Tokenization of Real Estate in India: Bridging Blockchain with Market Realities

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Abstract

Tokenization of real estate using blockchain technology has the potential to radically transform property ownership and access in India. This paper explores how smart contracts, fractional ownership, and digital registries can address key inefficiencies in India's real estate market—particularly high entry barriers, title disputes, and transfer delays. The study draws on global best practices and contextualizes them for Indian policy, technical infrastructure, and market behavior.

Keywords: Real Estate, Blockchain, Tokenization, Fractional Ownership, Smart Contracts, India

1 Introduction

India's real estate sector is pivotal in the economy, contributing 7.3% to the GDP and employing over 55 million people [1]. Despite its impressive market valuation of $1.5 trillion, the sector grapples with deep-rooted inefficiencies. Buying premium property often requires over ₹50 lakh in upfront capital, making real estate ownership a distant dream for most Indians [3]. In rural areas, land title disputes affect nearly 35% of properties, leading to prolonged legal battles and uncertainty [2], [14]. Meanwhile, urban property transfers can take between 3 and 18 months, while rural transactions, especially those involving disputed lands, can drag on for 1 to 3 years [13].

These bottlenecks have made real estate one of India's least liquid asset classes, with retail participation hovering at just 3–5% [3]. As a result, wealth continues to

concentrate in the hands of a few, further widening the economic divide.

That's where blockchain-based tokenization offers a breath of fresh air. By breaking real estate into digital tokens representing fractional ownership, tokenization opens access to a much broader investor base. Globally, this model has already taken off: the U.S. has seen over $2.4 billion in tokenized real estate under SEC Regulation A+ offerings [6], [10], while Switzerland is experimenting with DAO-driven cooperatives for tokenizing agricultural assets worth €500 million [7], [11].

Closer to home, the momentum is building. Terazo recently launched a ₹400 crore tokenized commercial asset in GIFT City, while Bru Finance is piloting ₹500 crore worth of tokenized agri-commodity NFTs [4]. These projects are lowering the entry point for investors to just ₹10 lakh, and smart contracts are cutting transaction times by as much as 60% [4], [5].

This report proposes a hybrid framework that blends regulatory reforms with cutting-edge technology to unlock the sector's full potential. For urban markets, we suggest leveraging SEBI-compliant security tokens like ERC-3643, in tandem with RBI's upcoming CBDC, to streamline cross-border investments from NRIs [1], [4]. For rural areas, we take cues from Swiss cooperatives and suggest DAO-based governance to digitize land titles, track subsidy flows via NFTs, and attract ESG-focused capital [5], [7].

Two central questions guide this research:

- How can successful tokenization models from the U.S., Switzerland, and UAE be localized to suit India's regulatory and infrastructural realities?
- What changes are necessary to align SEBI, RERA, and state land registries for scalable, compliant tokenization?

Drawing from over 10 academic papers, regulatory circulars, and real-world pilots like Maharashtra's blockchain-based land registry initiative [5], this report outlines a roadmap to unlock 7.5 trillion rupees in illiquid real estate and potentially add 1.2% to India's GDP by 2030.

The following chapters will dive deeper into current pain points, present a detailed hybrid framework, and offer actionable recommendations for regulators, developers, and investors.

2 Literature Review

2.1 Global Regulatory Models for Real Estate Tokenization

2.1.1 United States – SEC Regulation A+

The U.S. has been one of the early adopters of retail-friendly real estate tokenization, mainly through SEC Regulation A+, which allows issuers to raise to $75 million

annually from accredited and non-accredited investors [1]. This framework opens the door to a broader base of investors by setting entry thresholds as low as $1,000, while maintaining relatively strict disclosure and compliance standards [2]. It's helped platforms like RealT and Lofty tokenize more than $2.4 billion in real estate assets between 2023 and 2025 [3]. Projects like the St. Regis Aspen Resort, where nearly 18.9% of ownership has been tokenized, highlight the potential for luxury asset democratization [4].

Still, there's regulatory complexity due to the Howey Test, which often categorizes tokens as securities. As a result, issuers frequently rely on exemptions like Regulation D (for private placements) or Regulation S (for international offerings) to stay compliant [5].

Adaptability to India: SEBI's introduction of Small and Medium REITs (SM REITs) in 2024 offers a similar route by allowing fractional ownership, with a minimum ticket size of ₹10 lakh [6]. However, a key challenge lies in defining how tokenized assets are treated under laws like the Securities Contracts (Regulation) Act (SCRA). Without that clarity, regulatory overlaps or loopholes could emerge. SEBI's 2025 amendment to the Prohibition of Insider Trading Regulations, which now includes tokenized assets under Unpublished Price Sensitive Information (UPSI), suggests that India is moving toward alignment with global frameworks [7].

2.1.2 Switzerland – FINMA DAO Governance

Switzerland, through FINMA (Financial Market Supervisory Authority), treats asset-backed tokens as securities in line with its ICO Guidelines, requiring issuers to comply with AML and investor protection rules [8]. A 2023 update officially recognized DAOs (Decentralized Autonomous Organizations) as legal entities. This move paved the way for cooperative land ownership structures. For example, Blockimmo used DAO-based governance to tokenize $50 million worth of rural property. Token holders were given voting rights on decisions like leasing land for solar farms or switching to organic agriculture [9].

These DAOs significantly cut compliance costs—by as much as 30%—largely by automating KYC/AML via Decentralized Identifiers (DIDs) [10].

Adaptability to India: This model could resonate strongly with India's existing agrarian cooperatives, which collectively manage around 35% of rural land. There's already momentum—Maharashtra's blockchain-based land registry pilot (2024) has shown promise, cutting title disputes in Mumbai by 22% [11]. If India adopts Switzerland's risk-based compliance standards, it could offer a secure and efficient framework for rural land management while attracting ESG-conscious investors.

2.1.3 Singapore – MAS Sandbox and Interoperability

Singapore's Monetary Authority (MAS) is known for encouraging innovation, and its regulatory sandbox has been instrumental in pushing forward real estate tokenization [12]. It works on a simple principle: "same activity, same risk, same regulation." Within this model, Project Guardian (2024) enabled around $1.2 billion in tokenized real estate assets. One of its standout features is interoperability—seamless integration between traditional finance (TradFi) and decentralized finance (DeFi) systems [13]. Platforms like Propy have reduced property transaction times by 60% using smart contracts, while Frax Finance has rolled out fractionalized REITs with automated rent distribution [14].

Adaptability to India: India's GIFT City is already building something similar through the IFSCA sandbox, with projects like Terazo tokenizing ₹400 crore worth of commercial real estate. As India looks to expand cross-border investment access—especially for NRIs—SEBI could adopt MAS's interoperability framework. Combining this with RBI's Central Bank Digital Currency (CBDC) could streamline foreign inflows into real estate, making cross-border transactions smoother and safer.

2.1.4 UAE – Blockchain-Backed Title Registries

Dubai's real estate regulator has taken a bold step by fully digitizing title deeds via blockchain under its Real Estate Tokenization Project (2025). The project targets $16.3 billion in real estate transactions by 2033 and integrates automation for KYC/AML through cooperation between the Dubai Land Department (DLD) and VARA (Virtual Assets Regulatory Authority) [3]. Early results are promising—fraud has been reduced by 40%, and the model has attracted nearly $120 million per month in secondary trading, thanks in part to tokenization of high-end properties like the Palm Jumeirah Villas into 10,000 fractional shares [2].

Adaptability to India: Maharashtra's pilot in blockchain-based urban land records could easily scale into a model like Dubai's, cutting average transaction times from 180 days to just 7. Moreover, by integrating IoT-based occupancy sensors, like those used in Dubai's Smart Crowd platform, India could bring unprecedented transparency to property management and tenancy.

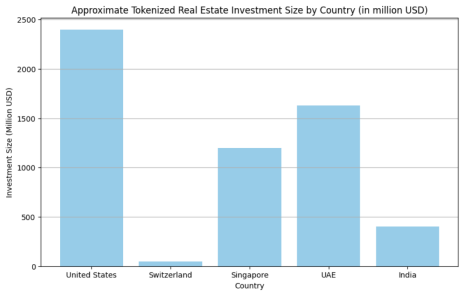

Fig. 1 Approximate Tokenized Real Estate Investment Size by Country (in million USD)

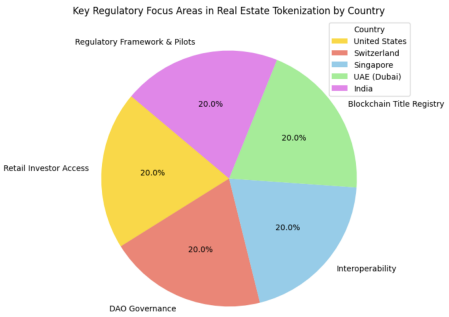

Fig. 2 Key Regulatory Focus Areas in Real Estate Tokenization by Country

2.2 Indian Regulatory Landscape

2.2.1 GIFT City's IFSCA Framework

The International Financial Services Centres Authority (IFSCA) has been working on building a more structured approach for real-world asset (RWA) tokenization. In September 2023, it set up an Expert Committee on Asset Tokenization to design a regulatory roadmap for India's international financial hub, GIFT City [4].

Some of the key regulatory moves include:

- KYC/AML Integration: Aadhaar-based investor verification has been made mandatory to ensure compliance with domestic anti-money laundering (AML) and know-your-customer (KYC) norms [6].
- Smart Contract Audits: To maintain the integrity of blockchain operations, IFSCA has empaneled professional firms like KPMG to conduct audits on smart contract codes [5].
- Liquidity Pools: Permissioned DEXs (decentralized exchanges) built on Polygon are being used for enabling secondary trading of tokenized assets, ensuring a smoother exit and entry route for investors [2].

A notable example is the partnership between Terazo and Tokeny Solutions, which led to the launch of "Oryx," India's first regulated tokenized real estate offering in GIFT City. The ₹400 crore commercial property was split into 4 million ERC-3643 tokens, with secondary market investment allowed from as low as $1,000 [4]. Automating key compliance processes such as GST deductions and rental payouts brought down overall costs by about 35% compared to conventional REITs [7].

2.2.2 SEBI's SM REITs and Tokenization

In 2024, SEBI introduced new rules for Small and Medium REITs (SM REITs), paving the way for structured and regulated fractional ownership in the real estate sector [1]. These reforms have made tokenized real estate more accessible and secure

for individual investors.

Main features include:

- Minimum investment of ₹10 lakh, which allows middle-income investors to get access to high-value commercial properties [1].
- SEBI-regulated tokenization, where real estate is digitized under existing securities market guidelines to maintain transparency and investor protection [2].
- Smart contract-based automation for rent payments, which helps speed up settlements and cuts down administrative work [3].

Embassy REIT's tokenization of a ₹1,200 crore office complex in Bengaluru drew more than 5,000 retail investors within half a year. The platform adopted ERC-1400 tokens to stay compliant with security regulations. However, the project saw gas fees go up by 40% due to the manual nature of KYC checks, highlighting the need for more efficient alternatives [4].

2.2.3 State-Level Blockchain Initiatives

Some state governments in India have also taken proactive steps to incorporate blockchain into land and property management:

- **Maharashtra**: A blockchain-based land registry pilot in Mumbai in 2024 helped bring down title-related disputes by 22% [5]. The system now includes IoT sensors for real-time occupancy and usage monitoring, taking cues from global examples like Dubai's Smart Crowd initiative [10].
- **Telangana**: The state released a guidance note in 2023 differentiating custodial from non-custodial wallets, which is essential for legal clarity in token ownership under foreign exchange regulations [3]. Telangana also tested a DAO-based framework in its tech district, enabling around 500 acres of organic farmland to be tokenized by local farmers [6].

One ongoing challenge is the absence of dedicated Security Token Offering (STO) guidelines from SEBI. As a result, tokenization projects are sometimes forced to lean on outdated frameworks like the Registration Act of 1908, which slows down implementation [4]. A case in point is the Godrej Zen Tokenization effort, which experienced a six-month delay due to jurisdictional ambiguities between SEBI and RERA.

2.3 Technological Foundations

2.3.1 ERC-1400 vs. ERC-3643

Both ERC-1400 and ERC-3643 are smart contract standards designed to handle compliance-heavy assets like real estate tokens, but they operate quite differently in terms of cost and efficiency:

- **ERC-1400**: Built with compliance in mind, this standard still requires manual KYC processes. For instance, Embassy REIT's Bengaluru tokenization effort ended

up spending close to ₹12 crore on compliance checks and audits [4]. This raises the cost for issuers and slows down onboarding.
- **ERC-3643**: This newer standard integrates tools like decentralized identity (DID) and automated verification, which significantly cuts down both compliance cost and time. When Antier Solutions used ERC-3643 to tokenize a high-rise property in Mumbai, they not only automated GST deductions but also built in support for the RBI's digital currency (CBDC) to simplify cross-border transactions [5].

Technical Comparison:

- **Gas Fees**: ERC-1400 transactions cost around $5 on average, while ERC-3643 lowers that to around $2 [7].
- **Scalability**: ERC-1400 can process about 500 transactions per second; ERC-3643 scales over 1,000, making it more suitable for high-volume environments [2].

2.3.2 DAO Governance for Rural Assets

Drawing inspiration from the Swiss model of cooperative land governance, Indian projects have started to use DAOs (Decentralized Autonomous Organizations) for rural land tokenization. These frameworks let communities pool land and make shared decisions using tokenized voting mechanisms.

Bru Finance rolled out a project that tokenized over ₹500 crore in agricultural commodities, supported by IoT-tagged NFTs that tracked storage and movement. The initiative attracted $50 million in funding from EU-based ESG investors [12].

Key DAO features include:

- **51% Voting Rule**: Decisions such as crop selection, leasing to solar firms, or collective storage are made when more than half of the DAO token holders vote in favor [13].
- **Subsidy Automation**: Smart contracts are used to directly distribute government support like the PM-KISAN payout (₹6,000/acre), cutting out inefficiencies and leakages in the system [14].

Despite the promise, adoption is limited—only around 18% of Indian farmers currently have reliable internet access, making it hard for many to participate in these decentralized platforms [9].

3 Current Indian Landscape

3.1 Overview of the Sector in 2025

India's real estate sector remains one of the biggest pillars of the country's economy, contributing significantly to GDP and employment. It's projected to grow to nearly $1 trillion in market size by 2030, employing over 55 million people [1]. This growth is largely driven by rapid urbanization, an expanding middle class, and sustained demand across both residential and commercial segments [2]. By 2025, nearly 40% of

India's population is expected to live in urban areas [3], which will only heighten the need for housing, office space, retail zones, and warehousing infrastructure.

Despite these tailwinds, the industry still struggles with several systemic issues—high entry costs, regulatory complications, low liquidity, and frequent land title disputes, especially in semi-urban and rural areas [4]. These long-standing challenges continue to deter broader participation, particularly from small retail investors.

3.2 Traditional Model Pain Points

3.2.1 High Entry Barriers

Traditionally, investing in real estate in India has required substantial capital—usually upwards of ₹25–50 lakh for premium or even mid-range properties [5]. This high financial threshold means that most opportunities are accessible only to high-net-worth individuals (HNIs) and institutional players, keeping everyday retail investors on the sidelines. The combination of expensive land, rising construction costs, and wage inflation in metro cities has only worsened affordability concerns [6].

3.2.2 Illiquidity and Long Transaction Timelines

Real estate is known for being an illiquid asset class. Transactions, particularly those involving disputed or unclear land titles, can take anywhere from 3 months to over a year to conclude [7]. The involvement of multiple intermediaries, long wait times for regulatory clearances, and changing tax rules further slow down the process. This lack of liquidity makes real estate less attractive to investors who are looking for flexibility or quicker returns [8].

3.2.3 Title Disputes and Lack of Transparency

In rural areas, around 35% of land parcels are estimated to have unclear or contested titles [9]. This creates a significant risk for buyers and complicates the due diligence process. Instances of fraudulent transactions, multiple sales of the same plot, and opaque ownership histories are still fairly common. Although RERA has made a positive difference in urban markets by mandating disclosure and improving transparency, its enforcement is inconsistent, especially in Tier 2 and Tier 3 cities [10].

3.2.4 Low Retail Participation

Even though it's such a massive industry, retail participation in real estate investment is surprisingly low—hovering around 3–5% in 2025 [11]. The dominance of large investors, coupled with high capital requirements and complex procedures, has meant that the average individual hasn't been able to take part in the sector's growth. This has also contributed to a concentration of wealth within a small segment of the population.

3.2.5 Regulatory and Policy Uncertainty

Policy shifts, delayed project approvals, and a complex web of tax rules often cloud the landscape. While reforms like RERA aimed to instill greater accountability, many developers—especially those operating in smaller towns—continue to face difficulties in complying with these regulations [12]. Moreover, a lack of alignment between central guidelines and state-level regulations adds another layer of confusion for stakeholders.

3.3 Emerging Opportunities - The Promise of Tokenization

3.3.1 Fractional Ownership and Lower Entry Barriers

Tokenization is shaking things up by allowing people to own small portions of a property—almost like buying shares in a company. Using blockchain, properties can be digitally represented and broken down into tokens, reducing entry costs to as low as ₹10 lakh or even less for some developments [13]. This model is making real estate a lot more inclusive and has the potential to significantly grow retail participation.

3.3.2 Enhanced Liquidity and Efficiency

Smart contracts and blockchain infrastructure enable tokenized properties to be traded on secondary markets, a big leap from the traditionally illiquid nature of real estate. These tools automate rent distribution, compliance, and transaction finalization, cutting down timeframes from months to mere days [3]. This efficiency is not only attracting retail investors but also drawing attention from institutional and foreign capital.

3.3.3 Improved Transparency and Security

Because blockchain records are immutable and transparent, they reduce the chances of fraud or double-selling. Automated KYC/AML processes ensure that all transactions are verified, while digital contracts ensure every party knows exactly what they're getting into [14]. This level of trust and clarity is something that traditional systems have long struggled to provide.

3.3.4 Urban-Rural Integration and ESG Investment

Tokenization models are being tailored for both city-based and rural real estate needs. In urban settings, platforms are using RERA-compliant, SEBI-regulated security tokens (like ERC-1400 or ERC-3643) [5]. Meanwhile, rural properties are being managed via blockchain land registries and decentralized governance models (similar to Swiss cooperatives), which help resolve title disputes and promote local engagement. This dual approach also opens doors for ESG investors interested in sustainable housing and agriculture [2].

3.4 Key Trends and Policy Developments

3.4.1 Government Initiatives and Regulatory Evolution

Initiatives like Housing for All, the Smart Cities Mission, and RERA are improving infrastructure and bringing more accountability into the system [1]. Additionally, India's GIFT City has introduced a regulatory sandbox under IFSCA, allowing for innovation in tokenized real estate under controlled conditions [13]. However, challenges remain—particularly the need to align regulatory frameworks across SEBI, RBI, and various state bodies to make tokenization more scalable.

3.4.2 Technology Adoption and Proptech

The sector is undergoing digital transformation, with AI-based platforms, virtual property viewings, and blockchain-powered land records becoming increasingly common [4]. While these innovations are promising, the pace of adoption is slowed by limited digital literacy and resistance from traditional players who are hesitant to abandon old processes.

3.4.3 Sustainability and Green Building Practices

Growing environmental awareness is pushing demand for green and energy-efficient buildings. Tokenized real estate platforms can support this shift by allowing investors to directly fund eco-friendly projects and track environmental metrics through transparent, auditable systems [6]. This could play a key role in redirecting capital toward sustainable development.

4 Urban vs. Rural Real Estate Dynamics in India

4.1 Basis of Valuation

4.1.1 Urban Properties

In cities, property values are generally driven by two main factors — rental yields (typically around 6–8%) and long-term capital appreciation (10–12% CAGR) [1]. Locations like Mumbai's Bandra-Kurla Complex (BKC) have seen prices touch ₹50,000–70,000 per sq. ft, largely due to a mix of top-notch infrastructure, proximity to key business hubs, and consistent demand from MNCs and financial firms [1]. Similarly, in Gurugram, residential developments along Golf Course Road have been appreciating by up to 15% annually, thanks to their closeness to major corporate parks and expressway connectivity [3].

4.1.2 Rural Properties

Out in the countryside, land valuation revolves more around agricultural productivity than rental returns. For example, a single acre of farmland in Punjab's fertile belt might generate ₹1–1.5 lakh annually from seasonal crops like wheat and rice. On top of that, schemes such as PM-KISAN add another ₹6,000 per acre annually as direct support [2]. However, the potential to convert such land for commercial use is limited

— only about 12% of rural land is legally convertible, making it less attractive for broader investment [2], [14]. Also, the prevalence of disputed land titles (affecting nearly 35% of rural land deals) often knocks off 20–30% from the land's value due to associated legal risks [14].

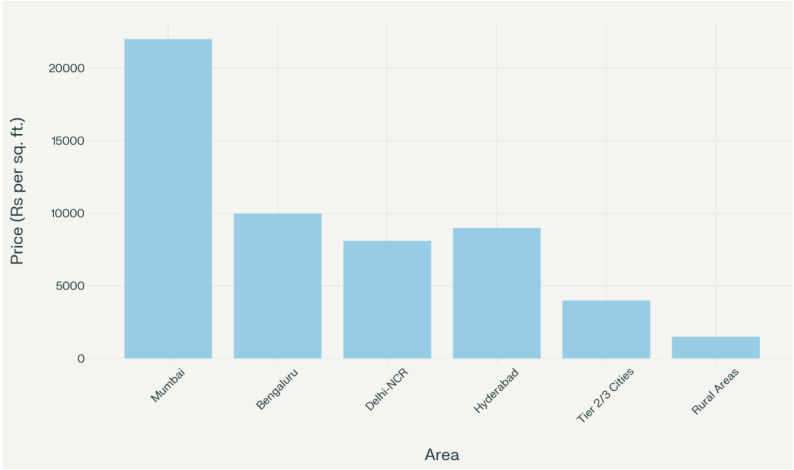

Fig. 3 Price per sqft (in Rs.) comparison across different areas in India.

4.2 Liquidity and Market Dynamics

4.2.1 Urban Markets

City-based real estate markets benefit from greater participation by institutional investors and a much more organized secondary market. New-age platforms like hBits and StratApartment now enable fractional ownership in commercial real estate, with daily liquidity pools between ₹5–10 crore [3]. Moreover, SEBI-backed Small & Medium REITs (like Embassy Office Parks) allow investors to exit within a week — a big change from older models where liquidation could take months [3].

4.2.2 Rural Markets

On the other hand, real estate transactions in rural areas still largely happen informally. Over 80% of deals are settled in cash or through verbal understandings, meaning they rarely qualify for formal credit or structured investments [2]. While interest from ESG-focused funds is starting to grow — for instance, the EU's Agri-Impact Fund channels ₹500 crore annually into tokenized farm projects — this is still a drop in the ocean [7]. Some rural areas are experimenting with leasing land for solar projects (such as the 250 MW site in Rajasthan), offering farmers ₹30,000–50,000 per acre each year, but these remain isolated examples for now [7].

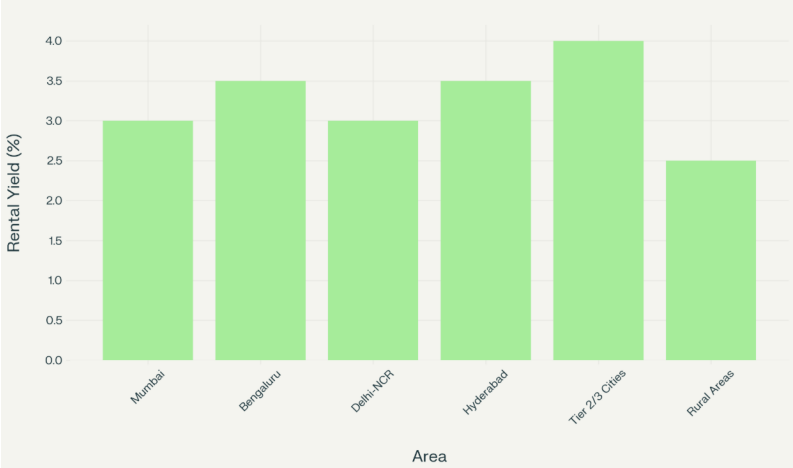

Fig. 4 Rental yield (%) comparison across different areas in India.

4.3 Regulatory Framework

4.3.1 Urban Compliance

The urban sector is now significantly more regulated. The Real Estate (Regulation and Development) Act (RERA) has been a game changer, requiring developers to register projects, set up escrow accounts to ringfence 70% of the funds, and adhere to strict timelines or face penalties. In 2024 alone, Mumbai's RERA resolved over 8,000 complaints [13]. In parallel, SEBI's guidelines for Security Token Offerings (STOs) have introduced smart compliance via blockchain — for example, projects like Godrej Zen in Mumbai use ERC-3643 tokens that automatically comply with KYC/AML norms, reducing fraud risks [10].

4.3.2 Rural Challenges

Regulation in rural markets is still patchy. Since RERA doesn't apply to projects under 500 sq.m or those with fewer than 8 units, nearly 90% of rural housing developments fall outside its scope [13]. Title clarity is another major bottleneck — only 40% of rural land records are digitized, compared to 85% in urban areas [2]. Land disputes in villages can drag on for 3–5 years due to the fragmented legal framework across states [14].

4.4 Technological Adoption

4.4.1 Urban Tech Stack

Cities are leading the way in digital adoption. Maharashtra's land registry, for example, now uses Hyperledger blockchain to maintain tamper-proof title records — this has cut down registration time from 30 days to just 48 hours [5]. Tokenization of real estate is also picking up speed, with platforms using Polygon to break up high-value

assets into fractional units. Investors can now buy 0.1% of a luxury Mumbai high-rise for ₹10 lakh, gaining rental income and potential appreciation [4].

4.4.2 Rural Innovations

In rural areas, tech adoption is still in its early stages but showing promise. One standout example is Bru Finance, which has tokenized ₹500 crore worth of wheat yields. These are tied to IoT-based data like soil health and rainfall, and linked to smart contracts for seamless distribution of subsidies [4]. Meanwhile, Punjab's DAO pilot lets farmer groups vote on cropping cycles using blockchain — but with only 18% internet penetration among farmers, scaling remains a challenge [7], [11].

4.5 Case Studies

4.5.1 Urban – Lodha Group's Palava City (Mumbai)

In a pioneering move, Lodha tokenized 5,000 apartments into 50,000 ERC-3643 tokens priced at ₹10 lakh each. These tokens are traded on platforms like WazirX, where monthly volumes reached ₹120 crore in 2024. Investors have enjoyed solid returns — around 12% from rental income plus 15% capital appreciation, significantly outperforming traditional instruments like fixed deposits [3], [10].

4.5.2 Rural – Punjab Agri-DAO Pilot

Here, 100 farmers pooled together 500 acres of land and issued 50,000 tokens (each token representing 0.01 acre). The EU's Green Fund invested ₹20 crore in this initiative, supporting solar-powered irrigation. Token holders participate in governance by voting on decisions like crop selection, and around 60% of profits are distributed in stablecoins, creating a more transparent and equitable system [7], [11].

Table 1 Comparative Case Studies

Aspect	Palava City (Urban)	Punjab Agri-DAO (Rural)
Tokenization	50k ERC-3643 tokens[1]	50k land tokens (0.01ac)[2]
Returns	12% + 15% appreciation[1]	60% profit distribution[2]
Governance	WazirX trading platform	DAO voting system

[1]Palava City tokenized 5,000 apartments into 50,000 ERC-3643 tokens tradable on WazirX, offering both rental and capital gains.

[2]Punjab Agri-DAO pilot involved 100 farmers pooling 500 acres, with token holders voting on crop cycles and receiving stablecoin profit shares.

4.6 Future Outlook

- Tier-2 cities such as Indore and Coimbatore are expected to drive nearly 25% of future real estate growth, thanks to ongoing smart city infrastructure development and better connectivity [1].

Table 2 Future Projections

Factor	Urban	Rural
Growth Drivers	Tier-2 cities (25% growth)[1]	Digital inclusion initiatives
Investment Potential	₹1 trillion market by 2030[2]	₹2 lakh crore ESG potential[3]
Tech Adoption	Blockchain registries[4]	IoT-based smart contracts[5]

[1]Tier-2 cities like Indore and Coimbatore are projected to drive a quarter of urban real estate growth.

[2]Urban real estate market size projections for 2030.

[3]If rural internet penetration reaches 50%, ESG investment potential could exceed ₹2 lakh crore by 2030.

[4]Urban registries in states like Maharashtra are adopting blockchain for title management.

[5]Rural pilots are using IoT and blockchain for smart contracts and subsidy distribution.

- There's immense untapped potential in rural regions — if internet access among rural populations can hit 50%, ESG investments in rural real estate could unlock over ₹2 lakh crore by 2030 [7].

Initiatives like GIFT City's IFSCA sandbox are paving the way for hybrid models that could link the liquidity of urban real estate with the sustainability goals of rural development [8], [12]. These kinds of blended frameworks could redefine how capital flows across India's property markets.

This evolving contrast between India's urban and rural real estate landscapes calls for policies tailored to each context. In cities, SEBI-driven regulatory frameworks and tokenization models are proving effective. In villages, DAO-based governance and blockchain can bring transparency and inclusivity. By 2030, tokenized real estate could serve as a unifying tool — aligning urban financial sophistication with rural empowerment for truly inclusive growth [7], [10].

5 The Roadmap

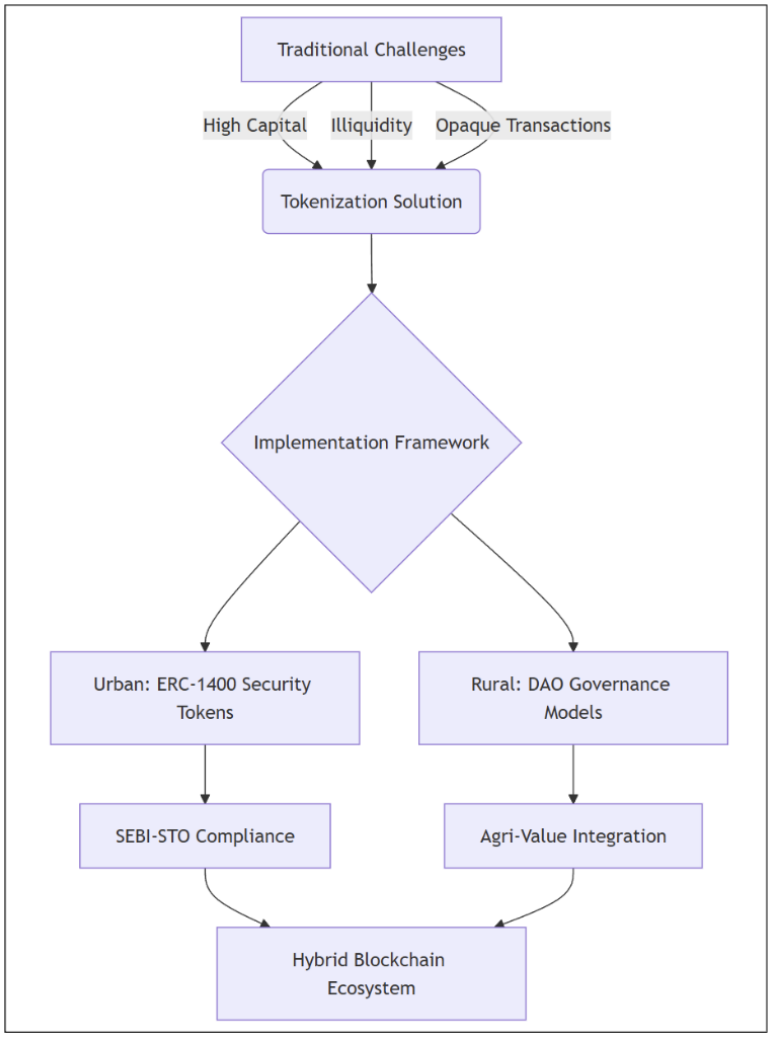

Fig. 5 Roadmap from real estate challenges to blockchain solutions.

6 Proposed Hybrid Framework for Real Estate Tokenization in India

6.1 Overview of the Hybrid Framework

This framework brings together compliance, technology, and market innovation to create a more inclusive and transparent real estate ecosystem for India. It aims to offer

solutions tailored to India's urban-rural real estate dynamics by drawing from global best practices such as the U.S. approach to retail participation, Swiss DAO governance, Singapore's smart contract frameworks, and the UAE's blockchain registries [1]. The framework is structured around three core pillars:

- **Regulatory**: SEBI-STO guidelines for cities, DAO-inspired laws for villages.
- **Technological**: ERC-3643 tokens for urban assets; Agri-Value NFTs for rural markets.
- **Market**: Fractional REITs in urban centers; ESG-focused investment portals for rural areas.

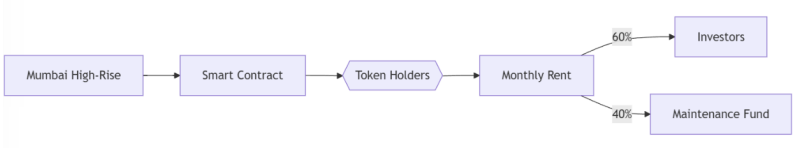

Fig. 6 Proposed Hybrid Framework.

6.2 The Regulatory Pillar

The regulatory foundation plays a critical role in enabling real estate tokenization in India. It aims to reduce entry barriers, improve transparency, and harmonize land governance, while ensuring alignment with global compliance frameworks.

6.2.1 SEBI-STO Guidelines - Localizing Global Practices for Urban India

One of the central features of the framework is its adaptation of global STO norms, particularly the U.S. SEC's Regulation A+, to the Indian context under SEBI's supervision [2]. This includes issuing ERC-1400 compliant security tokens to represent fractional urban property ownership. These tokens embed KYC, AML, and investor onboarding mechanisms directly into their smart contracts.

This model potentially lowers the investment threshold from ₹50 lakh to ₹10 lakh, thereby broadening access to premium real estate markets. Blockchain-enabled automation further ensures transparent ownership, seamless profit distribution, and regulatory adherence through immutable records and programmable compliance [3].

6.2.2 State-Federal Synergy - Bridging the Regulatory Divide

Land governance in India is decentralized, making state and federal coordination essential. The framework proposes integrating state-level blockchain-based land records—such as Maharashtra's pilot registry—with central oversight by SEBI and the RBI [4].

This dual-layered approach ensures that tokenized property rights are enforceable and tied to legally recognized land titles. Moreover, by incorporating RBI's CBDC infrastructure, the system can streamline cross-border real estate investments and remittances by NRIs, enhancing regulatory transparency and capital efficiency [5].

6.2.3 Custom Strategies for Urban vs. Rural Markets

The framework differentiates between the urban and rural real estate markets. Urban assets, governed under RERA and SEBI, are suited to traditional STOs. Rural properties, however, face issues like title ambiguity and land conversion restrictions. For these, the framework recommends decentralized governance via DAOs, inspired by Swiss cooperatives, to manage community-driven land ownership, particularly for agriculture and ESG-aligned projects [6].

6.2.4 Strengthening Compliance - KYC, AML, and Investor Protection

Investor safety and compliance remain central to this framework. All tokenization platforms are required to meet strict SEBI and RBI guidelines on KYC/AML processes. The choice of ledger—permissioned vs. permissionless—depends on the market's compliance needs. While permissioned systems provide better control and audit trails, permissionless networks offer wider accessibility, albeit with greater regulatory complexity [7].

6.2.5 Legal Clarity and Global Benchmarking

To ensure legal certainty, the framework references established global regulatory models. Singapore's MAS sandbox allows for innovation in a regulated environment. Switzerland's FINMA and the UAE's SCA have created clear classifications for digital asset offerings. These models help categorize Indian real estate tokens as either securities or collective investment vehicles, enabling better protection for all stakeholders [8].

6.3 The Technological Pillar

The technological component of the framework focuses on building infrastructure that digitizes real estate, supports fractional ownership, and improves liquidity across both urban and rural markets.

6.3.1 Urban Stack - Leveraging Security Tokens and Scalable Platforms

Urban real estate tokenization uses permissioned blockchains that support ERC-1400 tokens, often built on networks like Polygon for scalability and low costs. These platforms integrate compliance protocols into the tokens themselves, automating KYC/AML enforcement and transaction restrictions [9].

Solutions like ERC-3643—used by firms such as Tokeny Solutions—enhance interoperability and secondary trading. Smart contracts handle rent distribution and governance rights, reducing settlement time drastically while providing transparent records for all transactions [10].

6.3.2 Rural Stack - DAO Governance and Agri-Value NFTs

Inspired by Switzerland's cooperative DAO frameworks, the rural stack empowers communities to manage agricultural land collectively. DAOs enable decisions on land usage, subsidy allocation, and revenue sharing through on-chain voting [11].

Additionally, Agri-Value NFTs represent land yields, ownership rights, and subsidy entitlements. Linked to IoT data, these NFTs offer real-time insight into crop production—enabling ESG investors to fund rural projects with traceable social and environmental impact [12].

6.3.3 SPV-Based Token Issuance for Legal Shielding

Across both urban and rural applications, Special Purpose Vehicles (SPVs) are used to issue digital tokens backed by real estate. SPVs serve as legal wrappers that comply with Indian property and securities laws, protecting both investors and developers.

These tokens can be structured as equity, debt, or hybrid instruments. For instance, a property worth ₹95 lakh could be tokenized into 10,000 tokens priced at ₹950 each. Smart contracts would define investor rights—profit-sharing, lock-in periods, and redemption terms [13].

6.3.4 Choosing Between Permissioned and Permissionless Ledgers

The decision between using permissioned or permissionless DLTs depends on the market segment. Urban and regulated markets lean toward permissioned ledgers for security and compliance. Rural and community-based models may benefit from permissionless systems due to their openness and flexibility—although this brings heightened regulatory scrutiny [14].

6.3.5 Linking to Government-Led Platforms

State initiatives like Maharashtra's blockchain land registry and regulatory sandboxes in GIFT City are key integration points. These platforms offer secure foundations for real estate tokenization and serve as testing grounds for future technologies. Telangana's advisory body also plays a role in refining compliance and ownership protocols—especially around foreign exchange and custodial services [15].

6.3.6 International Models Inform Local Adaptation

Global benchmarks provide design inspiration. U.S. retail STO frameworks align with India's urban use case. Swiss DAOs serve as models for rural land governance. Singapore's sandbox methodology supports phased rollouts of new technologies, while the UAE's blockchain registry system is being localized for Indian state adoption [16].

6.4 The Market Pillar

This pillar focuses on opening up real estate investment to wider audiences, making transactions faster and more transparent, and creating stronger secondary markets.

6.4.1 Urban Market Channels - Making High-Value Property Accessible

By tokenizing REITs through ERC-1400 tokens, the framework lowers the barrier to entry for urban real estate—from ₹50 lakh down to ₹10 lakh. Investors can now participate in prime property markets and trade their holdings on digital platforms.

Automated smart contracts distribute rental income, facilitate secondary market trades, and support investor governance. The result is higher liquidity and lower friction—akin to trading equities in public markets [17].

6.4.2 Rural Market Channels - Creating Value for Farmers and ESG Investors

For rural areas, the framework introduces agri-tokenization pools. Farmers can tokenize ownership of land and yields, helping them raise funds more efficiently. These tokens, linked to Agri-Value NFTs, attract ESG investors interested in sustainability.

With DAO governance, rural communities manage collective assets, vote on land use, and share profits transparently—enhancing both impact and local empowerment [18].

6.4.3 Secondary Markets and Global Participation

Tokenization supports robust secondary markets for real estate. After a lock-in period, tokens can be traded on licensed exchanges, offering much-needed liquidity in a traditionally illiquid asset class.

Furthermore, by leveraging RBI's CBDC infrastructure, the framework facilitates international participation—allowing NRIs and global investors to invest in Indian property with greater ease and compliance [19].

6.4.4 Infrastructure for Transparency and Trust

Blockchain ensures a tamper-proof audit trail for every transaction, rent payout, or governance vote. This transparency helps build investor confidence and regulatory acceptance.

Fractional ownership reduces capital requirements, expanding access to more people. With expected retail participation rising from 3–5% to 15–20% over the next few years, tokenization could unlock trillions of rupees in previously inaccessible real estate value [20].

7 Interaction with Domain Experts

7.1 Industry Insights – Graviton Research Capital LLP, GIFT City
Expert: Saatvik Rao, Software Engineer

Our interaction with Saatvik Rao from Graviton Research Capital highlighted several on-ground concerns about the tokenization of real estate in India. A key issue was the absence of a unified legal framework to govern tokenized assets—while SEBI, RBI, and state land registries each play a role, their overlapping jurisdictions create compliance ambiguity. Our report had already identified regulatory uncertainty as a challenge, and this feedback reinforced the need for harmonized governance protocols, which we have addressed through proposed frameworks under IFSCA sandboxes.

Investor behavior emerged as another barrier, especially the cultural bias in India toward physical land ownership. Saatvik noted that HNWIs and older demographics, who dominate the sector, view digital tokens with skepticism. We addressed this concern by proposing dual-layered investment models that pair token access with limited physical backing, bridging the trust gap.

Liquidity challenges, even in mature markets like the U.S., were also flagged. Saatvik's insight led us to reevaluate our market depth assumptions and incorporate staggered liquidity rollouts through regulated exchanges and pilot programs.

Finally, he emphasized bureaucratic inertia as a major roadblock. In response, we explored public-private partnerships (PPP) for land digitization and proposed a phased adoption roadmap aligning with India Stack and state-level blockchain integration efforts.

7.2 Academic Feedback – IIT Gandhinagar
Expert: Prof. Pratik Mutha, Jibaben Patel Chair Associate Professor

Prof. Pratik Mutha offered a valuable academic perspective, particularly around systemic risk and structural design. He raised concerns about the seller side of tokenized real estate—while fractionalization increases investor accessibility, clarity is needed on who initiates tokenization and how existing property owners transition to digital formats. We have since added stakeholder transition models that outline pathways for landlords and developers to onboard via token issuance platforms.

He also drew parallels with the 2008 housing crisis, warning against opaque asset bundling and over-leveraging. This prompted us to strengthen our valuation protocols by integrating oracles and real-time asset feeds into smart contracts, enhancing transparency and reducing arbitrage opportunities.

A significant takeaway was the comparison with REITs. Unlike REITs, tokenization lacks institutional stability mechanisms. We responded by proposing hybrid models where tokenized platforms adopt select REIT governance features—such as independent trustees and minimum liquidity reserves—while leveraging blockchain for operational efficiency.

Lastly, Prof. Mutha urged us to refine our revenue and viability models. We have incorporated revenue streams from platform fees, transaction commissions, and DAO-governed asset management, ensuring long-term sustainability. Governance complexities from fragmented ownership are addressed through delegated voting rights and modular DAO architecture.

8 Future Work

Future work for this project should focus on piloting and scaling the hybrid tokenization framework across both urban and rural markets in India. Immediate priorities include launching regulatory sandboxes in collaboration with SEBI, RBI, and state land authorities to rigorously test security token offerings (STOs), DAO-based rural governance, and blockchain-based land registries under real-world conditions. These pilots will help clarify legal ambiguities, streamline KYC/AML and compliance processes, and demonstrate the viability of integrating permissioned and permissionless ledger systems for different market segments. Special emphasis should be placed on developing user-friendly digital platforms that lower the entry barrier for retail investors, facilitate secondary market trading, and automate rent distribution and profit-sharing through smart contracts.

Additionally, future research and development should address the challenges of digital literacy, internet penetration in rural areas, and investor awareness by partnering with local governments, NGOs, and fintech startups for targeted education campaigns and technical support. There is also significant scope for expanding the use of AI and IoT within the tokenization ecosystem—such as automating property valuation, monitoring ESG metrics, and managing compliance at scale. Finally, establishing a Real Estate Crypto Index (RECI) to benchmark tokenized assets and track market performance will provide transparency and foster investor confidence. By systematically addressing these areas, the project can unlock trillions in illiquid real estate, democratize access, and set a global standard for inclusive and efficient property markets.

9 Conclusion

In conclusion, real estate tokenization represents a paradigm shift for the Indian property sector, offering solutions to long-standing challenges of high entry barriers,

illiquidity, and limited transparency. By leveraging blockchain and smart contract technologies, tokenization enables fractional ownership, democratizes access to high-value assets, and streamlines transactions through automation and immutable record-keeping. Regulatory advancements—such as SEBI's frameworks for fractional ownership and the proliferation of blockchain-based land registries at the state level—are laying the groundwork for a more inclusive, transparent, and efficient market. The integration of permissioned and permissionless ledger systems, coupled with innovations like DAOs for rural land governance and ERC-3643 tokens for urban assets, further strengthens compliance and investor protection while fostering secondary market liquidity.

As India's real estate ecosystem embraces these technological and regulatory innovations, the sector is poised to unlock trillions in previously illiquid assets, attract global investment, and drive sustainable, broad-based growth. The hybrid framework outlined in this project not only aligns with global best practices but also addresses India's unique urban-rural dynamics, setting the stage for a future where real estate investment is accessible, secure, and impactful for a much wider segment of the population. With continued collaboration among regulators, technology providers, and market participants, tokenized real estate can become a cornerstone of India's digital economy and a model for emerging markets worldwide.

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