

Future Prospects on Use of Blockchain Technology in Public Services: With Special Reference to India

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ABSTRACT

Blockchain is an emerging technology in the era of the 4th Industrial Revolution and has the potential to revolutionise the framework of social, political, economic, and administrative governance. Blockchain technology started its career in the financial sector and gradually expanded its progress in public services. The article analyses the potential use of blockchain technology in various sectors such as voting, land management, identity credentials, issuing licenses, data management, maintaining personal records, supply chain management, asset tracking, financial services, etc. The study highlights how blockchain technology will help the government to ensure transparent, accountable, responsive, and efficient administration. It will also enhance the role of bureaucrats while integrating data, policy-making, and policy evaluation and reduce the effect of red tape, simultaneously improving coordination between different departments. The article covers the initiatives taken by the Indian government to promote blockchain technology in enhancing public services. Though India aspires to a \$30 trillion economy and aims for Viksit Bharat by 2047, the potential use of blockchain technology can be a game changer. The article is based on qualitative methods and data analyses from books, articles, and journals. It will give a brief overview of blockchain technology and its use in government services, as well as cover the best initiatives taken by other countries to implement blockchain technology in public services. The article concludes by identifying various limitations in implementing blockchain technology, and issues of privacy and data theft have been considered. However, the overall analysis shows huge potential in blockchain technology, which can transform the public administration and its e-government services by fostering smart and good governance.

KEYWORDS-Blockchain technology, Distributed Ledger Technology, e-government, good governance

INTRODUCTION

Blockchain is an irreversible shared ledger that facilitates asset tracking and transaction recording among a network of companies. Anything of value may be tracked and traded on the Blockchain network. A blockchain is a distributed database that is shared over a computer network. Blockchain stores information in a digital format, ensuring transaction security.

Blockchain is a new technology known as distributed ledger technology, or DLT. Blockchain technology can be used to digitally format and store currency and other items. It is actually an interchange process based on data blocks. In this case, one block is connected to another. These blocks cannot be hacked. Blockchain technology's objective is to safeguard digital documents. Blockchain technology can be better

understood by using Google Doc as an example. A document is distributed rather than copied or transferred when it is created and shared with others. But a Google Doc isn't as sophisticated as a blockchain. In a nutshell, distributed ledger technology, or Blockchain, renders every digital asset transparent and unchangeable by using decentralization.

Blockchain renders to store records and distribute the digital information. It is an immutable record of transactions which can neither be changed nor can be destroyed. Blockchain is claimed to be “next major innovation” in the field of governance and has potential to transform public service delivery and ensure last mile connectivity.

It is anticipated that the use of blockchain technology in public service delivery would have significant social, political, and environmental ramifications. Understanding sustainability as the balance of the three pillars—environmental, economic, and social—blockchain technology can make societies more sustainable. Among other benefits, blockchain holds the potential to enhance public registry accessibility and transparency, energy and water management and accessibility, citizen engagement tools, and international cooperation. Blockchain applications may benefit multiple Sustainable Development Goals [12] in this way, including lowering inequality (target 10), creating sustainable cities and communities (goal 11), and promoting peace, justice, and strong institutions (objective 16). Yet, blockchain may also result in expenses, such as the indiscriminate replacement of human workers by opaque processes, highly automated procedures or the general disempowerment of individuals due to the consolidation of power in a small number of powerful positions, hidden from democratic oversight. The changes brought about by blockchain are not predetermined and will depend on a variety of factors, such as the technology behind the system, how well-received it is in society, and political will.

CHARACTERISTICS OF BLOCKCHAIN

- **Decentralization:** Data is distributed throughout a network of computers, diminishing dependence on a singular central authority.
- **Transparency:** Transactions are documented on a public ledger available to all parties, hence promoting confidence.
- **Immutability:** Once a transaction is recorded, it cannot be modified or erased, hence maintaining data integrity.
- **Security:** Cryptographic methods safeguard data, rendering it very secure against manipulation and deception.
- **Pseudonymity:** Users can engage without disclosing their true identities, ensuring privacy while upholding transparency.
- **Scalability:** Diverse solutions, such as side chains or shading, are being devised to enhance the capacity and efficiency of blockchain networks.
- **Consensus Mechanisms:** Transactions are authenticated via consensus methods (such as Proof of Work or Proof of Stake), guaranteeing that all participants concur on the ledger's status.
- **Smart Contracts:** Self-executing agreements with terms encoded explicitly, facilitating automated and trustless transactions.

ROLE OF BLOCKCHAIN TECHNOLOGY IN PUBLIC SERVICES

- **Transparency and Accountability:** The decentralized ledger of blockchain facilitates real-time transaction tracking, hence enhancing the transparency of governmental procedures. Citizens can auth-

enticate the use of public money, mitigating corruption and enhancing confidence.

- **Secure Identity Management:** Blockchain can establish secure digital identities for citizens, facilitating access to numerous governmental services. This mitigates the danger of identity theft and streamlines procedures such as applying for permits or perks.
- **Efficient Voting Systems:** The integration of blockchain technology in voting can improve the security and transparency of electoral processes. Voter privacy is preserved, while guaranteeing that each vote is accurately recorded and immutable.
- **Property & Land Registration:** Blockchain can establish a definitive, unalterable record of land ownership and transactions, thereby reducing disputes and fraud in real estate transactions. This enables more convenient access to property records.
- **Smart Contracts:** These self-executing agreements can automate and execute contracts in diverse public service sectors, such as procurement or social service distributions, thereby diminishing bureaucracy and enhancing efficiency.
- **Healthcare Management:** Blockchain can safeguard patient records, facilitating enhanced data sharing among healthcare providers while ensuring patient privacy is maintained. This results in enhanced coordination and outcomes in care.
- **Supply Chain Transparency:** Governments can monitor the procurement and distribution of vital commodities, including food and pharmaceuticals, to ensure adherence to safety regulations and mitigate corruption.
- **Welfare and Benefits Distribution:** Blockchain can optimise the allocation of social benefits, guaranteeing that moneys are delivered to designate recipients effectively and transparently, thus minimising fraud.
- **Environmental Monitoring:** By documenting environmental data on a blockchain, governments can furnish reliable evidence regarding adherence to regulations and sustainability initiatives.
- **Decentralised Data Management:** Employing blockchain for data storage mitigates the risk of centralised data breaches and enhances individuals' sovereignty over their information.

GLOBAL PRACTICES ON USING BLOCKCHAIN TECHNOLOGY IN PUBLIC SERVICES

China places significant emphasis on the implementation and advancement of blockchain technology. President Xi Jinping highlighted the necessity to accelerate the advancement of blockchain technology and industrial innovation, while actively promoting their integration for economic and social progress. China possesses a solid foundation for the development and implementation of blockchain technology within the judicial sector. The technological support in this field has been progressively evolving. The Supreme People's Court has established an advanced smart court system utilizing technology, centered on a single national judicial blockchain platform. The platform employs blockchain technology to manage data, including electronic evidence, digital archives, enforcement investigation and control information, complaint and petition data, operational logs, and more information. The platform provides individuals and courts at all levels throughout China with access to a single system for judicial data storage and verification. Efforts to investigate the implementation of blockchain technology in all local people's courts are in progress. Following a thorough research and broad consultation and discourse, the Supreme People's Court developed and released the Opinions to enhance the utilization of blockchain in the judicial domain and to capitalize on its function in judicial practice.

Estonian specialists worked with Guardtime, an Estonian cyber-security firm founded in 2007, to secure patient records using the Keyless Signature Infrastructure (KSI) blockchain technology in 2011. Instead than dependent on other centralized trust authorities, KSI validates records only through the use of hash-function cryptography. To protect patients' medical records, an Estonian e-health foundation introduced blockchain technology in 2016.

By 2021, Dubai aspires to become the "first city fully powered by blockchain." A strategy for the use of blockchain technology in Dubai is established by the Dubai Blockchain 2020 Mandate, which is led by the Smart Dubai Office. Achieving efficiency by integrating blockchain into all relevant government services, developing and facilitating a blockchain ecosystem for startups and enterprises, and emerging as a worldwide thought leader through the piloting of cross-border blockchain cases are some of its objectives. In order to speed up the prototyping of blockchain solutions, telecom Du collaborated to develop the Blockchain Platform as a Service. All government agencies may leverage this platform to expand on a common framework in accordance with their operational requirements. A low-cost, scalable, and fully managed platform is provided by BPaaS. Paying for what you use is an option. BPaaS has been recognized by the Smart Dubai Office as a crucial instrument to support government organizations in their efforts at prototyping.

In order to promote the use of blockchain technology, the European Food Safety Authority provides trace labs to the Food Safety Market (FSM) initiative. Using blockchain and Big Data, the FSM plans to revolutionize the European food certification industry. An industrial data platform will be developed as part of the EU-funded FSM project to digitally enhance the food certification process in Europe. In particular, it will use cutting-edge blockchain technology to establish a public and cooperative online space where individuals and organizations concerned with food safety can interact and share data that is essential for certification purposes. European providers of inspection and certification services will participate in the project's broad piloting.

It is in Jordan's parliamentary elections paradigm that the Ethereum-based E Voting System (EBVS) was developed and tested. The e voting procedure becomes more complicated due to the unique features of this model. This work utilizes a custom smart contract that was developed to meet the peculiarities of the election system in Jordan; this model can be modified to suit other electoral systems.

CrimsonLogic's Global eTrade Services (GeTS) is an industry-leading provider of E-Government products and services, with headquarters in Singapore. Open Trade Blockchain (OTB), an expandable blockchain solution, was launched by GeTS. Trade communities can use it to make international trade more secure, transparent, and efficient. In line with the Southern Transport Corridor and China's Belt Road Initiative (BRI), OTB is the first regional cross-border blockchain platform. Whitelisted recognized trade compliance companies host OTB, a permissioned blockchain network. The purpose of the OTB is to strengthen the safety of trade-related documents, such as certificates and business invoices. The confidence and openness among shippers, customers, and freight forwarders is also preserved.

To keep track of data from the energy sector, Chile will adopt Ethereum's blockchain. By adding data to the public Ethereum ledger, it aims to boost confidence in information that is publicly accessible by enhancing security, integrity, traceability, and overall reliability.

The Swedish government and many European nations have significantly advanced the integration of blockchain technology into their land registration systems. An estimate from a partner of the Swedish government indicates that implementing blockchain technology in the land registry system will save the

government 106 million US dollars annually by reducing paperwork, minimizing fraudulent activities and accelerating transactions.

Sweden is now the most advanced country in Europe in integrating blockchain with its land register system, perhaps serving as a model for other European nations to improve their land registration systems using blockchain technology.

Poland has placed up a mechanism for electronically commencing land registration procedures using certified electronic signatures and has guaranteed public internet access to land registers. The public may safely confirm property deed ownership through Georgia's blockchain-based land registration system, which was developed in 2016. In 2018, the Netherlands established a specialized team to investigate the future of blockchain concerning legal matters, economic implications, and ethical considerations.

INITIATIVES TAKEN BY INDIA TO IMPLEMENT BLOCKCHAIN TECHNOLOGY IN PUBLIC SERVICES

The Ministry of Electronics and Information Technology (MeitY) has endorsed a multi-institutional initiative named “Distributed Centre of Excellence in Blockchain Technology,” with the Centre for Development of Advanced Computing (C-DAC), the Institute for Development and Research in Banking Technology (IDRBT) in Hyderabad, and the Veermata Jijabai Technological Institute (VJTI) in Mumbai serving as the executing agency. In pursuit of this goal, organizations have developed Proof-of-Concept solutions and researched the use of blockchain technology in a variety of industries. In Telangana State's Shamshabad District, a blockchain-based property registration system has been created and is presently undergoing testing. Proof-of-Concept solutions have been developed to support trade financing, Central Know Your Customer (CKYC), and Cloud Security Assurance. To enable Proof-of-Existence (PoE) for digital artifacts, such as academic degrees, sale deed documents, memoranda of understanding, and the like, a general blockchain-based PoE framework has been developed. The C-DAC Advanced Computing Training School (ACTS) is currently testing a solution that uses the PoE framework to confirm academic credentials in order to grant participation certificates for online seminars and workshops. The Ministry of Electronics and Information Technology (MeitY) has commenced a project focused on the design and implementation of a National Blockchain Framework (NBF) aimed at establishing a shared blockchain infrastructure and providing Blockchain as-a-Service. (TECHNOLOGY, 2021, p. 18)

The Indian government intends to initiate IndiaChain, a substantial blockchain initiative. The initiative was initially presented by the country's think tank NITI Aayog, which unveiled a blockchain system intended for India's public records in November of the previous year. This initiative represents the initial phase of a comprehensive system for record maintenance and the allocation of public resources. This project will incorporate capabilities akin to the Unified Payment Interface (UPI), a software tool that enables seamless and safe real-time monetary transfers. UPI is a payment API utilized by commercial enterprises to develop payment applications. At present, Amazon Pay, Google Tez, Paytm, PhonePe, and Reliance Jio operate on UPI, but WhatsApp is in the experimental phase of testing UPI payments.

An Indian blockchain group focused on financial applications has introduced a novel way for exchanging client information. The project, named 'ClearChain', is led by the BankChain consortium, established in February with the support of institutions such as the State Bank of India (SBI) and ICICI Bank, among others. The organization is collaborating with Primechain Technologies, a startup based in Mumbai, together with IBM and Microsoft on the software aspect.

The state of Telangana has initiated a land register pilot project in certain areas of its capital, Hyderabad. The blockchain will be integrated with the state's revenue department, assisted by the Center for Development of Advanced Computing (C-DAC). The government of Andhra Pradesh (AP) is considering the expansion of its blockchain program to include civil supply databases in addition to property records. To enhance the efficacy of e-governance throughout the state, the Maharashtra government has initiated a 'Blockchain Sandbox.' The government will implement various blockchain solutions in collaboration with companies in agriculture, marketing, supply chain, vehicle registration, documentation management, and other services to enhance transparency and efficiency.

The Election Commission of India approved IIT Madras's proposal for the use of blockchain technology to ensure a safe e-voting system. The online voting system is in development at IIT Madras and the Centre for Development of Advanced Computing (CDAC). The Election Commission of India was investigating the possible uses of blockchain technology to facilitate remote voting for migrant workers unable to vote in person. Blockchain technology may facilitate the goals of electronic voting by enhancing the credibility of the voting process and optimizing accessibility at polling stations.

India's blockchain projects in public services exemplify a progressive approach to government and technology. The country seeks to improve transparency, security, and efficiency in essential sectors, including land records, supply chain management, healthcare, digital identity, and financial services, through the implementation of blockchain technology. These initiatives, encompassing decentralized voting, secure educational credentials, and energy trade, demonstrate blockchain's capacity to mitigate corruption, guarantee data integrity, and enhance operational efficiency. With ongoing governmental support and expansion of these initiatives, blockchain may emerge as a pivotal instrument in India's advancement towards digital governance and enhanced public service delivery.

POTENTIAL OPPORTUNITIES AND FUTURE PROSPECTS

In India, blockchain holds immense potential to revolutionize public services by enhancing transparency, efficiency, and security across various sectors. The technology could play a pivotal role in addressing some of the country's long-standing challenges, such as corruption, inefficient public delivery systems, and bureaucratic delays. For instance, blockchain-based land registries can create tamper-proof records of property ownership, reducing land disputes and fraud. Similarly, digital identity management through blockchain can empower citizens to securely manage their identities, improving access to services like healthcare, banking, and social security. Blockchain's integration into supply chain management for public procurement can ensure transparency, preventing leakages and ensuring accountability in government spending. In the area of governance, blockchain-based voting systems can make elections more secure and transparent, reducing the risk of electoral fraud. The Indian government is already exploring the use of blockchain in sectors such as agriculture, finance, and energy, signaling strong future prospects. With its growing digital infrastructure, India is well-positioned to harness blockchain to create a more efficient, transparent, and inclusive public service ecosystem. However, widespread adoption will require regulatory clarity, scalable solutions, and public awareness.

In conclusion, blockchain technology presents a transformative opportunity for enhancing public services in India by making them more transparent, secure, and efficient. Its potential to address key challenges such as corruption, bureaucratic inefficiencies, and fraud can greatly benefit sectors like land registration, digital identity management, public procurement, and voting systems. However, for blockchain to reach its full potential in public services, several key steps need to be taken. The government should develop

clear regulatory frameworks to ensure secure and standardized blockchain implementation. Investments in digital infrastructure and capacity-building for public sector employees will be critical for seamless integration. Additionally, promoting public awareness about the benefits of blockchain and encouraging private-public partnerships could drive innovation and adoption. By addressing these factors, India can effectively leverage blockchain technology to create a more efficient, transparent, and inclusive public service ecosystem.

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