

Next Gen NOC Process Architecture for Public Offices in India

Vijay Shankar Pandey¹, Surabhi Kumari²

¹Email: [dfonagaur\[at\]gmail.com](mailto:dfonagaur[at]gmail.com)

²Email: [vspsurabhi\[at\]gmail.com](mailto:vspsurabhi[at]gmail.com)

Abstract: *Achieving the vision of Viksit Bharat by 2047 requires sustained economic growth supported by private investment, export competitiveness, and efficient governance systems. Despite significant reforms since 1991, fragmented regulatory processes and complex No Objection Certificate (NOC) mechanisms continue to increase compliance costs, delay project implementation, and constrain investment. This paper proposes a Next Generation NOC Governance Framework based on Artificial Intelligence (AI), Blockchain technology, and integrated digital infrastructure. The proposed architecture transforms the existing sequential approval model into a synchronous, interoperable system where multiple departments process applications simultaneously through real-time data exchange. AI-driven decision support enables automated verification, risk assessment, and improved regulatory compliance, while blockchain ensures transparency, traceability, and tamper-resistant records. The framework reduces procedural redundancy, minimizes delays, and enhances accountability by creating a unified governance ecosystem. The proposed model offers a pathway for modernizing regulatory administration and strengthening India's ease of doing business for sustainable economic development.*

Keywords: Blockchain, Artificial Intelligence (AI), NOC, Ease of Doing Business, License Raj, e-Governance

1. Introduction

With 1.44 billion semi-skilled population India aspires to become Vikshit Bharat by 2047. For dream of Vikshit Bharat to be realized, India needs sustained 7-8% economic growth. That hinges heavily on a revival of private sector investment and robust export growth. For that, structural reforms must be a priority to enhance private investment, domestic capacity and product quality for global competitiveness. While historical blunder of missing blue color industrial revolution phase, the aspiration of vast population to be meted out requires governance reforms by Easing Doing of Business, removing sackless that bind the animal instinct of value-added economy. This requires reforms in licensing and regulatory approval process and issuance of No Objection Certificates (NOC).

2. License Raj Reforms in India

Following independence, India adopted a centralized, state-led governance model characterized by extensive government intervention in economic activities. Policies such as the Monopolies and Restrictive Trade Practices (MRTP) Act, stringent labour regulations, and the License Raj reflected the strategy of import substitution and public sector dominance. While these measures aimed to promote equitable development, they also increased bureaucratic discretion, regulatory complexity, and compliance costs, thereby constraining private investment and entrepreneurial growth. The economic reforms initiated in 1991 marked a significant transition from a control-based regime to a liberalized and market-oriented governance framework. Driven by the Balance of Payments crisis, these reforms emphasized deregulation, privatization, and the establishment of transparent regulatory institutions. More recently, the policy objective of "Maximum Governance, Minimum Government" has accelerated efforts to improve the Ease of Doing Business (EoDB). Digital governance initiatives such

as PRAGATI, PM Gati Shakti, and the National e-Governance Plan have streamlined administrative processes through online service delivery, transparent monitoring, and time-bound approvals. Complementary reforms, including labour law rationalization, single-window clearance mechanisms, and the Jan Vishwas Acts, have reduced regulatory burdens and simplified compliance. Despite these advancements, persistent challenges, including overlapping regulations, state-level procedural variations, and delays in statutory clearances, indicate the need for continued governance reforms to enhance administrative efficiency and foster sustainable economic growth. The persistence of the License Raj through multiple No Objection Certificates (NOCs) remains a major governance challenge. While NOCs ensure regulatory compliance and accountability, complex and time-consuming approval procedures increase transaction costs, delay project implementation, and constrain both private and public investment, highlighting the need for streamlined, risk-based regulatory reforms.

3. Current Status of NOC Process System in India

Although the 1991 economic reforms significantly improved governance at the central level, similar reforms have progressed slowly across many Indian states. Several state departments continue to rely on physical file-based systems, while critical reforms in land administration, the judiciary, and policing remain limited. Departments such as Forest, Mining, Revenue, Public Works, and Industry often function in silos with minimal interdepartmental coordination, resulting in fragmented decision-making and procedural delays. Weak contract enforcement and unresolved land disputes further discourage private investment. Despite the introduction of single-window clearance systems, applicants frequently require separate approvals from multiple departments, each following independent verification processes. For instance, establishing a stone-crushing unit

requires clearances from Forest, Mining, Revenue, Pollution Control, and Environmental authorities, leading to repetitive scrutiny, conflicting decisions, and higher compliance costs. Additionally, fear of administrative accountability often results in risk-averse decision-making and delayed approvals. Greater digital integration, land and judicial reforms, and coordinated regulatory mechanisms are essential to improve governance efficiency and facilitate investment. The issuance of No Objection Certificates (NOCs) in India involves multiple departments, including Fire, Forest, Revenue, Pollution Control, Municipal, Mining, and Urban Development authorities, which often function in isolation. This results in repetitive documentation, multiple inspections, delayed approvals, increased compliance costs, and reduced investment efficiency. Manual processes, fragmented databases, and limited interdepartmental coordination further hinder transparency and accountability. Although reforms such as single-window systems, e-office platforms, digital signatures, online portals, and risk-based approvals have

improved governance, their effectiveness remains constrained by departmental silos, weak enforcement, poor database interoperability, and inadequate digital integration. NOC time taken can best be exemplified by existing mining process architecture figure 1 as follows:

Let,

Time to issue mining NOC by Revenue Department = $T_{revenue}$

Time to issue mining NOC by Forest Department = T_{forest}

Time to issue mining NOC by Mining Department = T_{mining}

Time to issue mining NOC by Pollution Control Board = T_{pcb}

Time to issue mining NOC by State Level Environment Impact Assessment Authority = T_{seiaa}

Time to issue final mining NOC = $T_{processing}$

Under existing mining NOC Architecture:

$$T_{processing} = \sum(T_{revenue}, T_{mining}, T_{forest}, T_{pcb}, T_{seiaa}) \dots (1)$$

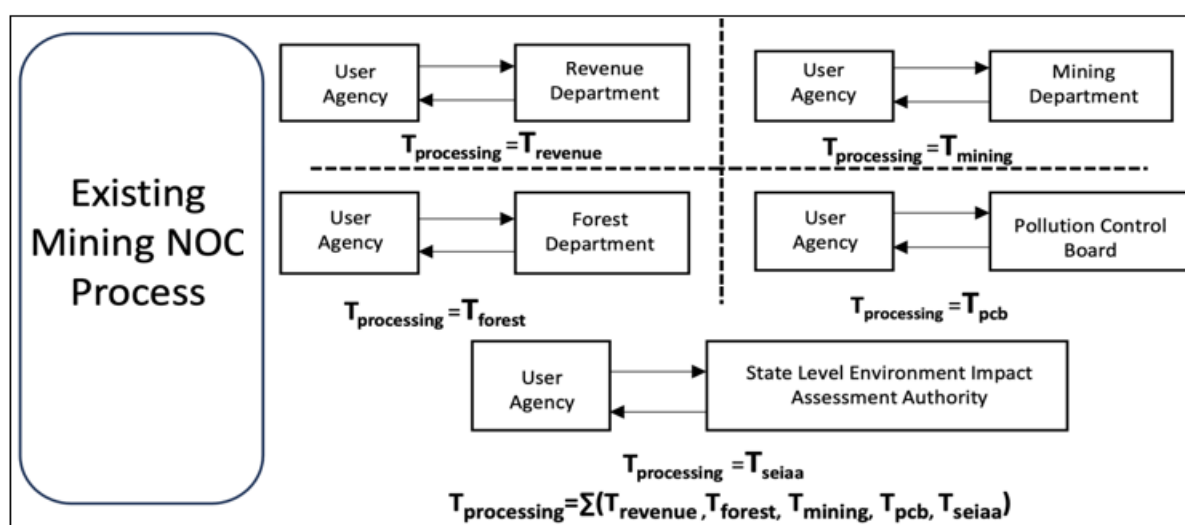


Figure 1: Existing Mining NOC Process Architecture

Existing No Objection Certificate (NOC) approval mechanisms largely operate through asynchronous and fragmented workflows, increasing both processing time and compliance costs. The absence of integrated decision-making allows errors by one department to propagate across subsequent approvals, often resulting in conflicting decisions and rejection of otherwise valid applications. For instance, an incorrect land classification by the Revenue Department may lead the Mining Department to grant a mining lease, while the Forest Department subsequently rejects the proposal because the land is recorded as forest land. Such inconsistencies impose substantial financial losses on applicants, delay project implementation, and undermine investor confidence and the Ease of Doing Business. Although several states organize investment summits and sign Memoranda of Understanding (MoUs) to attract private investment, fragmented NOC systems frequently delay project execution, resulting in low conversion of investment commitments into operational projects. Therefore, achieving the vision of **Viksit Bharat by 2047** requires transitioning to an integrated, technology-driven approval ecosystem. Emerging technologies, including Artificial Intelligence for automated document verification, risk assessment, and fraud detection, and Blockchain for secure, tamper-proof approval tracking,

can significantly enhance transparency, efficiency, and accountability. Global best practices, such as Singapore's integrated digital approval system and Estonia's paperless governance with interoperable databases and digital identity, provide useful models for modernizing India's regulatory approval framework.

4. Blockchain Framework

Blockchain is a decentralized distributed ledger technology that enables secure, transparent, and tamper-resistant exchange of digital assets and information across peer-to-peer networks. Its architecture integrates cryptographic mechanisms and consensus protocols to establish trust without reliance on centralized authorities. Each participating node maintains an updated copy of transaction records, eliminating single points of failure and reducing vulnerabilities to manipulation. Transactions are validated through network-based verification before being permanently recorded in interconnected data blocks. The resulting immutable and synchronized ledger provides a reliable single source of truth, enhancing data integrity, traceability, and security across distributed systems. A bare Blockchain ecosystem⁷ can be best described as:

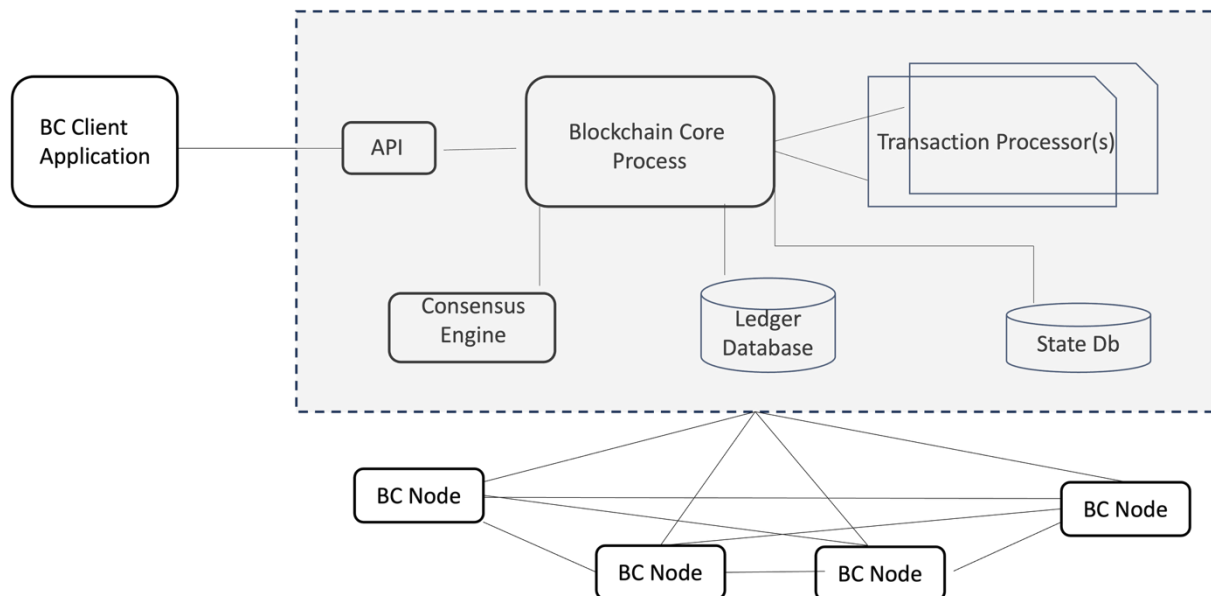


Figure 2: Blockchain ecosystem

Recent studies highlight the potential of Blockchain, Artificial Intelligence (AI), and Machine Learning (ML) in improving government approval systems. Shang and Price¹ demonstrated that Blockchain-based land registry in Georgia enhanced efficiency, transparency, and reduced corruption. Iwuda et al.² found that Blockchain licensing systems improved trust, automated approvals, and reduced piracy. Gandhi et al.³ proposed Blockchain-based approval frameworks to minimize delays and increase transparency between authorities and users. Silvia S et al.⁴ conclude that Estonia's e-Government model shows the effectiveness of secure digital governance. Taylor et al.⁵ emphasized AI/ML-based automation for faster and more accurate NOC

processing. These technologies can modernize India's fragmented approval ecosystem by enabling transparent, efficient, and accountable governance.

Proposed Next Gen NOC Process Architecture

Proposed model of Next Gen NOC approval model seeks to create a unified NOC Governance Platform which mandates API integration across department. Each department operates simultaneously with User Agency making an application for NOC to unified NOC platform. Intra departmental processing framework uses Artificial intelligence-based decision support system and global Blockchain database which is updated in real time. The model operates as per figure 3:

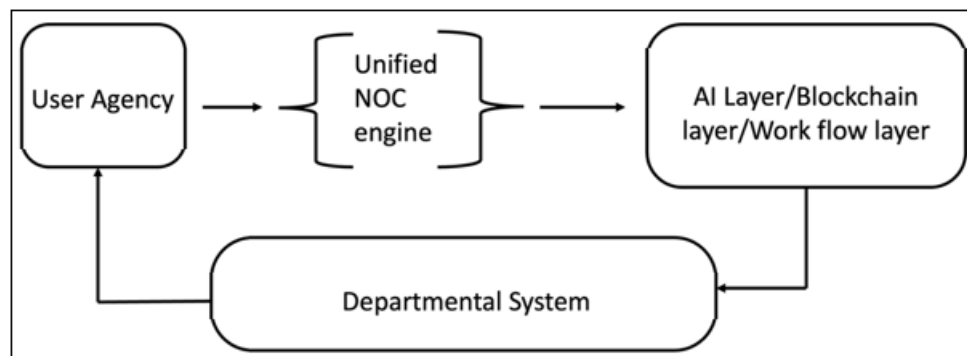


Figure 3: Next Gen NOC Process Model

Proposed Next Gen NOC Architecture works on synchronous architecture wherein each linked steps work simultaneously of their desired works. The progress done by each individual department entity is simultaneously updated based on blockchain architecture. The time of approval for NOC under the proposed model depends upon which one is the rate determining department in the chain. The highest time taken

out of all chain departments in the time of approval of NOC. For existing model architecture, the time of approval of NOC is sum total of time taken by each department individually. Further the proposed model avoids the redundancy and error as databases are interconnected and updated on real time based on blockchain model. The proposed NOC approval model can be represented as per figure 4.

Next Gen NOC Process Architecture

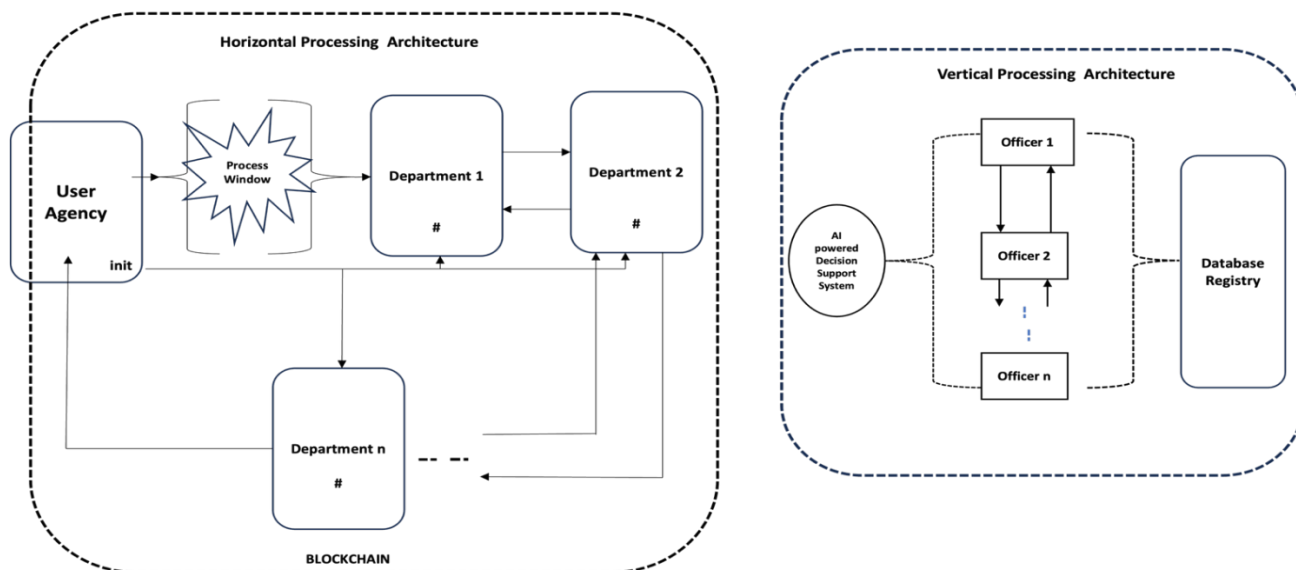


Figure 4: Next Gen NOC Process Architecture

Under the proposed architecture whole process works in blockchain architecture with support for Artificial Intelligence Decision Support System and interacted database registry. The proposed architecture has been divided into two segments i.e. Horizontal and Vertical Segments.

Horizontal Processing Segment: The segments present block view of process flow from User Agency to various departments and ends at User Agency. The **init** signal from User Agency block activates functioning of each department simultaneously based on starting information from User Agency via **init** signal. The whole architecture works on public Blockchain platform.

Vertical Processing Segment: The segment deals into actual decision making in a department regarding signal. The process takes input from previous department, **init** signal from User Agency and is supported by Artificial Intelligence powered decision support system and required Interactive Database registry. The whole segments work in local as well as global registry Blockchain.

Time Complexity: With the start of **init** signal each department starts working simultaneously with access to public Blockchain data base. Departmental processing operation is independent of each other.

Let,

Processing time of each individual department = T_i

Processing time from application by User Agency to final

approval = $T_{\text{processing}}$

Number of departments in approval chain = n

Hence,

$$T_{\text{processing}} = \text{Max}(T_i) \text{ for } i \in (1, n) \dots \dots \dots (2)$$

5. Key Outcomes

Table 1: Comparative analysis of existing and next gen noc process architecture

No	Parameter	Existing NOC Process Architecture	Next Gen NOC Process Architecture
1	Approval time	Weeks/Months	Days/Hours
2	Transparency	Low	Very high
3	Document fraud	Moderate	Minimal
4	Manual verification	High	Complete
5	Accountability	Multiple	Complete
6	Citizen visits	Multiple	Nil
7	Auditability	Difficult	Real time

For better understanding two case studies have been represented with their Next Gen NOC process architecture and their processing time as follows:

[A] Case Study 1: Mining NOC Next Gen Process Architecture

For Next Gen NOC process architecture for mining as per figure 5, the processing time is as per equation (3):

$$T_{\text{processing}} = \text{Max}(T_{\text{revenue}}, T_{\text{mining}}, T_{\text{forest}}, T_{\text{pcb}}, T_{\text{seiaa}}) \dots \dots \dots (3)$$

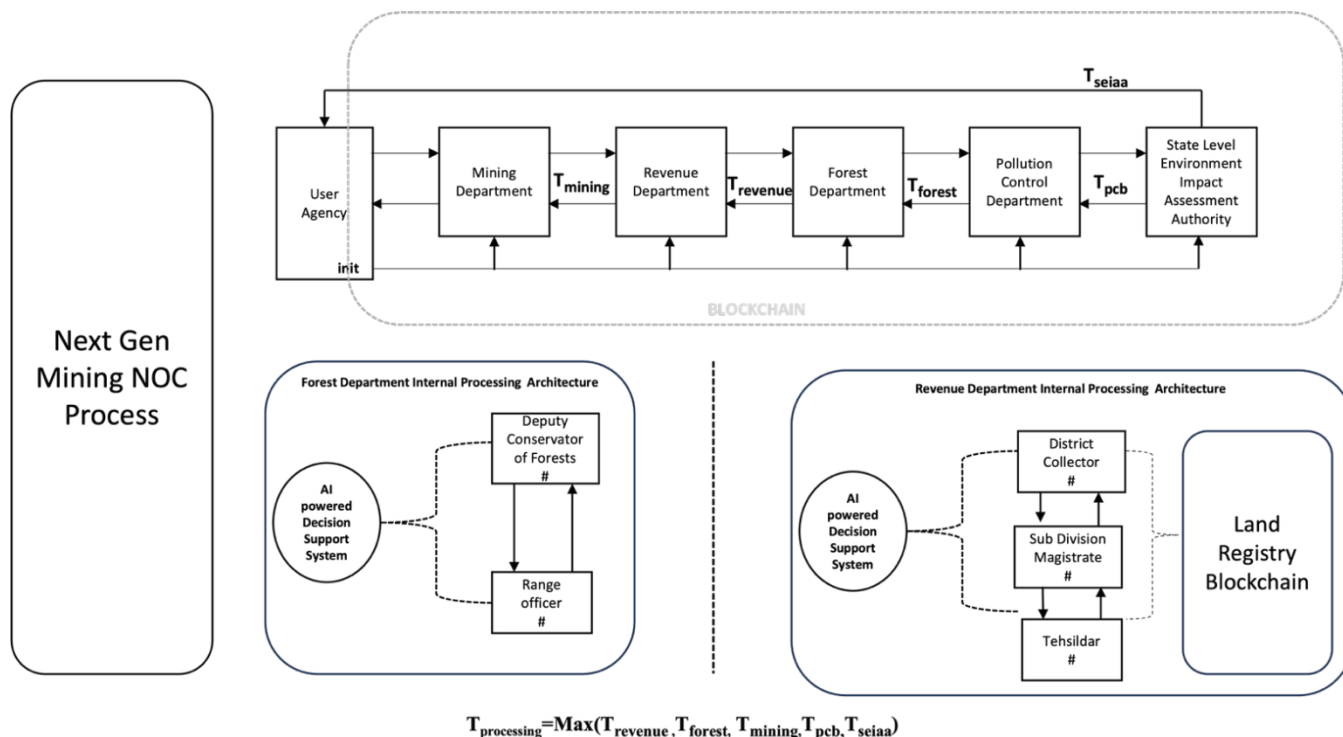


Figure 5: Next Gen NOC Process Architecture for mining

[B] Case Study 2: Forest land diversion Next Gen NOC Process Architecture

Forest land diversion cases are key rate determining processes for big ticket infrastructure projects involving forest land. Complex and multistage nature of approval process leads to final NOC getting issued after months. Let
 Time to process the proposal from User Agency at DCF level = T_{dcf}

Time to process the proposal from DCF to CCF level = T_{ccf}
 Time to process the proposal from CCF to Nodal Officer level = T_{nodal}
 Time to process the proposal from Nodal officer to Forest Secretary = T_{fs}
 Time to process the proposal from Forest Secretary to IRO = T_{iro}
 Time to process the proposal from IRO to REC = T_{rec}

Table 2: Comparative analysis of processing time in exiting and next gen architecture of PARIVESH

Processing time under Existing Architecture	Processing time under Next Gen NOC Architecture
$T_{\text{processing}} = \Sigma(T_{\text{dcf}}, T_{\text{ccf}}, T_{\text{nodal}}, T_{\text{fs}}, T_{\text{iro}}, T_{\text{rec}})$	$T_{\text{processing}} = \text{Max}(T_{\text{dcf}}, T_{\text{ccf}}, T_{\text{nodal}}, T_{\text{fs}}, T_{\text{iro}}, T_{\text{rec}})$

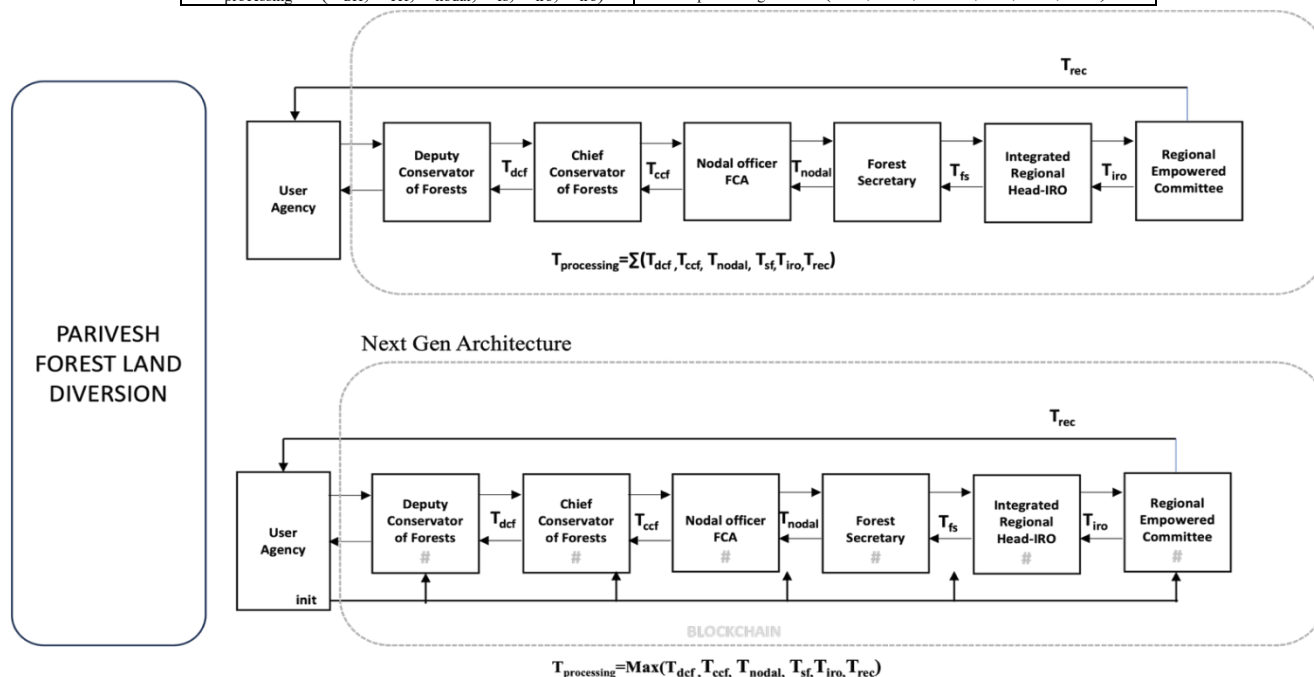


Figure 6: Next Gen NOC Process Architecture for forest land diversion

6. Conclusion

A Blockchain enabled AI-driver unified NOC ecosystem can transform India's NOC approval framework from fragmented paper-heavy process to into a transparent, temper proof, predicative and citizen centric governance model. By combining permissioned Blockchain, smart contracts and AI-assisted decisions support and scrutiny system, India can create a Single Source Truths for approvals, dramatically reducing delays, corruption risk and compliance cost while improving ease of doing business and public service delivery. The proposed Next Gen NOC process architecture can serve large in reducing processing time for issue approvals/licenses. It can serve best in attracting private capital investment, ease of doing business in achieving vision Vikshit Bharat by 2047.

Acknowledgment

We thank Arijit Benerjee, IFS, PCCF (HoFF), Pawan Kumar Upadhyay, IFS, PCCF and Udai Shankar, IFS, APCCF for motivation and guidance. Also, thank Khyati Mathur, IFS, CCF Ajmer for continuous support.

Vijay Shankar Pandey belongs to Indian Forest Service (IFS) 2016 batch and currently serves as Deputy Conservator of Forests, Nagaur. **Surabhi Kumari is a banker working as Assistant Manager, Canara Bank, Udaipur.

References

- [1] Shang, Qiuyun & Price, Allison. (2019). A Blockchain-Based Land Titling Project in the Republic of Georgia: Rebuilding Public Trust and Lessons for Future Pilot Projects. *Innovations: Technology, Governance, Globalization*. 12. 72-78. 10.1162/inov_a_00276.
- [2] Iwuala, Chibueze & Eze, Udoka & Chukwudebe, G. & Etus, Chukwuemeka. (2024). Development of a Blockchain System for Licensing Services for Nigerian Communications Commission. *International Journal of Innovative Science and Research Technology (IJISRT)*. 81-92. 10.38124/ijisrt/IJISRT24MAY512.
- [3] Kiwelekar, Arvind & Gandhi, Sanil & Netak, Laxman. (2023). A blockchain-based data-driven trustworthy approval process system. *International Journal of Information Management*. 3. 10.1016/j.jjime.2023.100162.
- [4] Semenzin, Silvia & Rozas, David & Hassan, Samer. (2022). Blockchain-based application at a governmental level: disruption or illusion? The case of Estonia. *Policy and Society*. 41. 10.1093/polsoc/puac014.
- [5] Tailor, Shrinath and Verma, Devanshu, Study of Fire Safety Service: Using AI and ML to Automate the Process of NOC Issuance and Follow-Ups (December 04, 2024). Available SSRN: <https://ssrn.com/abstract=5048512> or <http://dx.doi.org/10.2139/ssrn.5048512>
- [6] Alotaibi, Eid & Issa, Hussein & Codesso, Mauricio. (2025). Blockchain-based conceptual model for enhanced transparency in government records: a design science research approach. *International Journal of Information Management Data Insights*. 5. 1-15. 10.1016/j.jjime.2024.100304.
- [7] <https://blockchain.gov.in>