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## Blockchain for E-governances and foster innovations: A context on Indian Subcontinent

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### Abstract

With the advent of multiple emerging technologies, we are on the verge of 4IR. This revolution exposes new challenges as well as exciting opportunities. Only the countries with expertise in these emerging technologies can successfully meet the challenges and exploit the opportunities. Blockchain technology is widely regarded as one of the core and foundational technologies that will be one of the driving forces for the upcoming 5IR (Fifth Industrial Revolution). Realizing its potential, many developed as well as developing countries around the world have started exploring how blockchain technology can prepare them for the future challenges and benefit them to solve many existing complex problems to achieve the SDGs (Sustainable Development Goals) by 2030. This paper is an effort to recognize the need to explore blockchain technology in order to advance its technical capacity, increase efficiency in e-Governances and foster innovations.

**Keywords:** 5irechain; Digital governances; SDG; 5IR

### 1. Introduction

The impact on the societies and the economy is providing novel ways by which we can address Sustainable Development Agendas 2030. According to the Digital Economy Report 2019 by UNCTAD [United Nations Conference on Trade and Development], only the countries that have prepared themselves can meet these challenges and exploit the opportunities. Blockchain or Distributed ledger technology [DLT] can be used to store permanent and tamper-proof records of digital data [1]. A blockchain is a distributed ledger consisting of consecutive 'blocks' of digital data chained together following a strict set of rules. The ledger is distributed and stored by the nodes [computers] of a peer-to-peer [P2P] network. Each block of data is periodically added to the ledger in a decentralized fashion. The order of the blocks is confirmed through the use of a distributed consensus algorithm [2]. There are major two types of blockchain: private and public; both systems exhibit desirable properties such as immutability and irreversibility of ledger state, data persistence and provenance, accountability and transparency, etc. Governments in Indian subcontinent can use the following key action plans to fulfill the desire of a blockchain-enabled nation:

- Build a team of blockchain experts and solution companies [e.g. 5ireChain], academicians, government officials and other stakeholders.
- Develop plans to integrate the most relevant online services with a suitable blockchain platform.
- Develop capacity by promoting research, innovation and training and by increasing awareness.
- Prioritize use-cases for initial piloting and highlight those use-cases that can bring huge benefits to government service delivery models.
- Release funds to initiate and maintain these activities.

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## 2. Methodology

We first define the data set identification. We chose to use the Scopus database because it is the largest abstract and citation database of peer-reviewed literature and it is largely used by scholars worldwide. Then, we decided to use the application of the PRISMA protocol that has helped us to create a dataset of papers. Subsequently, content-based research was conducted to analyze the content of the papers and identify the main bibliographic information of the papers and the relationships to e-governances and foster innovations. Additionally, we scrutinized 5irechain as a case study with their USPs for e-governances. This paper focuses on Indian subcontinent specifically with the nationwide and socio-economic scenario however it can help to understand global phenomenon of blockchain. The Indian subcontinent, or simply the subcontinent, is a physiographical region in South Asia which is situated on the Indian Plate, projecting southwards into the Indian Ocean from the Himalayas. It generally includes the countries of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.

## 3. Discussion

### 3.1 Blockchain misconceptions

**Table 1** Misconceptions on blockchain and its resolution

Power consumption	Because of the huge power consumption by a number of popular public blockchain systems, many people believe that every blockchain system consumes 12 considerable electricity. As explained before, the power consumption of any private blockchain system will be comparable to any existing system [4]. Hence, this concern can be effectively addressed by leveraging a private blockchain system
Data encryption	Many believe that a blockchain provides data encryption by default. This is a serious misconception [5]. A blockchain system strongly depends on cryptographic mechanisms, such as digital signature and cryptographic hash, to function. Digital signature is used for data provenance while a cryptographic hash is used to ensure data integrity. In a blockchain system, data encrypted is never provided. However, anyone can use any encryption algorithm to any data before it is stored in a blockchain.
Data integrity	A blockchain can guarantee the integrity of data only after it is stored in the blockchain. It cannot provide any such guarantee if the data is corrupted in the source or during transmission. In this sense, a blockchain system is essentially a “Garbage-in garbage-out” system where corrupted data will be stored and remain as corrupted [6].
Large-scale data storage:	The data immutability feature tempts many to store as much as possible data in the blockchain. However, as explained before, a blockchain is not a database and should not be considered as such. The rate by which data can be stored and accessed in any traditional database is far better than any blockchain system as of now. This applies not only to any public blockchain system, but also to any private system. Therefore, it is advisable to store as minimum data as possible in the blockchain.
Data immutability	Data stored in blockchain is considered immutable. However, there are two types of data that can be stored in a smart-contract supporting blockchain [7]. One is related to any transactional data that is recorded when a certain amount of cryptocurrency of a particular blockchain system is transferred between two accounts. Another type can be considered as a smart-contract data that is required to execute the smart-contract code. A smart-contract utilises such data using a variable and a variable, as its name suggests, can be updated with different values. Interestingly, such data transferred to a smart-contract using a transaction is recorded in the blockchain in an immutable fashion. This entire means is that a transactional data is immutable; however, a smart-contract data can be changed. But, the ways the value of a variable changes is recorded in an immutable and auditable fashion.
Crypto-currency and blockchain	Many have the misconception that the notion of crypto-currency and blockchain is synonymous [8]. One cannot live without the other. However, a crypto-currency, in reality, is just, and currently the most popular, application of a blockchain system. There are many other applications of a blockchain system which do not rely on or require any crypto-currency to function.

There is no doubt that Blockchain technology has the potential of heralding a new era in multiple application domains. However, due to misconceptions and lack of knowledge, it is sometimes hyped in wrongful ways [3]. In order to harness the true potential of blockchain technology, it is imperative to have a clear understanding of these misconceptions. Following table gives a brief review solution for such kinds of misconceptions.

### **3.2 Potential Blockchain Application Domains: Indian Subcontinent Perspective**

It has been envisioned that blockchain technology can disrupt a wide range of application domains. These application domains cover a plethora of use-cases. It will be an overwhelming experience to assess the impact of blockchain technology over all these use-cases.

#### *3.2.1. Smart City Application Domain*

**Smart infrastructure:** In a smart city all the resources are integrated using information technology to ensure effective and efficient use of the resources. With the help of emerging technology i.e. IoT, cloud computing, machine learning, real time direct benefit can be provided by the government to the citizens. Blockchain technology can add more values by connecting all the technologies together. It will also provide additional security [9].

**Citizen services:** A blockchain-enabled smart city can facilitate many citizen services in an automated and decentralized fashion [10]. Such services can issue e-ID for identity verification for their citizens which in turn can be used for e-voting systems, recording and sharing medical information, property management, and the use of crowd-funding platforms and so on. Therefore, for the future planned smart-city, blockchain technology can help to unlock the above advantages for its citizens.

#### *3.2.2. Land Application Domain*

##### **Mutation**

The property documents can be easily counterfeit and manipulated by malicious people. Blockchain technology can play a key role to guard against such unauthorized manipulations because of its immutability and transparency properties. The introduction of a blockchain-based system thus can enhance trust in the trade of property in the Indian subcontinent [11].

##### **Registration**

Land registration generally describes systems by which different associated activities such as ownership, possession or other rights in land can be carried out with a respective government agency. Such systems must facilitate transactions and to prevent unlawful disposal of land. A blockchain based system can be beneficial by reducing Land selling/buying processing time from months to few days through eliminating paperwork and in purchase system, preventing fraud, manual intervention, and providing a high level of security in ownership by digital signature [12]. Blockchain technology can be really promising for Indian subcontinent as land registration and ownership transfer are still manual and less transparent.

##### **Verification**

Once the registration of property is completed using a blockchain based solution, a legal authority which has access to the same system can easily verify it. In addition to this, such a system can be used to provide the title certification and right of ownership deeds and land recording [13]. In Indian subcontinent, where verification can be quite challenging because of the manual and error-prone process, such a solution will be really useful.

#### *3.2.3. Agriculture Application Domain*

##### **Procurement**

The main challenge for the agriculture sector is proper tracking of agricultural products and ensuring payment after product delivery [14]. The whole process of coordination currently depends on third parties. Both the seller and the buyer have their agent for delivery and payment of food, ultimately these agents add additional cost to the system. If blockchain technology can be leveraged, buyers and sellers can directly interact with each other which would speed up the process and reduce time and cost for the farmers. A blockchain system thus will ensure that farmers will receive a large share of sale [15]. In Indian subcontinent, it is a common phenomenon that farmers do not get fair prices for their products. To handle this situation, a blockchain system will be highly impactful.

### Disintermediation

With the features like traceability and auditability of Blockchain, farmers can directly sell crops or foods to the consumers, thereby reducing the need for intermediaries [16]. Therefore, it will reduce the cost incurred by intermediaries and ensure proper distribution of agro-products within the country and surplus in foreign countries.

### Agricultural insurance

In the Indian subcontinent, agricultural insurance systems are mainly the collection of non-formal private mutual and community-based crop and livestock initiatives. For ensuring social protection to various natural disasters affected people, still some low-cost agricultural insurance schemes are used. The adoption rate of insurance is very low as the benefits are not well communicated. A blockchain based insurance system can help the insured farmer to get the benefit instantly in adverse weather through automatic data feed and local hype data without the need for any claim assessment [17].

### 3.2.4. Identity Application Domain

#### E-KYC

KYC refers to Know Your Customer which is a mandatory procedure to be carried out by maximum financial institutions for the customers. In order to comply with KYC, banks and other Financial Institutions must dedicate a huge amount of resources. This is particularly wasteful since each single financial institution has to satisfy KYC requirements for each new customer, even though that customer has probably completed a KYC process somewhere else before. A blockchain-based KYC solution will enable a seamless exchange of KYC state between different financial institutions. The transparency of a blockchain system provides a perfect opportunity for any financial institution to streamline the KYC process and enhance and speed up the customer's boarding experience are clear. It is particularly a lucrative proposition for Indian subcontinent, since the KYC process is mainly carried out manually and sharing KYC data is almost non-existent.

#### Reputation System

Currently, consumers rely heavily on online reputation systems in order to make online purchase decisions. Unfortunately, there are several issues in the existing online reputation systems as the manipulation of reputation data can be easily carried out by malicious entities to fool customers. Some fake customers even give fake ratings based on payments. A blockchain-enabled reputation system can obsolete this malicious activity and aggregate reputation data across the web through verifying and creating unique digital identities for all users [18]. Therefore, the trust and transparency in the reputation system will be ensured.

### 3.2.5. Finance Application Domain

#### Pension

In most of the Indian subcontinent countries, the retirement system is reconciled on the time of paying pensions. During this time, the calculation of pension is done manually where there always remains a chance to manipulate data. In some cases, pensions were even paid to dummy workers by manipulation and fraud which ultimately cost millions to the government. A blockchain-based pension system can guard against this manipulation and guarantee transparency [19].

#### Payment

There is a huge potential for blockchain technology in the payment industry. Traditionally, financial institutions rely heavily on middlemen to conduct any type of settlement. A blockchain-based payment system can facilitate a more direct approach which effectively could cut out any middlemen during the settlement process. This can ensure huge savings for such institutions. Furthermore, international payments can be carried quickly and cheaply in comparison to how long it takes and how much it costs now. The payment system can also be revolutionized using a blockchain-based payment system [20].

#### Stock Market

Currently, the transaction settlement process in the stock market mainly depends on the presence of intermediaries, such as brokers, regulators and so on. Overall, the settlement process takes time and the presence of intermediaries entails additional cost to the trader and the organization. A blockchain based system can reduce the cost by eliminating

intermediaries, increase speed by regulating and settling transactions without a need for central authority through smart contracts.

#### Subsidies

In economic systems subsidies are often used as a tool to deal with deficit and short time poverty. In order to assess the eligibility of recipients of the fund and the utilization of the fund, the government needs proper tracking systems. With a blockchain subsidy distribution platform, governments can easily assess the eligibility of recipients to get various forms of subsidies and track them easily.

#### 3.2.6. *Expatriates Application Domain*

##### Employment

In the Indian subcontinent countries, the governments manage various employment opportunities for the citizens in different countries. However, all the activities related to employment are not interconnected and monitored. Sometimes the agency charges a huge amount of money for providing these government services, which threaten the reputation of the government service provider. Through blockchain, it is possible to create employee profiles and track all the steps in the employment process. Government can then track the amount of money taken by the agency and remove the unauthorized middlemen. By smart contract, the inter-government can decide the terms and conditions of the employment exchange process. Based on this the records of the employment payment made by employee, training and certificate provided to the employee can be tracked and facilitated.

##### Remittance

Remittance is one of the potential sectors of Indian subcontinent countries where blockchain technology can play a crucial role. Because of the excessive expense of sending through banks and legal channels, many expats send money through personal channels or illegally. The implication is that this reduces government revenue substantially and the actual remittance income cannot be properly tracked. A blockchain-enabled remittance service will have no-intermediaries which ultimately will reduce cost and expats will be encouraged to send money through a proper channel. The currency fluctuation risk also can be minimized with the help of digital currency on top of a blockchain.

##### Welfare

The Governments of Indian subcontinent countries conduct various activities to ensure the welfare of the overseas employee. However, it is challenged by the proper maintenance of integrated databases, exploitation by middlemen, tracking after arrival employee management etc. therefore, Blockchain can be one solution to all these issues. proper wages, allowances and other benefits can be ensured based on the terms of the smart contract. The employment status can be monitored and various after arrival services, i.e. employment periods extension, help in crisis moments, etc. can be provided with proper track record.

#### 3.2.7. *Commerce Application Domain*

##### Consumer protection

In Indian subcontinent countries, consumer rights are not always protected from fraud and dishonest sellers. When transparency will be provided, fraud sellers can be detected and the consumer rights will be protected. Through a blockchain based system consumer information and overall rights also can be protected from any misuse [21].

##### VAT

Currently, in most of the Indian subcontinent countries VAT collection is ensured through a challan number in every transaction of registered point only. However, there are lots of pitfalls and scope for manipulation exit in the payment of VAT. If a smart-contract supported blockchain system can be integrated with the VAT collection system, VAT can be automatically calculated, collected and recorded without any human intervention [21, 22]. This will reduce manipulation and ensure the timely collection of VAT during each sale of a product.

##### Fraud detection of consumer products

Fraud happens when there is no presence of transparency. As transparency is one of the major benefits of Blockchain, therefore it can be used in prevention of fraud in consumer products. If a product record is stored in a blockchain which can only be updated by authorized entities, it will prevent any fraudulent occurrence or if this happens, it can be easily

detected [23]. In addition, such information recorded on a blockchain can easily be traced back to its origin because the information is shared in the distributed ledger.

### *3.2.8. Health Application Domain*

Privacy-preserving collection, storage and retrieval of health data: Health data is collected when a patient undergoes some medical treatments including tests and diagnosis. Generally, in Indian subcontinent countries, the results are signed by the doctor and are delivered to the patient which they can keep with full control. Unfortunately, such a process imposes several challenges: it has a very limited scope to preserve, storage and retrieve such information for further consultation. An automated system is the solution; however, a centralized system has a single point of failure and they do not promote transparency. A blockchain based solution which stores and retrieves medical data in a privacy-friendly way is the perfect solution in this scope [24].

### *3.2.9. Judiciary Application Domain*

#### Securing digital evidence

Blockchain technology can be used to secure digital evidence. For example, CCTV footage, mobile phone data, internet usage data, important files retrieved from the seized computers all represent important evidence which can be used as evidence in many countries in the world [25]. However, digital evidence can be manipulated easily, thereby the authenticity and integrity of such evidence is often questioned. Blockchain technology can be an effective tool to mitigate this situation. A blockchain-based solution will open many ways to verify and secure digital evidence when this happens.

### *3.2.10. Supply Chain Application Domain*

#### Agricultural supply chain

In agricultural supply chain Blockchain can help to remove the intermediaries and ensure that the farmers get the proper payment as discussed earlier [26].

#### Medicine supply chain

In the medicine industry, there is a constant risk for the supply of fake and adulterant medicine. This is very hazardous for the customers and is also risky for the medicine manufacturers. Through blockchain technology, the origin of the medicine can be tracked and the risk of fraud can be reduced. Ultimately, both the customer and medicine producer will be benefited [27].

### *3.2.11. Document Verification Application Domain*

#### Government certificate

In developing countries, certificates and documents can be counterfeit easily for dishonest purposes, which are challenging to deal with. Here, a blockchain-based system can be used as a solution to issue different certificates with a proper verification mechanism which is impossible to counterfeit [28]. This will help various government organizations to eliminate the risk, thereby increasing trust and transparency to the concerned authority.

#### Educational certificate

Educational certificates are used for different purposes. However, it is not free from the risk of fake and falsified certificates. A blockchain-based solution can be used to store educational certificates on a distributed ledger so that people can access it anytime, anywhere without the fear of unauthorized modifications [29]. Such a solution can also ensure that only authorized entities can verify the certificates. It will ultimately help to track any fake certificate holders in the job market and other important positions within and outside the country.

### *3.2.12. Infrastructure Application Domain*

#### Protection of Critical Information Infrastructure

Blockchain technology can be utilized to protect the national information infrastructure which is critical to digitize different aspects of the country and to facilitate e-Governance.

### 3.2.13. Banking/Insurance Application Domain

#### Digital Asset Management

Nowadays organizations are being transformed digitally where the management of digital assets have become a crucial part. Many organizations are also focusing on asset digitization. However, the concern lies in managing those assets through controlling misuse and protecting privacy. A blockchain based system can be used to manage the ownership and transfer of intellectual property of these digitized assets and to guard against the misuse of the assets [30].

#### Inter-bank settlement

In most of the Indian subcontinent countries, the inter-bank settlement is mainly done through the reconciliation process which is time-consuming. Banks can speed up and enhance this process by using a blockchain system that will streamline the transaction process through their shared ledger [31]. Therefore, banks can get rid of the reconciliation process by which a settlement is not carried out manually and separately.

#### Trade finance

Trade finance refers to financial transactions that relate to both domestic and international trade. In Indian subcontinent countries, the whole trade finance mechanism currently is composed of complex lengthy processes through the presence of intermediaries. Blockchain-based trade finance could streamline this process as soon as transactions occur in the network. There is no need to have multiple copies of documents related to a single transaction in the database of different stakeholders. Ultimately, it will speed up the transaction settlement time, increasing transparency between all parties. In this way, the available capital, that in the traditional setting waiting to be transferred between concerned parties in the transaction, can be unlocked, thereby increasing efficiency.

#### P2P lending

Through Blockchain borrowers and lenders can exchange funds without a need of intermediaries such as banks, underwriters and others. This will reduce the time and cost. The rate of interest will also be determined according to the profile of the borrower in the smart contract. Therefore, the lending process will be more efficient and effective.

#### Anti-money Laundering

When customer data such KYC data is kept in a blockchain, it will be beneficial for Anti-Money Laundering [AML] procedure as well. In most of the Indian subcontinent countries, as the KYC data is still not shared with various financial organizations, it is impossible to keep track of individual transaction records. Blockchain technology can help immensely in this regard and will be an essential tool to track any illegal financial activities [32].

#### Digital Currency

A blockchain-based digital currency can be beneficial for the banking and financial industry. A blockchain-based digital currency can be more efficient than the existing and could provide better transparency and accountability.

#### Credit rating

Currently, the credit rating mechanism in Indian subcontinent countries is mostly manual and is done without accurate data about borrowers and investors. A blockchain-based rating will be better than the manual system with a decentralized credit rating agency, the credit rating process is transparent to all parties including the regulators and would leave no room for manipulation.

#### Insurance

The claim settlement process in Indian subcontinent countries is a complex manual. In a blockchain-based insurance system, an insurance claim cannot be modified. It can facilitate a faster claim settlement. The terms and conditions will be in the smart contract, the claim settlement process will be executed automatically and the fund will be released to the policyholder instantly. In the case of reinsurance, data sharing can be done between insurers and reinsurers. Ultimately, blockchain technology will unlock lots of hassle-free insurance opportunities to insurance companies and potential policy takers.

Above are some potential application domains of blockchain in the perspective of the Indian subcontinent. However, these are not the only application domains where blockchain can bring enormous positive change. There are more application domains like- uniformity management of citizens, managing energy sector through managing energy uses,

in the educational sector to manage learning outcome and degree awards, enforcing laws and regulations, voting, ensuring food safety etc.

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#### 4. Conclusion

The Fifth Industrial Revolution will entirely depend on a few cutting edge technologies. This revolution will introduce new challenges as well as exciting opportunities. Tackling these challenges and exploiting the opportunity will solely rely on the effective usage of these emerging technologies. Countries who are better equipped and prepared to embrace these emerging technologies will have a greater chance of success in this upcoming revolution. Blockchain is often considered as the foundational technology for this revolution. Realizing its potential, many countries around the world are exploring the ways blockchain technology can be effectively leveraged. It is important to realize this is an extremely fast moving domain where technologies are changing at an unprecedented rate. Therefore, governments must act fast, otherwise, they may not be able to prepare for the fifth industrial revolution in due time.

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No conflict of interest was found during the entire duration of this paper.

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