POC) in banking, land registry and insurance have been presented as part of the Indian government's blockchain projects.
- The Reserve Bank of India's (RBI) Institute for Development and Research in Banking Technology (IDRBT) led two proofs-of-concept – domestic trade financing letter of credit and enhanced information for payments – including banks and technology businesses like Infosys and IBM.
- Andhra Pradesh is the country's first state to use Blockchain in land records, and it is also establishing India's first Blockchain Centre of Excellence. States like Maharashtra, Karnataka, Kerala is also looking for upcoming projects.

The Market projection for Blockchain Industry

With the passage of time, the Blockchain industry has reached new milestones. Blockchain is a way for documenting financial transactions over a vast secure network using virtual methods in the finance business. Blockchain technology is one of the most well-known financial technologies,

Table 3: List of Top Companies Using Blockchain in India

Company	Description
Hyperlink InfoSystem	Hyperlink InfoSystem is a prominent web and mobile application development firm. The firm provides the most effective blockchain-based solutions to a variety of sectors. They create blockchain tools to assist businesses to tackle real-world challenges. The company's blockchain solutions are reliable, safe, and transparent.
Infosys	Infosys Limited is a global organization headquartered in India that specializes in business consulting, information technology, and outsourcing. After TCS, Infosys is India's second-largest IT company. The company has 123 development offices, 82 sales and marketing offices and across the world.
Tata Consultancy Services	TCS is one of India's most well-known IT firms and one of the world's most valuable IT services brands. Mobile apps, Enterprise apps, Internet of Things, Blockchain, Cloud Solutions, Automation, and AI, are just a few of the services offered by the company. It began operations in 1968 and today has 149 facilities in 46 countries.
Accenture	Accenture is among Fortune Global 500 company that specializes in consulting, app development, Oracle, Blockchain, Cloud, Software Engineering, Supply Chain and Operations, Salesforce, SAP, and so on. The firm employs over 492K people who serve customers in over 200 locations throughout 120 countries.

Capgemini India Pvt ltd	Having over 270K employees in over 50 countries, Capgemini is one of the major MNCs in consulting, technology, professional, and outsourced services. Cloud Services, AI Solutions, SAP Solutions, Blockchain Solutions, App Development Services, and practically all sectors are among their specialties.
Tech Mahindra	Tech Mahindra is a Mahindra Group company that provides Information Technology (IT) services to practically every industry. This corporation employs 125,000 people in 90 countries and has over 900 active clients worldwide. Web and app development, Cloud solutions, Enterprise business solutions, Digital Supply Chain, Data Science, and other services are available.

with the promise to reduce fraud, provide speedy and secure transactions and exchanges, and eventually aid risk management inside the global financial system's linked network. This is accomplished by the use of sophisticated encryption that is claimed to be resistant to hacking, hence increasing the credibility of the transaction environment.

In the financial industry, cryptocurrency is currently one of the most popular blockchain applications. Blockchain allows data consumers to securely transfer information without the necessity of intermediaries, and it also provides several benefits for enterprises. Financial organizations may save up to $12 billion each year by embracing Blockchain, according to one estimate.

The dynamic nature of the industries, as well as the growing usage of blockchain technology, notably in the banking industry, indicate that qualified individuals will be in high demand. Working professionals in the blockchain industry have a variety of possibilities for furthering their careers. For the trainees out there, enrolling in a fintech and finance blockchain course would be a sensible choice.

Emerging Industries in Blockchain

Loyalty Reward Programs with Blockchain: In the next years, businesses are planning to employ Blockchain technology to reward customers with tokens instead of gift cards. Companies may utilize this technology to cut down on card waste and fraud while also eliminating the need for third-party financial transaction management.

Blockchain in the Music Industry: Artists are exploring the use of blockchain technology to help them manage and expedite content development and dissemination, licensing and distribution, digital use, payments, and royalties. One of the Blockchain-based projects that let musicians achieve more control over their assets and distribution. Last year, JAAK began a Blockchain pilot program to solve royalty payment difficulties. In the industry, there is some debate over whether this technology will function. Most of the experts believe that as more information about technology becomes available, music will benefit.

Blockchain in Weapons Tracking: The black-market trading of illicit weapons could be prohibited via blockchain technology. By producing a worldwide database that cannot be changed once recorded, blockchain technology could be used to track weapons from manufacturing to sale. The database may keep track of every transaction and purchase.

Conclusion

In this study, we discovered that there is a lot of potential for blockchain adoption in India, as well as many industries using blockchain. Corruption, intermediary tampering, data leaks, financial ledger manipulation, and other ills plaguing India's economy might all be resolved with blockchain technology. We have approximately 6 million engineers in India that can offer high throughput. In the global IT services industry, India holds a 55% market share. These findings suggest that all the components are working together to accelerate India's technological adoption.

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