Revolutionizing Tender Evaluation in Public-Sector Procurement through Blockchain Technology

Tanvi Hodage, K V Kashi Raj

INTRODUCTION:

Procurement processes are fundamental to public and private sector operations, involving the acquisition of goods and services essential for functionality. In India, platforms like the Government e-Marketplace (GeM) have modernized procurement through digitization.

Ng et al. (1997) (Ref1) identified three primary factors that impact the duration of the procurement cycle. The first factor is the evaluation of suppliers, which focuses on selecting suppliers who can deliver products in a timely manner. The second factor is the internal procurement process, particularly the time it takes to convert a purchase requisition into a purchase order. The third factor is the nature of the relationship between the firm and the supplier

However, evaluation of suppliers particularly during the verification of Bidder Qualification Criteria (BQC) documents, remain a significant challenge. Any delays in these increase costs, extend project timelines, and impede efficiency improvements. Further evaluation of suppliers can be optimized by incorporating Blockchain in the Bidding Process. Bidder qualification criteria play a critical role in bid evaluation as they serve as the foundation for assessing and selecting the most suitable supplier or contractor for a project or contract.

This case study explores how blockchain technology can address the evaluation of suppliers by streamlining the submission and reducing the time required in evaluation of BQC documents. Leveraging blockchain's transparency, immutability, and automation, this approach aims to expedite the evaluation of commercial and financial criteria while ensuring high vendor qualification standards. By minimizing delays, this solution seeks to enhance procurement efficiency and keep projects on schedule.

Procurement For Economic Growth: Procurement plays a pivotal role in driving economic growth by facilitating the acquisition of goods and services necessary for both public and private sector operations. Globally, public procurement constitutes approximately 12% of GDP in developed countries, with figures reaching 15-20% of GDP in developing nations (Ref. 2) such as India. In monetary terms, government procurement in India surpasses INR 25 lakh crore annually (Ref. 6), underscoring its significant economic footprint.

Global and Domestic Trends: The significance of procurement extends beyond economic metrics. In recent years, global trends such as digital procurement, sustainability, and the adoption of technology have redefined traditional practices. According to a report by the World Bank, efficient procurement systems can save up to 20% of costs (Ref.2) while improving service delivery. In India, the advent of platforms like GeM has demonstrated how digitization can enhance transparency and accessibility in procurement processes.

Challenges in Procurement:

Despite its transformative potential, procurement faces several persistent challenges:

Delays in Tender Evaluations: Manual processes often result in prolonged timelines, disrupting project schedules and escalating costs.

Transparency Issues: Limited visibility into the procurement process can lead to inconsistencies and reduced stakeholder trust.

Administrative Burden: High volumes of repetitive documentation and compliance requirements impose significant workloads on procurement teams.

Revolutionizing Tender Evaluation in Public-Sector Procurement through Blockchain Technology

Tanvi Hodage, K V Kashi Raj

Delays in Procurement and Their Ripple Effects

Delays in procurement processes often extend to project execution, significantly affecting timelines and budgets. In India, the prevalence of such delays is well-documented:

Extent of Project Delays:

As of December 2022, over 51% of government projects costing ₹150 crore and above were delayed, marking an increase from 32% in November 2020 and 19% in March 2018 (Ref 7). Infrastructure projects face particularly severe delays. Out of 647 delayed projects, over 124 projects were delayed by more than 61 months (Ref 8).

Sector-Specific Challenges:

The road transport and highways sector lead with 262 delayed projects, followed by 115 railway projects and 89 petroleum projects (Ref 9).

Impact of Delays:

Delays contribute to substantial cost overruns. As of December 2023, 431 infrastructure projects in India experienced cost escalations exceeding ₹4.82 lakh crore (Ref 10). The average time overrun for delayed projects is approximately 36 months.

Reasons for Delays

While many delays stem from factors beyond the purview of procurement, such as land acquisition and environmental clearances, a proportion can be attributed to inefficiencies in the procurement process itself. These include:

Significant time in Bid evaluation: Manual Bid evaluation (Commercial, Technical & Financial)

Administrative Inefficiencies: Lack of digitized and automated workflows.

By addressing these controllable factors, such as using blockchain to reduce evaluation time for BQC documents, procurement processes can be streamlined, reducing delays and ensuring projects proceed on schedule.

Blockchain: A Game-Changer for Procurement

Blockchain is a decentralized digital ledger technology that records transactions across multiple systems in an immutable and transparent manner. Its core features immutability, transparency, decentralization, and automation—make it an ideal tool for addressing inefficiencies in procurement.

Applications of Blockchain in Procurement

Transparent Supplier Verification: Blockchain can store immutable records of supplier qualifications, certifications, and past performance, reducing the need for repetitive document verification in subsequent tenders (Ref 11).

Smart Contracts for Automation: Smart contracts—self-executing contracts with predefined rules can automate various procurement tasks, such as bid evaluations, milestone payments, and compliance checks (Ref 12).

Fraud Prevention: By providing an unalterable transaction history, blockchain minimizes opportunities for fraud, ensuring a fair and transparent procurement process (Ref. 5).

Reducing Evaluation Time: Documents such as financial reports and previous work records can be stored and verified once on the blockchain, allowing for instant retrieval and faster bid evaluations (Ref 6).

Traceability in Supply Chains: Blockchain can provide end-to-end visibility into supply chains, ensuring that procurement decisions align with sustainability and ethical sourcing goals (Ref 13).

Revolutionizing Tender Evaluation in Public-Sector Procurement through Blockchain Technology

Tanvi Hodage, K V Kashi Raj

Time Duration for Bidding Process: Current Timeline

The bidding process for procurement in public-sector organizations typically follows a well-defined sequence of activities. Below is an approximate timeline for each phase:

I. Project Inputs and Pre-Tender Meet:

Once project inputs are released, a pre-tender meeting is conducted within 2 days to assess potential bidders and discuss any considerations required in the Bidder Qualification Criteria (BQC).

II. Preparation of Invitation for Bid (IFB):

After the pre-tender meeting, the Invitation for Bid (IFB) is prepared within 3-4 days for approval and to proceed with the Notice Inviting Tender (NIT).

III. Floating the Tender and Submission Period:

The tender is floated in the public domain, and bidders are typically given 3 weeks (21 days) to prepare and submit their proposals.

IV. Evaluation of Bids:

Post-submission, the bids undergo evaluation based on technical, commercial, and financial criteria. This process usually takes 4-5 weeks, depending on the complexity of the tender and the volume of bids. In some cases, the evaluation period may extend further due to resource constraints or document verification challenges.

V. Price Bid Opening and Award:

Once the evaluation is complete, price bids are opened, and the contract is awarded to the successful bidder (typically the L1 bidder). This phase takes an additional 1 week.

Summary of Timeline:

Total Time Duration: From project inputs to contract award, the entire bidding process currently spans approximately 9-10 weeks, with potential extensions based on case-specific complexities.

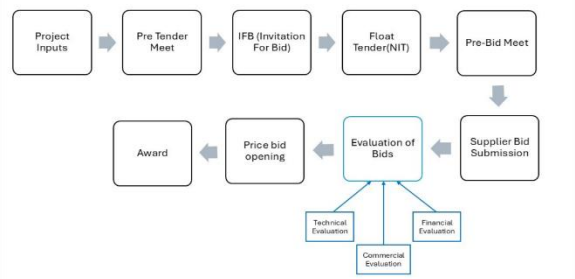

Fig 1: Flowchart of Bidding process

Proposed Solution: Blockchain Integration

Objective: Use blockchain for storing and verifying BQC documents for commercial and financial evaluations.

Blockchain-Based Document Management Process: In the proposed blockchain-based system, bidders submit their documents to the organization, which then verifies the authenticity and compliance of the documents. Once the submitted documents are approved and deemed suitable for qualification, they are uploaded to the blockchain.

Document Submission and Verification: Bidders provide required documentation, including financial reports, past performance records, and audit reports.

Process: The organization conducts a thorough verification process to ensure the accuracy and authenticity of the submitted documents.

Revolutionizing Tender Evaluation in Public-Sector Procurement through Blockchain Technology

Tanvi Hodage, K V Kashi Raj

Blockchain Upload: Approved documents are uploaded to the blockchain after receiving necessary approvals from the client organization. These documents remain immutable and accessible for any future tenders.

Futuristic Use: For future tenders, if the same bidder participates, their blockchain-verified documents can be retrieved instantly without requiring further verification. This reduces redundancy, saves time, and ensures seamless qualification for repeat bidders.

This streamlined approach eliminates repetitive evaluations, enhances transparency, and significantly reduces the time required for bid evaluations.

Key documents include:

- Audit reports
- Previous work completion certificates
- Purchase Orders (POs)
- Verification of the POs
- Other unchanging compliance documents.

How it works:

- Bidder submits the documents to the buyer organisation, evaluator evaluates, and uploads verified documents to the blockchain once. These documents serves as the reference for the future bids.
- Immutable storage ensures documents remain tamper-proof and readily accessible for future tenders.
- Evaluation teams retrieve pre-verified documents, eliminating redundant checks.

Implementation Roadmap:

Phase 1: Pilot implementation for Commercial and Financial Document storage and verification. A small set of tenders will be selected to test the feasibility of using blockchain for reducing evaluation time and enhancing data accuracy. This phase will help identify any technical challenges and gather feedback from procurement teams and bidders.

Phase 2: expand to Include Technical evaluation and to integrate with smart contract for Bid Processing. After successful completion of the pilot, the scope will be expanded to include technical evaluations. Smart contracts will be integrated to automate bid compliance checks and streamline bid processing workflows. This phase aims to cover more complex aspects of procurement and ensure that the system is robust enough for larger-scale adoption.

Phase 3: Full Scale out option across all the tenders in the organization. The final phase will involve rolling out blockchain technology across all tenders within the organization. Training programs will be conducted to familiarize procurement teams and suppliers with the system. Continuous monitoring mechanisms will be established to evaluate the system's performance, address any issues, and identify opportunities for further optimization.

Benefits:

- Reduced Documentation Workload: Blockchain can digitize and store compliance-related documents (such as tax clearance certificates, environmental clearances, etc.) in a way that simplifies compliance verification, reducing the amount of paperwork and manual intervention required.
- Enhanced Collaboration: Different procurement teams (technical, commercial, legal, Finance) can collaborate in real-time using the same verified data, thus speeding up the evaluation and decision-making processes. By reducing delays and improving efficiency in the short term, blockchain can have significant long-term benefits for procurement organizations. These include cost savings,

faster project execution, and improved supplier relationships.

- Speedier Bidder Execution: With faster bid evaluations and decision-making, projects can progress quickly, helping to keep deadlines and timelines on track.
- Cost Savings: By reducing delays in the procurement process, organizations can reduce cost overruns due to extended timelines, thus promoting economic efficiency.

Future scope:

The future of blockchain in the procurement process is poised to reshape how businesses handle transactions, supply chains, and relationships with suppliers. Here are some futuristic examples of how blockchain could transform procurement:

1. Decentralized Supplier Networks: A company might join a decentralized procurement platform where multiple suppliers are connected through a blockchain network. In this ecosystem, suppliers can offer their goods and services in real-time, and companies can place orders directly, bypassing traditional centralized procurement systems. In this system, blockchain ensures that all transactions are secure and traceable. A company could quickly compare multiple suppliers' offers on price, lead time, and quality, allowing for better purchasing decisions with a transparent audit trail. This reduces dependency on intermediaries, speeds up procurement cycles, and fosters healthy competition among suppliers.

2. Automated and Self-Executing Contracts (Smart Contracts): A multinational corporation enters a contract with a supplier using a blockchain-powered smart contract. Once the contract terms are agreed upon, the smart contract is automatically executed when conditions are met. For instance, upon shipment delivery, blockchain automatically releases payment to the supplier. Additionally, if quality inspection results are uploaded into the blockchain, a clause in the smart contract could trigger a penalty if the product doesn't meet the required standards. This reduces the time and cost associated with legal intermediaries, dispute resolution, and administrative processes, while also increasing efficiency and accountability.

3. Real-Time, Transparent Supply Chain Tracking: Using blockchain, every step of the procurement process—from the extraction of materials to final delivery—could be tracked in real time, providing stakeholders with transparent, immutable data. For instance, a company might need ethically sourced raw materials for its products. Blockchain could provide an audit trail showing that the supplier has adhered to ethical sourcing standards, ensuring transparency from farm to factory. This reduces the risk of counterfeiting and ensures compliance with sustainability and ethical standards.

4. Frictionless Payment System: A cross-border supplier sends goods to a buyer in another country. Traditionally, this would involve multiple intermediaries, banks, currency conversions, and wire transfers—leading to delays and added costs. With blockchain, the entire payment process could be executed instantly using cryptocurrency or tokenized fiat currency. Blockchain’s secure and transparent payment system would enable immediate settlement without third-party involvement, reducing transaction costs and speeding up the entire process.

5. Advanced Inventory Management with Blockchain: Imagine a situation where a company’s raw materials are being used across multiple production facilities. Each facility tracks its inventory on the blockchain, and once stock levels hit a predefined threshold, the system automatically triggers an order with the supplier to replenish it. Furthermore, the supplier could instantly update the blockchain with shipment details, ensuring that everyone involved in the supply

chain has real-time visibility. This system ensures that procurement is leaner, reduces inventory shortages, and eliminates human error.

6. Blockchain for Sustainability and Compliance Verification: A large retail brand sources clothing from a network of global suppliers. Using blockchain, the brand can ensure that every stage of the supply chain adheres to environmental and labor standards.

7. Predictive Analytics in Procurement: By integrating blockchain with AI and machine learning, companies can predict procurement needs more accurately. For example, an AI algorithm can analyze data stored on the blockchain (such as past purchasing trends, market prices, supplier performance, and shipping data) to forecast future procurement needs. Blockchain ensures the data is accurate and tamper-proof. The AI system then suggests the best suppliers, optimal order quantities, and potential cost-saving opportunities, further optimizing the procurement process and reducing the need for manual intervention.

In summary, the blockchain's future scope in procurement is rich with potential. By offering enhanced transparency, security, efficiency, and automation, blockchain could drastically reduce procurement cycle times, improve supplier relationships, and ensure more reliable, cost-effective sourcing strategies. The key to these advancements lies in the combination of blockchain's immutable ledger with emerging technologies such as AI, IoT, and smart contracts. These fusion promises to create highly efficient, secure, and future-ready procurement systems.

Impact of Blockchain:

- Reducing Bid Evaluation Time by 2-3 weeks (from 4-5 weeks to 2-3 weeks).
- Reducing Administrative Workload by 40%.
- Speeding up Contract Execution by 1-2 weeks.
- Facilitating Real-time Collaboration saves 30% of the time.

Blockchain technology can reduce procurement delays by 30-40% in India's public-sector procurement processes bringing the entire process down to approximately 6-7 weeks instead of the current 9-10 weeks. This is achieved through faster bid evaluations, reduced administrative work, and automated contract execution, leading to cost savings, quicker project timelines, and improved supplier relationships. With the potential to save several weeks in procurement cycles, blockchain can greatly enhance procurement efficiency, keeping projects on schedule and within budget.

By addressing these bottlenecks, blockchain not only enhances the speed of procurement but also improves transparency, accountability, and long-term sustainability, ensuring that projects are delivered on time and within cost constraints.

Revolutionizing Tender Evaluation in Public-Sector Procurement through Blockchain Technology

Tanvi Hodage, K V Kashi Raj

References

1. Ng, B., Ferrin, B.G. and Pearson, J.N. 1997. The role of purchasing/transportation in cycle time reduction', International Journal of Operations and Production Management, 17(6), pp.574– 591 https://www.emerald.com/insight/content/doi/10.1108/01443579710167267/full/html
2. World Bank. (2020). Public Procurement Systems: Efficiency and Economic Impact. Retrieved from [World Bank Reports].
3. Government of India. (2012). Public Procurement Policy for Micro and Small Enterprises. Ministry of MSME.
4. GeM India. (2023). Impact of Government e-Marketplace on Procurement Efficiency.
5. OECD. (2019). Government at a Glance: Public Procurement Statistics.
6. KPMG. (2021). The Future of Procurement: Digital Transformation and Beyond.
7. New Indian Express. (2022). 51% of Govt Projects Face Delays. Retrieved from [New Indian Express].
8. India Tracker. (2023). Delayed Infrastructure Projects in India. Retrieved from [India Tracker].
9. Moneycontrol. (2023). Infrastructure Project Delays. Retrieved from [Moneycontrol].
10. Economic Times. (2023). Cost Overruns in Delayed Projects. Retrieved from [Economic Times].
11. World Economic Forum. (2021). Blockchain in Procurement: Unlocking Value. Retrieved from [World Economic Forum].
12. IBM Blockchain. (2022). Smart Contracts for Procurement Efficiency. Retrieved from [IBM Blockchain].
13. PwC. (2023). Blockchain in Supply Chains. Retrieved from [PwC Reports].