

# A Review On Block Chain Technology in Construction Industry in India

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**Abstract:** Block chain technology is an emerging technology in various fields in India including real estate. It is a decentralized distributed ledger work in peer to peer network which enables to store, record data and provides transparency and fair transaction. It stores information in chronological and crypto graphical format. This paper presents a review of BCT for construction industry in Indian context. Digitalization is becoming a part of development in the country. There are several different tools and software adopted for a successful infrastructure development, still there are some imperfection which are a glitch for the industry. The objective of this paper is to study and analyze competency of BCT for construction industry which would overcome different issues in various phases of a project. With the review of literature and case studies the research discusses various issues in the industry and how BCT would be able to overcome them.

**Keywords:** Block chain technology, Construction, Project phases.

## 1. Introduction

India is a developing nation with a wide vision in raising excellent infrastructure nationwide. Construction industry plays an important role for raising smart cities. There are various new technologies adopted today in construction of projects. Block chain is an emerging technology which is adopted by various sectors globally and in India. It is system that tracks transactions across a peer-to-peer network. Block chain is a decentralized distributed ledger (a simple database, but with special properties) of information work in peer-to-peer network, such as transactions or agreements, that are stored across a network of computers which is stored chronologically and in cryptographic format. It can be viewed by a community of users, but is and is not usually managed by a central authority such as a bank or a government. Once published, the information on the block chain cannot be changed. Block chains acts as a distributed digital ledger among this peer-to-peer network where various kinds of agreements, whether they are financial transactions or contracts, can be recorded and confirmed once complete. Block chain are of various types like private, public and hybrid types. A network can be created as per the progress of various stages of the project involving the stakeholders.

## 2. Need of study

There are various flaws in construction industry like corruption, lack of monitoring progress, quality, excessive delays, which lead to lapses in productivity, cost overruns and an unsatisfied owner. Failure to pay on time can lead to conflict, and dispute.

Unavailability of data such as records, details and documents of projects. No transparency in project execution.

## 3. Methodology

The methodology adopted for the research is a comparison between various aspect of construction industry in traditional practice and the advancement of block chain technology for the industry. Discussion provided with some examples and a survey results.

## 4. Literature review

Using block chain to automate the contractual processes and paperwork underpinning these complex projects could save money, free up valuable resources, and speed up project delivery, timely information, and unambiguous communication. Registering transactions at legally binding moments, where accuracy and an audit trail are essential. Block chain technology has the potential towards a more transparent and fair practice enhancing the project management. Block chain can deliver a more streamlined procurement process, reducing the high level of fragmentation and complexity of major projects.

With BIM (Building Information Modeling), block chain can create fair and true aspects of construction. Can become the trusted digital twin of an asset supporting not only its design and construction, but its operation and maintenance along the whole lifecycle. Smart contracts are one way that these contracts can be updated and transactions recorded.

Geographic Information Systems (GIS) provide 1 data that planners, designers, and engineers which could be utilized to monitor and update the progress of the work. Block chain can deliver a more streamlined procurement process, reducing the high level of fragmentation and complexity of major projects.

The provenance of the materials can reduce waste and drive quality of products and service forward with high

accountability. Enhance predictability with regards to procurement, but also in the case of the whole project delivery. (BalintPenzes2018). Block chain is revolutionizing and disrupting organizations across all industries. It is next big technological invention after Internet. In Block chain Code is the law and Smart Contracts are the new way of doing business. (Mahendra Kumar Shrivias)

**5. Case study: Block chain in other sectors**

1. *Land Registry Monetization & Gamification for Abu Dhabi Municipality:* Block chain to improve Customer Experience, Enable New Services and Streamline Processes, mobile app based Land transactions can be carried over the blockchain. KYC and on boarding process for authentic users and officers. Land Marketplace can be created for public bidding of land. Land registry and record of rights can be used to apply, verify and clear welfare schemes that are linked to land ownership. Block chain based and records can be used by Law & Judiciary to resolve disputes. Land Acquisition and land conversion process can be executed over the block chain.
2. *Andhra Pradesh's Land Registry:* Chroma Way has partnered with the government of Andhra Pradesh to build a block chain-powered solution, bringing to life a secure and smart system for land registration, that can help solve fraud and misuse problems by decentralizing data storage in such a way that it becomes difficult to manipulate without having the proper authority and following proper protocols. Greatly reduce the administrative burden of land registration and title transfer
3. *Lantmäteriet, (The Swedish Mapping, Cadastre and Land Registration Authority)* Telia, SBAB, Landshypotek Bank ChromaWay and Kairos Future: Block chain technology can redefine real estate transactions and mortgage deeds. Solutions developed have broader application in real estate related issues. Solution for rent which is to be charged as per the use of facilities by the tenant.

**6. Discussion**

Block chain is useful for the project right from the planning phase up to the completion. Considering the planning and execution phase some hypothetical examples elucidate how block chain be supportive for the industry.

**A. Planning phase**

When a project is proposed usually the owner and the project team are involved in the primary decision, later the other stakeholders are involved as per the hierarchy of the flow pyramid chart of management that would see the client at the top, feeding down to the main contractor and the supply chain below them. The contractors and suppliers are involved in the project after series of changes and approvals. Still there are flaws which actually develop when the project starts.



Fig. 1. Flow pyramid of management

In block chain all the stakeholders, organizations working in multiple clouds in the planning stage can connect through the network where very decision and changes with the progress could be updated by everyone involved in the network. This network can work in Zues ecosphere. Every change or update is recorded in the block which is store in chronological and cryptographic format and all the nodes of network can access it and work accordingly. This also provides an easy mode of communication.



Fig. 2. Zeus ecosphere in block chain

1. At the planning stage the topography, boundary of the site, landscape or whether conditions are not usually considered. It is done prior execution by manual surveys after the actual site visit. If any problem is identified again the changes and rectifications are required which consumes time and may delay the project. This could be avoided in block chain by utilization of GIS system.
2. Economic conditions and trading losses accounted for a considerable number of insolvencies of the suppliers and contractors as they invest in the stock and equipments due to delays in starting the work. Block chain technology establish a collaborative system can enhance to minimize misalignments of contracts and enable collective corrective actions in the joint venture. Through the traceable data on the block chain the progress monitoring and the accuracy of cost and schedule can be prepared.
3. All the information of the design team is done either by emails or official letters to the owner/client. The other stakeholders are informed by the owner's organization or the design team if authorized. This needs lot of time and documentation with various approvals and correction. The payment procedure also is carried out in same manner.

Time as an important constrain of project, a smart contract working in a block chain network can be a solution for the process.

When a design is finished, the document control system can inform the smart contract that a design package has been submitted. The necessary parties are then notified to check the document and as their ID is registered as well on the block chain with their trustworthy digital signature, the document can be signed off. All of these interactions are registered on the same block chain platform; hence payments and project performance measure updates can then be initiated by smart contracts.



Fig. 3. Planning phase network

### B. Execution Phase

At a construction site every labor or worker who enters the site passes its ID card for security, health and safety reasons. The information about who entered and how much time they spent on site working is recorded manually in a site record register. This is totally inspected by the supervisors or the staff appointed on the site. There could be manual errors or manipulations by the individual. The payment of the labors also provided based on this record.

1. If the entry of the labor is captured and registered on a block chain enabled distributed ledger between the client, the consultant and the contractor, there is no additional administration needed to validate this information, as it has already been logged on the block chain. Based on the agreed terms with regards to the number of worked hours on site, a smart contract can initiate payment and send payment certifications for all parties if needed. This could also avoid inadequate cash flow or high cash use, poor strategic management, poor financial control, including a lack of record-keeping.
2. There are usually few provision of risk of incidents on the site (extreme weather conditions, unauthorized actions on site, riots, events logged in the risk register, etc.) block chain enabled construction management system, every health and safety incident or record of unsafe conditions can be registered and the risk mitigation can be initiated. At this stage the use of sensors and the internet of things (IoT) are primarily useful as these tools can act as a reliable source of data. The critical information from these sensors processed in a smart contract. If certain trigger levels are reached, the smart contract can notify the appropriate person on site to prepare risk mitigation or to change the construction plan. The data is processed automatically; and all the important information sharing

interactions (data from sensors, alarm from smart contract) are registered on the block chain system.

3. If equipment such as lift equipment is operating on site, any mistakes can cause serious health and safety issues. This issue is not identified on the site immediately and takes time to inform to the maintenance team or relevant person in charge on the construction site. Together with sensors installed, the operational status can be easily followed and registered on a block chain system. If the sensor records high lifting load or extreme wind this data can trigger, by the smart contract, a safety alarm to the crane operator, project manager, maintenance team on site in order to prevent any accidents due to overloading or misuse. If the equipment manufacturer needs the record of the equipment failure or default the data could be easily available.
4. In case of accidents, the hospitals and the insurance need time to record, inspect, and identify the cause and approval of the mishap event. This could affect the person injured for the treatment and also in case of insurance claim. Smart contract, in collaboration with hospitals and insurance companies, through block chain can avoid this and provide effective solutions for the labors and workers on the site.
5. Payment modes for any completed work, orders requires series of bills, visits and approvals from the authority is the present practice which involves documentation and may cause human errors, but a basic automatic and immutable block chain layer, every task order, approval and work completion on site with its relating payment are registered and traceable and every transaction can be fair and transparent. This enables continuous payments from the project account and creates a transparent flow of value right to the bottom of the supply chain. Digitally signed approval (with their Smartphone or a tablet on site) the smart contract can release payments and update the program.

### C. Other aspects.

1. Telephonic conversation is a mode of communication adopted for informing change or event. This communication is not authentic and cannot be recorded. Whereas the any change in block chain can be recorded and is stored.
2. A project when completed the data of the project like specifications and construction conditions the agencies appointed related to all relevant standards are usually not readily available. Sometimes the record such as materials used in the construction such as steel and cement, type of contract, time span of project, and all such information is not provided. This is necessary for the user to know the quality of the structure he is using.

Block chain provides this information and supporting documentation available upon request by uniquely live-link of digital data of a particular project. This information is useful for

the decision of appointment of the designer, contractor and other relevant personals for the new project.

Telephonic conversation is the mostly used to update any change or event on site.

### 7. Survey

With the above assumption a random sampling survey was taken with the flowing results of the respondents.

- 1) Problems faced during commencement and execution of a project

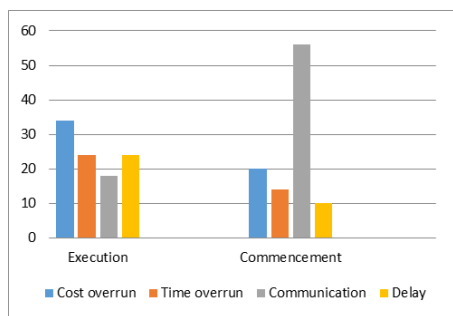


Fig. 4. Responses of Problems faced during commencement and execution of a project

55% of the respondent reacted to the communication as flaw in commencement of the project.

- 2) Mode of communication used during planning and execution phase of a project

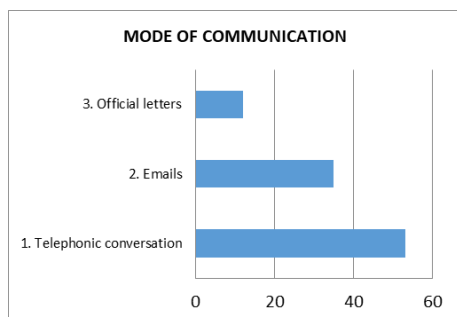


Fig. 5. Responses of communication modes of a project

- 3) Use of GIS system during planning and execution phase

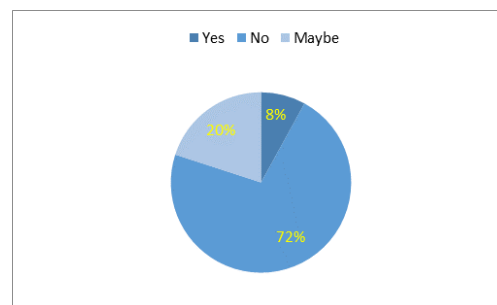


Fig. 6. Responses of use of GIS system in project

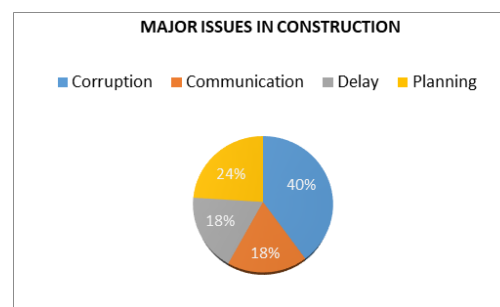


Fig. 7. Responses of use of GIS system in project

### 8. Findings

1. Communication between the various stakeholders and cost over runs are root cause of all the issues arising in project life cycles initial and execution phase.
2. Most of the communication is through telephonic conversation which is not authentic and cannot be recorded as data or is proofs for any disputes.
3. GIS is not connected to construction workflows.

Table 1

Comparative study of traditional practices and Block chain

| Sr. no. | Traditional practice & other applications (cloud, internet of things, artificial intelligence (AI), machine learning (ml), quantum computing) | Block chain technology   | Analysis   |
|---------|---|--|--|
| 1       | Method and application  | Technology(pattern adopted for execution of a project)                             |  |
| 2       | Centralized   | Denaturalized  | Transparency ,reliability                        |
| 3       | Authority to one organization   | Authority to several nodes   | Minimum 3 nodes                                  |
| 4       | Data is stored in form of documents, excel sheets, drawings, PDF, JPEG files etc.   | Data is stored in cryptographic format Like hash function, digital signature, etc. | Secured  |
| 5       | Changes done need to be informed by several communication modes   | Digitally informed at every node at once the change or alternations made           | Easy communication and saves time                |
| 6       | Information can be copied ,leak or hacked easily  | Difficult to crack the cryptographic code  | More secured                                     |
| 7       | Private access to data  | Both, private and public, can be published for reference, recommendation and sale. | Quality check recommendations                    |
| 8       | Data cannot be recovered  | Data is stored chronologically at several nodes                                    | Reference ,organizations assets stored digitally |
| 9       | Network is closed once the project is over  | Network can be continued further   | Time saving, ready modules                       |
| 10      | Payments need mediators (banks, currency)   | No mediators required if crypto currency is acceptable (bit coin)                  | Easy procurement                                 |

### 9. Conclusion

1. Block chain provides an effective and systematic technique of accomplishing a successful project with minimizing the flaws in construction industry.
2. It provides an unambiguous communication and more transparent and fair practice.
3. By implementing BCT strategies administrative load, fraud and human errors can be reducing in a construction project.
4. Block chain technology has a potential to improve and change the current practice in construction industry.

### 10. Recommendation

Block chain technology is an effective and advance technique for construction industry which has an ability to overcome various issues in India.

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