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Block Chain Technologies in India: Opportunities & Challenges

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Abstract
The Blockchain is a disseminated database of all transactions or digital events that is maintained as Blocks. These operational records that are executed between parties are stored as blocks in Blockchain and dispersed among parties that continue the blocks. Every block is verified, analyzed, and deposited by the parties who are part of the network/system. Each block comprises the info of a one transaction and a hash key of the old block. Blockchain is the backbone of digital crypto currencies like Bitcoin. Blockchains are very secure by design, and the technology enables error-free record keeping. Bitcoin, a decentralized digital money, will be exchanged peer-to-peer without the participation of a third party. Other areas where Blockchain will be used include financial transactions, identity management, food traceability, medical records, and even voting processes. Electronic payments have made a significant breakthrough in the Indian banking industry, and they are expected to continue to develop as new innovations and improvements to the present system are introduced. We verbalize the merits and demerits of different state-of-the-art approaches. We also emphasized the challenges of the blockchain with the scope of interoperability and governance so that this gives clear thoughtful to researchers and professionals

Keywords: Blockchain architecture, Interoperability, Smart contract, Bitcoin, Internet of Things, Security.

I. INTRODUCTION

A blockchain is a virtual chain made up of information from multiple blocks (transactions) arranged in a chronological order. This chain keeps a decentralised, distributed, unchangeable, and secure record (or ledger) of all transactions that happen between various blockchain nodes. A consensus mechanism governs the process of adding a new block to the database/ledger. Where the various nodes on the network take part in determining whether or not to add a fresh block of transactions to the database. The blockchain's decentralised structure (due to the fact that it is governed by a community of nodes rather than a single central authority) makes it more safe for members because the network's properties cannot be modified by a single entity for its own gain.

Each node stores a copy of the database/ledger, which contains all of the previous entries' information. While this adds redundancy to the network, it also adds security by preventing record modification. Any effort to corrupt the network (by a hacker) can only succeed if the

data stored on the majority of the network's nodes is tampered with. It is almost hard to amend, alter, or delete a record after it has been added to a blockchain. As a result, the blockchain's data record of previous transactions is nearly permanent and unalterable. Instead of modifying or deleting the previous record, an entry may only be modified by adding a new block.

Cryptography (a mathematical procedure for encoding information for security purposes) and economic incentive mechanisms are used to add a block to the database, and they do not need trusting the other nodes in the network. This is an emergent characteristic of using a consensus process to maintain a distributed and decentralised database. The elimination of the requirement to trust the other nodes involved allows for more confident transactions and interactions. Every transaction's data are sent as a block to all computers in the network using blockchain technology. The network computers verify the block and add it to the chain. This chain serves as a trail for the transaction's history, which cannot be altered with. These transactions cannot be changed without the consent of all parties/computers involved in the chain's maintenance. The use of blockchain in financial applications will be extremely beneficial.

The use of blockchain in banking applications will give a significant tool for making bank transactions more efficient and transparent. Despite the fact that the technology appears to be difficult, with cryptography, distributed databases, and a network of devices, the user interface will be made simple for banking employees and end consumers to utilize. Aside from facilitating trade in the financial industry, Blockchain makes it almost hard for a hacker to alter transaction data stored in the cloud, and it also removes any mistakes or duplicates that may occur due to procedure gaps. Despite the existence of various crypto currencies such as Litecoin, Ethereum, Zcash, Dash, and others, Bitcoin is the most prominent and one of the greatest use cases for Blockchain technology.

II. REVIEW OF THE LITERATURE

Satoshi Nakamoto (2008) presented Bitcoin as a technological platform that allowed for a peer-to-peer electronic movement of funds between two parties without the use of a financial middleman. As a result, the idea of leveraging Blockchain for safe transactions was born.

Melanie Swan (2015) explains that the Blockchain platform can be used to create a decentralized database that will hold a public ledger of transactions involving tangible entities such as financial transfers, inventory logistics, and property registration details, as well as intangible entities such as health care and election processes.

According to Harsha Gandhi et al. (2019), the hash function utilized in Blockchain is tamper-proof due to public key encryption and provides greater security, mobility, and time savings.

III. THE STUDY'S OBJECTIVE

The main goal is to investigate the current state of Blockchain adoption in India, as well as the difficulties and possibilities that it presents. A survey is also included in the study to determine public approval of Blockchain.

IV. BLOCKCHAIN IN INDIA

As a trial project, ICICI Bank and Emirates NBD have launched a Blockchain network for international remittances and trade financing. The Mahindra Group and IBM, a worldwide IT solutions provider, have revealed plans to develop a cloud-based Blockchain-backed supply chain finance application that might revolutionise the country's supplier-to-manufacturer financing transaction system. Bajaj Electricals has declared that it would use Blockchain in smart contracting to finance vendors and suppliers. With the help of Yes Bank, IBM, and Cateina Technologies, a fintech start-up. A Blockchain pilot was recently launched by the Government of Andhra Pradesh's Land Records Department and Transport Department. The Telecom Regulatory Authority of India (TRAI) is utilizing Blockchain to keep annoying spam phone calls and texts under control, possibly the first time this technology has been used in the telecom sector. The UIDAI's Aadhar project is without a doubt the largest application of demographic and biometric technologies ever undertaken by a government organisation.

V. BLOCKCHAIN EVOLUTION AND DEVELOPMENT

The growth of blockchain and the internet have many similarities. The internet layer was not end-user-centric by itself, necessitating the development of web browsers, website hosting platforms and services, search engines, application development tools, and other tools to enable the provision of services such as social networks, ride-hailing apps, video platforms, and so on. A similar process exists with blockchains: developers first establish the foundational architecture of blockchain technology, which can then be used to build new apps and services.

Bitcoin and the fundamental tools that go with it were part of Blockchain version 1.0. The majority of the applications focused on Bitcoin's financial uses and assisted users in transacting with Bitcoin. This began to change with the release of Blockchain version 2.0, which saw the introduction of Ethereum, smart contracts, and other tools that developers required to create consumer-focused apps. It also saw the proto-app development as a proof-of-concept, highlighting the holes in the tools and indicating the additional work necessary to investigate potential applications. Permissioned blockchain solutions, such as Hyperledger, were also developed as part of Blockchain 2.0. This was followed by Blockchain version 3.0, which attempts to address scalability, identification, and the creation of developer tools. New methods are being investigated to improve the efficiency of the consensus mechanism (for example, Ethereum's choice to go from Proof-of-Work (POW) to Proof-of-Stake (POS) consensus mechanism).

VI. KEY RELEVANT BLOCKCHAIN TECHNOLOGY RELATED CONCEPTS

The procedure through which nodes agree to make modifications to the blockchain is referred to as blockchain governance. The procedure also outlines which stakeholders are engaged in the decision-making process and how they reach an agreement.

Forking

One of the benefits of blockchain is that it allows all transactions to be carried out in line with the governance rules established at the time of the blockchain's inception. Do blockchains, on the other hand, have the flexibility to adapt to changing conditions? Depending on the type of

blockchain and its governance rules, forking may be able to facilitate such changes. If a group of nodes wants to modify the governance rules, they can create a fork by splitting the rules from the original blockchain. All participants can move to the new fork if the modifications are accepted by all nodes. However, if only a small number of nodes agree to make the modification, they can split into two blockchains at the moment of forking. Until the time of forking, a forked blockchain usually has access to the ledger/data. "Hard forks" are forks that are incompatible with prior versions of the protocols and algorithms. Hard forks often alter consensus rules (such as block size, mining algorithm, and consensus mechanism) in such a way that earlier blockchain versions become incompatible. Soft forks, on the other hand, are backwards compatible with earlier blockchain versions.

Smart contracts

A smart contract is a programmable code that, after satisfying certain pre-defined criteria and circumstances, is performed on a blockchain, therefore self-enforcing an agreement between two or more parties. They work on the "if and then" logic, which means that if the participants to a transaction meet the pre-determined requirements, the transaction is verified by a smart contract; otherwise, it is denied. It's a computer protocol for digitally facilitating, verifying, and enforcing agreement execution. Platforms like as Ethereum allow you to put up a programming logic for processing transactions between nodes. Smart contracts are becoming increasingly essential in the world of technology and commerce, thanks to the introduction of 5G, the Internet of Things (IoT), and Artificial Intelligence (AI). The majority of stock market trading nowadays is algorithmic, with AI playing a vital role in selecting whether to purchase or sell assets.

Crypto-tokens and initial coin offerings (ICOs)

Crypto-tokens serve as a means of exchange for blockchain transactions. They're similar to loyalty points, air miles, or credit card points, which are utilized by a small number of people. They do not have the same widespread acceptance as fiat currencies. They are made using common templates, such as those used by the Ethereum network, which allow applications to build their own crypto-tokens. Smart contracts, also known as decentralised apps (DApps), are programmable, self-executing programmes that are used to execute and manage the different transactions that take place on the blockchain. The development and selling of crypto-tokens is referred to as an ICO. An initial coin offering (ICO) is when a blockchain programme produces a certain quantity of crypto-tokens and sells them to the general public. For one or both of the following reasons, the public may be interested in the crypto-tokens on offer:

Crypto-tokens have the advantage of allowing the holder access to a service, a vote in the result, or a piece of the project's revenues.

Depending on demand and supply, crypto-tokens may grow in value. Initial purchasers sell their shares and new buyers can join at any moment on crypto exchanges, where crypto-tokens are commonly published. Crypto-token sales, a sort of digital crowd funding, allow start-ups to not only acquire capital but also to bootstrap their project's adoption by motivating crypto-token holders to utilise it.

Decentralised autonomous organisation (DAO)

"Why do businesses exist?" has long been an issue in economic theory. and why the same goals cannot be achieved by individual contracts. The reason for the establishment of a business is because managing contracts between individuals for the purpose of performing work effectively is highly complex, and the economic cost of managing these contracts may be significant.

VII. OPPORTUNITIES

India has established a progressive attitude toward digitization in the aftermath of demonetization, and is aware of the benefits blockchain provides, as well as its potential in good governance.

1. The Indian government's blockchain activities are evident in the numerous proofs-of-concept (PoC) that have been proven in the domains of banking, land registry, and insurance.

2. The Reserve Bank of India's (RBI) Institute for Development and Research in Banking Technology (IDRBT) led two proof-of-concepts – domestic trade financing letter of credit and improved information for payments – including banks and technology businesses like Infosys and IBM.

3. Andhra Pradesh is the country's first state to use blockchain in land records, and it's also establishing a Blockchain Center of Excellence to become India's first Blockchain state. Maharashtra, Karnataka, Kerala, and Rajasthan are among the states that have followed suit.

Many other Indian companies have also been early adopters, testing concepts in trade finance, cross-border payments, supply chain management, digital identification, and loyalty programmes. They had to overcome a number of obstacles before they could use the PoC test.

VIII. CHALLENGES

1. The absence of adoption

Blockchains are ecosystems that rely on widespread adoption to function properly. For example, track-and-trace capabilities in supply chains would necessitate not just an organization's adoption of a blockchain network, but also those of its suppliers. Despite this, according to APQC, just 29% of firms are experimenting with blockchain or have fully implemented it. The efficacy and scalability of blockchains will be restricted until they are widely used.

However, there are reasons to be positive about blockchain adoption. Organizations are increasingly organizing collaborative blockchain working groups to solve common pain points and build solutions that benefit everyone without disclosing private data.

For example, prior to the COVID-19 pandemic, the Blockchain for Clinical Supply Chain Industry Working Group was formed by many significant pharmaceutical companies and Deloitte. The organisation created Kit Chain in collaboration with blockchain developer Ledger Domain. The tool, among other things, allows organisations to track packaged drug

shipments, which helps safeguard the supply chain while also reducing reliance on paper records and ensuring the confidentiality of medical trial data.

2. Skills gap

Blockchain is still a relatively new technology, and the skills required to build and use it are few. Figure 2 demonstrates that this skills gap is a top problem for 49 percent of research participants. For quite some time, the market for blockchain expertise has been very competitive. According to the Blockchain Council, demand for blockchain engineers increased by more than 500 percent in 2019 compared to the previous year, with basic salary for blockchain developers rising in tandem. The cost and complexity of acquiring talent in this area further adds to enterprises' worries about using blockchain and integrating it with older systems.

One approach to bridge the skills gap is to employ blockchain as a service (BaaS), which allows businesses to benefit from the technology without having to spend heavily in the technical capabilities required.

In the context of other technologies, such as robotic process automation, we've previously seen this strategy close the skills gap (RPA). Rather than developing bots and writing code in-house, businesses may now turn to a variety of providers with the experience to adopt RPA and modify it to their specific needs. Users simply need a rudimentary understanding of the technology and are not need to be programmers to benefit from it. Users will also need to know how to execute smart contracts (which utilise blockchain to automatically carry out particular activities whenever the contract's requirements are satisfied), but they will not require technical understanding of distributed ledgers. The Blockchain as a Service (BaaS) model has the potential to reduce the blockchain skills gap.

3. User confidence

The third main barrier to widespread adoption is a lack of trust among blockchain users. This problem has two sides: organisations may not trust the technology's security, and they may not trust other participants in a blockchain network.

The blockchain considers every transaction to be safe, private, and verifiable. This is true even though, because the network is decentralised, there is no central authority to confirm and verify the transactions. The consensus algorithms that generate universal agreement on the current state of the distributed ledger for the whole network are a critical component of any blockchain network. It assures that each new block contributed is the only version of the truth that all nodes in the blockchain agree on. Business executives have discovered that private blockchains, which have no known users, have a higher level of confidence.

Platforms like TradeLens (a global logistics network established by Maersk and IBM utilizing the IBM Blockchain Platform) highlight what may happen when peers and rivals collaborate to discover answers to shared difficulties, which helps to increase customer trust. Members of the TradeLens private blockchain are referred to as "Trust Anchors" and are known to the network based on cryptographic identities, unlike anonymous public blockchains. To provide immutability, privacy, and traceability of shipping papers,

TradeLens employs a permissioned blockchain.

4. Financial resources

According to participants in APQC's research, the fourth hurdle to mainstream blockchain implementation is a lack of financial resources. Blockchain implementation is not cheap, and many businesses' resources are already stretched due to the epidemic and disruption of 2020. Another takeaway from the pandemic is that firms, particularly IT departments, may shift far more quickly than previously imagined.

A closer look at this roadblock reveals that it stems from a lack of organisational knowledge and comprehension of blockchain. We've seen that as public knowledge of new technologies grows, so does the capacity to effectively make a business case for their adoption. This will be true with blockchain as well, assuming that proponents focus on developing a business case that shows how the technology's advantages will outweigh the costs of deployment.

5. Interoperability of blockchains

As more businesses use blockchain, many of them will design their own systems, each with its own set of features (governance rules, blockchain technology versions, consensus models, etc.). These disparate blockchains do not interact with one another, and there is presently no global standard that allows them to do so.

The capacity to exchange, see, and access information across multiple blockchain networks without the use of a middleman or central authority is referred to as blockchain interoperability. Because of the absence of compatibility, broad adoption may be nearly impossible.

Interoperability for blockchain will be vital in a post-pandemic corporate world where collaboration across functions, with suppliers, and with consumers is essential. It's the only way to ensure that businesses get the most out of their blockchain investments. The good news is that we've witnessed an increase in the number of interoperability initiatives aimed at bridging the gap between different blockchains over the past year. Many of them are targeted at bridging the gap between private networks and public blockchains. Prior approaches that concentrated on public blockchains and cryptocurrency-related tools were less valuable to corporate executives in the end.

SCOPE FOR FURTHER RESEARCH

The breadth of Blockchain's acceptability in a collection of relevant domains has been identified in this study. Future researchers will be able to spot possibilities to raise Blockchain awareness and adoption. The study was limited to a single geographic location; however, future research should focus on different geographic areas in order to better understand the behaviour patterns of diverse populations.

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