

# A Permissioned Blockchain Framework for Tamper-Evident Land Record Verification

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**Abstract**— Land records are often maintained in separate systems by different offices, which makes verification slow and creates room for disputes. This paper proposes a permissioned blockchain framework in which authorised offices record each change of ownership as a signed transaction, giving citizens and banks a tamper-evident history. A prototype built on an open-source permissioned platform shows acceptable transaction throughput and latency for district-level use. The paper also discusses privacy, governance and integration with existing systems. Figures in this template are sample values.

**Index Terms**— *blockchain, land records, e-governance, smart contracts, data integrity*

*This is a template: all data, results and references are placeholders for the author to replace.*

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## I. INTRODUCTION

Clear land titles are essential for buying property, obtaining loans and resolving inheritance. When records are kept in different offices and formats, verifying ownership can take weeks and errors are hard to trace.

A blockchain keeps an append-only ledger shared among participants. In a permissioned network, only authorised organisations can add records, which suits government processes better than public cryptocurrencies.

The main contributions of this paper are as follows:

- A framework design with roles for revenue, registration and survey offices.
- Smart contracts that enforce the sequence of approvals for a transfer.
- A performance evaluation of a prototype network.

The rest of the paper is organised as follows. Section II reviews related work, Section III describes the proposed framework, Section IV presents the experimental setup, Section V reports and discusses the results, and Section VI concludes the paper.

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## II. RELATED WORK

Pilot projects have explored blockchain for property registries in several countries [1].

Permissioned platforms offer higher throughput than public blockchains [2].

Studies stress that a blockchain cannot correct errors already present in the original records [3].

Privacy-preserving designs store documents off-chain and only hashes on-chain [4].

| Ref. | Approach                   | Data         | Limitation              |
|------|----------------------------|--------------|-------------------------|
| [1]  | Public blockchain registry | Pilot        | Low throughput, privacy |
| [2]  | Permissioned ledger        | Simulation   | No integration plan     |
| [3]  | Hash anchoring             | Prototype    | Limited workflow        |
| [4]  | Policy review              | Case studies | No implementation       |

TABLE I. Summary of related work

## III. PROPOSED FRAMEWORK

Each participating office runs a peer node. A transfer request is created by the registration office, endorsed by the revenue and survey offices, and committed only when all endorsements are present.

Scanned documents are stored in an off-chain document store; only their cryptographic hashes are kept on the ledger, which keeps personal data off the shared chain.

### A. Overview

The architecture has three layers: a web portal for citizens and banks, an application layer with smart contracts, and the ledger network with peer nodes for each office.

Figure placeholder — block diagram of the proposed framework

Fig. 1. Overview of the proposed framework

### B. Algorithm

1. Citizen or bank submits a transfer request through the portal.
2. Registration office verifies documents and creates a transaction.
3. Survey and revenue offices endorse the transaction.
4. The ordering service commits the block.
5. The portal shows the updated, verifiable record.

## IV. EXPERIMENTAL SETUP

A test network with five peer nodes and one ordering service was deployed on virtual machines. Synthetic records were used; no real personal data was involved.

| Parameter          | Value                 |
|--------------------|-----------------------|
| Peer nodes         | 5                     |
| Ordering service   | Raft, 3 nodes         |
| Block size         | 50 transactions       |
| Records            | 10,000 synthetic      |
| Endorsement policy | 3 of 3 offices        |
| Load tool          | Open-source benchmark |

TABLE II. Experimental parameters

### A. Evaluation Metrics

- Throughput (transactions per second)
- Average commit latency (seconds)
- Storage growth per 1,000 records

## V. RESULTS AND DISCUSSION

The prototype handled typical district workloads comfortably. Latency increased with stricter endorsement policies, as expected.

| Endorsement policy | Throughput (tps) | Latency (s) |
|--------------------|------------------|-------------|
| 1 of 3             | 310              | 0.9         |
| 2 of 3             | 245              | 1.3         |
| 3 of 3             | 190              | 1.8         |

TABLE III. Comparison with baseline methods (sample data)

Chart placeholder — insert a graph of your results

*Fig. 2. Throughput as the number of concurrent clients increases (sample data)*

A district office processes far fewer transfers per day than the measured throughput, so performance is not a barrier.

The main challenges are governance — who runs the nodes — and the quality of the initial digitised records.

## A. Ablation Study

To understand the contribution of each component, we removed one component at a time and repeated the evaluation. Table IV shows that every component contributes to the final result, with the largest drop observed when the endorsement step is removed.

| Variant                  | Latency (s) |
|--------------------------|-------------|
| Full model               | 1.8         |
| Without endorsement step | 0.9         |
| Without pre-processing   | 1.7         |
| Baseline only            | 0.8         |

*TABLE IV. Ablation results (sample data)*

## B. Limitations

- Synthetic data only.
- No user study with citizens or officials.
- Legal recognition of blockchain records is outside the scope.

## C. Threats to Validity

Internal validity may be affected by the choice of hyper-parameters, which were tuned on a validation split and not on the test data. External validity is limited because the data were collected in a specific region and time period; results may differ in other settings. Construct validity depends on how well the chosen metrics reflect real-world usefulness, which we partly addressed through feedback from domain users.

## VI. CONCLUSION AND FUTURE WORK

A permissioned blockchain can provide a tamper-evident history of land transactions with acceptable performance for district-level use.

Future work includes a pilot with real anonymised data, integration with existing registration software and a usability study.

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