



## Special economic zones and the tilt of land laws in India: Balancing development, ownership rights, and legal innovation

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### Abstract

Special Economic Zones (SEZs) have emerged as a cornerstone of India's economic strategy since the enactment of the SEZ Act, 2005, aimed at attracting investment, promoting exports, and fostering industrialization. The rapid proliferation of SEZs has, however, generated complex legal and socio-economic challenges, particularly in the realms of land acquisition, ownership rights, and environmental sustainability. This paper critically examines how SEZ legislation reshapes conventional land law principles, highlighting the tension between facilitating economic development and safeguarding individual property rights. Beyond traditional legal and socio-economic analyses, the study introduces a novel framework that explores the integration of technological innovations such as blockchain, smart contracts, and GIS mapping into SEZ land governance, offering new avenues for transparency, accountability, and efficient land management. Through a doctrinal and comparative methodology, the paper examines the SEZ Act alongside the RFCTLARR Act, 2013, and other land-related statutes, while drawing lessons from international practices in China, Singapore, and the UAE. Key areas of focus include the legal flexibility granted to SEZ developers and its implications for consent and compensation, the environmental consequences of converting agricultural land for industrial use, and the socio-economic impact on displaced communities, including considerations of gendered land rights. By situating India's SEZ land framework within a global and technological context, the paper not only identifies policy gaps but also proposes forward-looking reforms to balance rapid economic growth with justice, equity, and sustainability. This study contributes a multidimensional perspective, integrating law, technology, and socio-environmental considerations, thereby offering a comprehensive roadmap for modernizing SEZ land governance in India.

**Keywords:** Special economic zones; land laws; sustainable development; socio – economic impact

### Introduction

Special Economic Zones (SEZs) have been central to India's economic strategy since the enactment of the Special Economic Zones Act, 2005. Designed to attract foreign investment, promote exports, and stimulate industrial growth, SEZs have significantly altered the landscape of land use and legal frameworks [1]. However, the rapid expansion of these zones has led to complex challenges concerning land acquisition, ownership rights, and the balance between development and social justice [2]. The legal transformation associated with SEZs is not merely a modification of existing laws but a bending of traditional land rights to accommodate economic objectives [3]. This shift raises critical questions about the extent to which legal frameworks can and should adapt to facilitate economic growth without undermining fundamental rights. The SEZ Act, 2005 provides a legal basis for the establishment of SEZs, but its implementation has often led to conflicts with existing land laws, particularly concerning the acquisition of agricultural land and the displacement of rural communities [4].

A significant concern is the tension between the legal flexibility afforded to SEZ developers and the protection of individual property rights<sup>2</sup>. Exemptions granted under SEZ regulations have been criticized for compromising principles of consent and fair compensation [5]. For instance, the acquisition of land for SEZs has sometimes been justified under the guise of 'public purpose,' leading to disputes over the legitimacy of such acquisitions and the

adequacy of compensation provided to affected communities [6].

Environmental considerations also play a crucial role in the discourse on SEZs [7]. The conversion of agricultural land into industrial zones raises questions about ecological sustainability and the long-term impact on local ecosystems. The balance between economic development and environmental conservation remains a contentious issue, with calls for more stringent environmental assessments and regulations to mitigate adverse effects [8].

The socio-economic impact on displaced communities is another critical area of concern. Displacement often leads to the loss of livelihoods, cultural heritage, and social networks. The adequacy of rehabilitation measures, including compensation and resettlement, has been questioned, with many communities experiencing marginalization and impoverishment post-displacement. Furthermore, the role of technological innovations in land governance within SEZs presents new avenues for reform. The integration of technologies such as blockchain and smart contracts could enhance transparency, efficiency, and accountability in land transactions and management. These technologies offer potential solutions to address issues of land record integrity and streamline the process of land acquisition and compensation [9], which has been actively examined and catered to in this paper.

Comparative perspectives from other countries, such as China, Singapore, and the UAE, provide valuable insights into best practices and policy frameworks that balance economic objectives with social and environmental

considerations. These international examples can inform India's approach to SEZ development, offering lessons on effective governance and sustainable land use practices. In conclusion, while SEZs are instrumental in driving economic growth, their impact on land laws necessitates a critical examination of legal frameworks to ensure they uphold the principles of justice, equity, and sustainability. This paper aims to explore the complexities associated with SEZ-related land laws, proposing reforms that align legal structures with contemporary challenges and opportunities in land governance.

## Research and Discussions

### 1. The Legal Recalibration of Land Rights Under Sez Regimes - From Ownership to Economic Facilitation Re-framing Land in the SEZ Paradigm

The enactment of the Special Economic Zones Act, 2005 ("SEZ Act") marked a paradigmatic shift in India's land governance framework. Land—historically embedded within agrarian livelihoods, customary tenure systems and community identity was re-conceived as an economic asset mobilised for export-oriented industrialisation. The SEZ regime signals a move from a property-rights paradigm (where ownership, security of tenure and procedural protections dominated) toward an economic-facilitation paradigm, where the state and private developers assume expansive mobilising powers, and ownership rights become contingent on alignment with growth-objectives.

While the SEZ Act's stated objectives include "generation of additional economic activity", "promotion of exports of goods and services", "promotion of investment from domestic and foreign sources" and "creation of employment opportunities" (Section 5 of SEZ Act, 2005) [10], these goals implicitly re-allocate the meaning of land rights: land becomes defined by its economic use rather than its socio-legal status [11].

In jurisprudential terms, this shift raises fundamental questions about the nature of ownership in a constitutional democracy: if land tenure must now serve economic policy imperatives, what becomes of the rights of individuals and communities whose livelihoods derive from land? The law is thus "bent", not via explicit repeal of rights, but through the realignment of land-law's structural logic to favour developmental facilitation.

### Constitutional Foundations and Procedural Thresholds

Under India's constitutional scheme, the right to property is no longer a fundamental right but is protected under Article 300A of the Constitution of India, which states that no person shall be deprived of his property "except by authority of law". The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARR Act) jurisprudence has clarified that compulsory acquisition must satisfy procedural and substantive safeguards embedded in the concept of "authority of law" [12]. Recent judgments show that such sub-rights include: notice to the owner, hearing of objections, a reasoned decision, acquisition only for public purpose, fair compensation, efficient process, and a final conclusion of proceedings [13].

This constitutional framework positions landowners' rights in a rule-of-law paradigm: deprivation must be lawful, for a public purpose, and procedurally fair. Yet, the SEZ regime, by design and implementation, erects a space where these

procedural thresholds may be compressed, reframed or bypassed, thereby recalibrating the nature of ownership rights. For example, the SEZ Act is silent on detailed acquisition procedure, whereas the RFCTLARR regime prescribes rigorous safeguards [14].

Thus, the doctrinal architecture of land rights is under stress: the facilitation-driven regime of SEZs operates in a zone of tension with traditional property jurisprudence, raising questions about legitimacy, fairness and constitutional fidelity.

### Ownership as Resource: The Normative Shift

Traditionally, ownership of land confers a bundle of rights: the right to exclude, the right to use, the right to transfer, and the right to security against expropriation without due process. Under the SEZ model, however, ownership is re-framed as a resource to be mobilised for economic ends - a shift in the normative meaning of land.

First, the prioritisation of land for SEZs often entails conversion of agricultural or rural land into industrial use, altering the nature of tenure and usage. For instance, empirical work indicates that large portions of acquired SEZ land remain unused or under-utilised, despite displacement of agrarian communities [15].

Second, tenure security is reduced: land-owners in SEZ zones may face pressures, either through state acquisition or negotiated agreements under conditions emphasising rapid conversion and investor certainty rather than long-term tenure stability [16]. Misra (2022) notes that "involuntary acquisition of agricultural land for setting up of SEZs in India benefited the elite at the expense of small farmers [17]." Third, the transformation of land into a "flexible economic input" dilutes its social and cultural significance. Communities that derived security and identity from land find themselves repositioned as stakeholders in a developmental project rather than rights-holder citizens. This normative shift is central: ownership becomes conditional on compliance with a growth model, rather than unconditional protection of property rights.

### Structural Tilt in Legal Instruments

The SEZ Act and its Rules manifest features that illustrate the structural tilt toward facilitation of economic objectives. By design, the statute provides a "single-window" mechanism, reduced regulatory burdens, exemption from certain duties, and special treatment of SEZ land (e.g., to be "deemed foreign territory for the purposes of trade operations" under S. 2(d)) [18]. These features demonstrate how the law elevates developmental utility of land above standard land-law protections.

Notably, the Act does not itself prescribe a detailed acquisition mechanism or embed strong agricultural-land protections comparable to general acquisition laws. For example, the SEZ Rules (2006) set minimum land-area thresholds for multi-product or sector-specific SEZs, but do not impose strict caps on developer-landholdings nor robust constraints on agricultural-land conversion [19]. The absence of maximum land-area ceiling and lack of clear agricultural-land safeguards have been criticised as legislative design choices that privilege land-mobilisation over tenure protection [20].

Additionally, implementation data reveals a disconnect between purpose and use: as the Comptroller and Auditor General of India (CAG) reported, significant amounts of

land acquired for SEZs remain unused or diverted to real-estate speculation, rather than productive industry<sup>[21]</sup>. Such outcomes underscore how the structural tilt in legal instruments opens space for land-rights attenuation, despite formal legal guarantees.

### **Implications for Ownership Rights and Justice**

The recalibration of law under the SEZ regime has multi-layered implications for ownership rights and justice. First, the weakening of tenure security and procedural safeguards places land-holders (especially small, agrarian or informal rights-holders) in a vulnerable position. Ownership becomes conditional, optional or subject to negotiation under disadvantaged power relations.

Second, the shift from secure ownership to rapid mobilisation often means compensation, rehabilitation and alternative livelihood arrangements become second-order concerns. When land is treated primarily as a growth-input, rights-holders may be expected to relocate or exit without full remedial support.

Third, the normative shift in ownership meaning raises distributive-justice questions: who benefits when land is converted for nationalised economic zones and whose rights are diminished? The displacement of agrarian communities, conversion of common lands, and erosion of informal tenure point toward a re-ordering of land distribution favouring capital and investor interests.

Finally, the legitimacy of the law itself comes into question when the facilitation model undermines constitutional protection of ownership rights. If procedural safeguards and substantive tenure protections are weakened in the name of growth, the law risks becoming an instrument of dispossession rather than justice.

## **2. Socio-Economic, Gendered, And Indigenous Impacts Of Land Acquisition Under The Sez Act, 2005, And The Rfctlarr ACT, 2013**

### **Navigating Development and Rights**

Land acquisition in India occupies a critical juncture between national development imperatives and the fundamental rights of affected communities. The enactment of the Special Economic Zones (SEZ) Act, 2005, represented a strategic governmental push to accelerate economic growth through the creation of industrial enclaves. However, the implementation of this Act often precipitated severe socio-economic, gendered, and indigenous community impacts, frequently overshadowing the intended developmental benefits and sparking widespread socio-political dissent<sup>[22]</sup>. In direct response to the glaring inadequacies and injustices arising from earlier land acquisition regimes, the Parliament enacted the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (RFCTLARR) Act, 2013. This transformative legislation was designed to institutionalize principles of justice, equity, and transparency, mandating comprehensive procedures for fair compensation, rehabilitation, and resettlement for all affected families<sup>[23]</sup>. This section undertakes a detailed comparative analysis of land acquisition dynamics under these two Acts, highlighting the multifaceted impacts on vulnerable communities and arguing for a rights-based approach to development<sup>[24]</sup>.

### **SEZ Act, 2005: Mechanisms, Displacement, and Inadequate Redressal**

The SEZ Act, 2005, significantly streamlined land acquisition by treating land for SEZs as a "public purpose," enabling its transfer from the state to private developers, often at concessional rates<sup>[25]</sup>. This mechanism, while effective for industrial acceleration, inadvertently became a primary driver of mass involuntary displacement of rural populations, especially those reliant on agrarian and traditional livelihoods<sup>[26]</sup>. Critiques of the SEZ regime highlight the systemic inadequacy of compensation, which frequently failed to reflect true market value or the total economic loss suffered by displaced families<sup>[27]</sup>. Furthermore, rehabilitation and resettlement (R&R) measures were often poorly conceptualized, inadequately funded, or entirely absent, leaving dispossessed families without viable alternative livelihoods<sup>[28]</sup>. The high-speed, top-down nature of acquisition under the SEZ framework severely limited meaningful consultation and informed consent with affected communities, a democratic deficit that fuelled protests and social unrest, most notably in Nandigram, West Bengal<sup>[29]</sup>. The lack of transparency in land valuation and transfer processes under the SEZ Act further compounded the grievances of affected populations<sup>[30]</sup>. However, recent SEZ reforms in 2025, particularly for the semiconductor and electronics sectors, have reduced minimum land requirements from 50 hectares to 10 hectares and allow mortgaged or leased land to be utilized<sup>[31]</sup>. These changes aim to facilitate industrial expansion while potentially limiting large-scale displacement, offering a partial mitigation of tenure-security and socio-economic concerns historically associated with SEZ acquisition.

### **RFCTLARR Act, 2013: A Paradigm Shift Towards Equity and Rights**

The RFCTLARR Act, 2013, represents a fundamental reorientation of the state's approach to land acquisition, moving from a purely eminent domain model to one grounded in equity, social justice, and procedural transparency<sup>[32]</sup>. The Act mandates rigorous Social Impact Assessments (SIA) to determine both the necessity and potential negative effects of acquisition<sup>[33]</sup>. Consent provisions under the Act require approval from a specified percentage of affected landowners, thereby injecting democratic agency into the process<sup>[34]</sup>. Additionally, compensation formulas under the RFCTLARR Act are significantly enhanced, often four times the market value in rural areas, and are explicitly linked to comprehensive R&R packages aimed at restoring or improving the socio-economic status of displaced families<sup>[35]</sup>. Implementation challenges persist, including bureaucratic delays in conducting SIAs, resistance from developers to incur R&R costs, and attempts by some state governments to dilute protective provisions<sup>[36]</sup>.

### **Comparative Analysis: Divergent Objectives and Social Outcomes**

The fundamental divergence between the SEZ Act and RFCTLARR Act lies in their objectives and philosophical underpinnings. The SEZ Act prioritizes rapid industrial development and investment facilitation, often treating landowners' rights as secondary externalities<sup>[37]</sup>. Conversely, the RFCTLARR Act is rights-based, integrating

social safeguards with economic objectives [38]. The insistence on SIA and informed consent ensures development projects undergo public welfare scrutiny, making them structurally more inclusive and equitable than those under the expedited SEZ mechanism [39]. By internalizing the social costs of displacement, the RFCTLARR Act enhances accountability and minimizes socio-political backlash associated with forced acquisition [40].

### Case Studies Illustrating Operational Dynamics

#### a. Kakinada SEZ, Andhra Pradesh: Acknowledging Past Injustice

The Kakinada SEZ provides a critical example of the long-term socio-economic consequences of expedited SEZ land acquisition [41]. Land was acquired in the early 2000s from over 1,500 farming families, many of whom depended entirely on agriculture for their livelihoods. The compensation offered was substantially below market rates, and R&R measures were minimal, leading to widespread economic insecurity and loss of traditional agricultural knowledge. Over the following decade, multiple protests and legal disputes emerged, highlighting systemic failures in accountability and community consultation. In 2023, the Andhra Pradesh government returned 2,180 acres of unused land to the original families [42], underscoring the need to integrate ethical, participatory approaches and R&R commitments in industrial development projects, aligning retrospectively with principles later codified in the RFCTLARR Act [43]. This case illustrates how delayed recognition of rights can create generational distrust and socio-political tension.

#### b. POSCO Steel Plant, Odisha: The Cost of Community Resistance

The proposed POSCO steel plant in Jagatsinghpur, Odisha, exemplifies the socio-political and environmental costs of bypassing procedural safeguards in SEZ land acquisition [44]. The project faced over a decade of community resistance from fisherfolk and betel-vine cultivators, concerned about the loss of customary lands, projected livelihood destruction, and potential environmental degradation along the coastal ecosystem. Multiple studies revealed that compensation packages failed to account for long-term economic displacement and ecological damages, fuelling legal battles and international scrutiny [45]. Ultimately, persistent grassroots mobilization, coupled with strategic litigation, led to the project's withdrawal, highlighting the critical importance of Social Impact Assessments, informed consent, and transparent engagement mandated by the RFCTLARR Act [46]. The POSCO case demonstrates that bypassing rights-based procedures not only disrupts communities but also delays industrial projects and damages investor confidence.

#### c. Mundra SEZ, Gujarat: Environmental and Livelihood Destruction

The Mundra SEZ, developed by the Adani Group, caused widespread displacement of thousands of fisherfolk, farmers, and pastoralists, resulting in loss of common property resources, including grazing lands and fishing grounds [47]. Independent social audits documented that compensation was substantially below market value and that R&R programs failed to restore or improve displaced

communities' socio-economic conditions [48]. Environmental degradation from industrial development further undermined traditional livelihoods. The Mundra case demonstrates that procedural safeguards, environmental assessments, and livelihood restoration measures, as outlined in the RFCTLARR Act, are crucial not only for social justice but also for the long-term sustainability of SEZ projects [49]. Prolonged neglect in rehabilitating displaced communities has created intergenerational poverty and social marginalization, emphasizing the need for stricter adherence to rights-based frameworks.

#### d. Nandigram, West Bengal: A Turning Point in Policy Discourse

The 2007 Nandigram violence became a watershed moment in India's land acquisition history [50]. The state government's attempt to establish a chemical SEZ resulted in large-scale protests, violent clashes, and loss of life, driven by the community's perception of coercion, inadequate consultation, and insufficient compensation. The crisis brought national attention to the ethical, legal, and socio-economic failures of expedited land acquisition practices under SEZ frameworks. Nandigram catalysed policy reforms, directly influencing the drafting and enactment of the RFCTLARR Act, which emphasizes procedural fairness, stakeholder consent, and robust R&R mechanisms [51]. The event highlights how ignoring local governance and consent provisions can escalate into severe human rights and political crises.

#### a. Sri City SEZ, Andhra Pradesh: An Example of Proactive Social Management

In contrast to the conflict-ridden examples, the development of the Sri City SEZ in Andhra Pradesh offers an important perspective on successful social management within the industrial development process [52]. Sri City is frequently cited in policy discussions as a model industrial park that has achieved significant economic growth while proactively addressing local social concerns. The developer's commitment to creating local employment opportunities and investing in community infrastructure, combined with a relatively transparent and voluntary land acquisition process, helped mitigate some of the typical negative outcomes associated with SEZ displacement [53]. This proactive engagement and integration of corporate social responsibility (CSR) into the project design demonstrate that when private developers prioritize social sustainability alongside economic metrics, the adverse effects of large-scale land conversion can be significantly managed and positive socioeconomic transitions can occur for displaced populations [54].

#### Gendered Impacts of Land Acquisition: Marginalization and Vulnerability

Women are disproportionately affected by land acquisition due to their central role in agricultural labour, household food security, and resource management, yet their legal ownership of land is often tenuous or absent [55]. Displacement disrupts traditional livelihoods and access to resources, simultaneously increasing household workloads and economic vulnerability. Compensation schemes often recognize only male heads of households, excluding women from R&R benefits and decision-making processes. Studies have documented that women face increased food

insecurity, loss of customary work, reduced access to education, and social disempowerment post-displacement<sup>[56]</sup>. Women-headed households, widows, and single women are especially vulnerable to exploitation during resettlement and land compensation procedures. Although the RFCTLARR Act mandates co-sharer benefits for women and gender-sensitive R&R provisions, implementation remains inconsistent, leaving many women economically marginalized and socially invisible in post-acquisition contexts<sup>[57]</sup>.

### **Indigenous Community Impacts: Threats to Ancestral Domain and Cultural Integrity**

Indigenous communities in Scheduled Areas, whose identity, livelihoods, and cultural practices are intricately linked to their ancestral lands, are highly vulnerable to SEZ land acquisition<sup>[58]</sup>. SEZ projects often bypass collective rights, resulting in forced displacement, cultural erosion, and loss of traditional ecological knowledge. Studies indicate that the uprooting of Indigenous communities not only erodes social cohesion but also threatens ecological stewardship of forests, water bodies, and biodiversity they have traditionally managed. The RFCTLARR Act requires Gram Sabha consent and SIA assessments to evaluate impacts on indigenous life and culture, yet enforcement is inconsistent due to bureaucratic inertia, economic pressures, and political influence<sup>[59]</sup>. Consequently, even with legal safeguards, Indigenous populations often face incomplete compensation, insufficient rehabilitation, and ongoing struggles to preserve cultural heritage and secure sustainable livelihoods.

### **Socio-Economic Impacts on Displaced Communities: Poverty and Exclusion**

Displacement severs affected families from primary sources of income, predominantly land-based livelihoods, while also limiting access to viable alternatives<sup>[60]</sup>. Households face immediate financial distress, increased dependency on informal labour markets, and heightened exposure to debt traps. Inadequate compensation and poorly executed R&R programs perpetuate cycles of poverty, social exclusion, and intergenerational vulnerability. Women, children, and elderly members are disproportionately affected, facing reduced access to education, healthcare, and social mobility. The RFCTLARR Act's safeguards, including enhanced compensation, SIA, and participatory planning provide mechanisms to mitigate these impacts, but their effectiveness depends on active engagement, transparency, and diligent enforcement<sup>[61]</sup>. Historical evidence from SEZ projects illustrates that communities excluded from meaningful consultation experience long-term socio-economic marginalization and declining human development indicators.

### **Future Directions and Rights – Based Imperatives**

To ensure equitable development and mitigate future conflicts, the principles of the RFCTLARR Act must serve as the non-negotiable legal floor for all land transactions<sup>[62]</sup>. This requires harmonization of all land acquisition processes and a renewed commitment to transparency and public accountability<sup>[63]</sup>. Effective implementation hinges on rigorous, independent Social Impact Assessments<sup>[64]</sup> and the political will to enforce protective clauses against dilution<sup>[65]</sup>. Ultimately, the law's success lies in prioritizing social

justice and human dignity over mere economic expediency, ensuring development is truly inclusive and sustainable for all affected stakeholders<sup>[66]</sup>.

## **3. Technology As A Legal Equalizer: Blockchain, Smart Contracts, And Gis Mapping In Sez Land Governance**

### **Addressing Governance Deficits with Emerging Technology**

The persistent socio-legal conflicts surrounding land acquisition for Special Economic Zones (SEZs) in India fundamentally stem from opaque administrative processes, unreliable paper-based records, and asymmetrical power dynamics<sup>[67]</sup>. While the RFCTLARR Act, 2013, mandates sophisticated procedures like Social Impact Assessments (SIA) and detailed Rehabilitation and Resettlement (R&R) plans, the absence of robust, verifiable enforcement mechanisms often allows these legislative safeguards to be undermined<sup>[68]</sup>. Emerging technologies offer a powerful solution to bridge this governance deficit. Specifically, the integration of Blockchain, Smart Contracts, and Geographic Information Systems (GIS) promises to enforce transparency, verify consent, and establish an immutable audit trail, thereby transforming the land acquisition process into a more rights-affirming and equitable exercise<sup>[69]</sup>. This section meticulously examines the potential of these digital tools to act as a legal equalizer and proposes a comprehensive digital governance model tailored for SEZ development.

### **Blockchain Technology: Institutionalizing Immutability and Trust**

Blockchain technology, functioning as a distributed ledger system, introduces the principle of immutability to land records, which is crucial for building public trust<sup>[70]</sup>. By digitising critical land titles, original ownership histories, and acquisition records onto a blockchain, a permanent, chronologically ordered, and tamper-proof chain of events is established<sup>[71]</sup>. This digital architecture ensures that once a piece of data such as a displaced family's right to compensation or the verification of their land claim is recorded, it cannot be unilaterally altered, destroyed, or backdated by any single administrative entity<sup>[72]</sup>. The decentralized nature of the ledger, visible to verified stakeholders including government agencies, SEZ developers, and community representatives, inherently boosts traceability and accountability. This capability is vital for linking every acquired land parcel directly to its corresponding SIA finding, consent resolution, and final compensation disbursement, effectively mitigating fraud and the administrative manipulations often associated with legacy land administration<sup>[73]</sup>. Furthermore, a well-designed blockchain can host a digital inventory of all land acquired under the SEZ Act, allowing for instant verification of its intended use, thus enforcing the use-case restrictions stipulated by the law.

### **Smart Contracts: Automating Legal Compliance and Rights Enforcement**

Smart Contracts extend the functionality of the blockchain by embedding the terms of a legal agreement directly into executable code<sup>[74]</sup>. In the highly regulated environment of SEZ land acquisition, Smart Contracts can be programmed to automate and enforce compliance with the stringent

requirements of the RFCTLARR Act [75]. For example, complex legal conditions related to consent, which often become subjective bureaucratic bottlenecks, can be objectified. A Smart Contract could be designed to hold compensation payments in escrow and automatically trigger disbursement only when the digitally verifiable consent (perhaps linked to unique biometric identifiers or digital signatures) from the minimum stipulated majority of affected landowners (70% or 80%) has been cryptographically confirmed on the blockchain [76]. Beyond consent, these contracts can automate the equitable disbursement of compensation, ensuring that funds are instantly and irrevocably transferred to the digital wallets of all legally entitled beneficiaries, including women co-sharers and other vulnerable groups, the moment the Collector's Award is finalised and the land is possessed [77]. Crucially, Smart Contracts can also enforce the time-bound nature of the acquisition process. By integrating time-stamps, they can automatically flag or initiate a process of de-acquisition if legal milestones, such as the lapse clause under Section 24(2), are not met within the statutory period, thereby furnishing irrefutable, code-based evidence for judicial scrutiny [78].

### **GIS Mapping and Satellite Monitoring: Enhancing Spatial Transparency**

The foundational problem in land governance lies in the lack of accurate, readily accessible spatial data [79]. The integration of Geographic Information Systems (GIS) and high-resolution satellite mapping provides the necessary spatial intelligence to overcome this challenge. GIS technology allows for the creation of precise, geo-referenced cadastral maps that accurately define ownership boundaries, delineate specific land-use categories (e.g., irrigated multi-cropped land), and map common property resources [80]. Within the SEZ context, GIS is essential for conducting a reliable SIA; it enables the social impact data such as locations of vulnerable hamlets, water bodies, and livelihood zones—to be directly overlaid onto the proposed SEZ footprint [81]. This visual transparency allows developers, regulators, and the public to objectively assess the true extent of the social and environmental cost of the project before acquisition is finalised. Furthermore, coupling GIS with continuous satellite imagery provides a real-time monitoring system. This can instantly detect any unauthorized land use diversion (such as converting SEZ land for residential housing) after its official notification, ensuring strict compliance with the SEZ Act and reducing land speculation [82]. This spatial transparency also supports participatory governance, enabling local communities and Gram Sabhas to contribute to and verify land records, particularly concerning customary or unrecorded tribal rights [83].

### **The Proposed “Smart SEZ Land Governance Model”**

To operationalize these technologies holistically, a Smart SEZ Land Governance Model is proposed. This model integrates the three technological components across the entire land acquisition and compliance lifecycle. First, a Digital Land Registry is built on a permissioned blockchain, serving as the single, immutable source of truth for all foundational land data, including pre-acquisition titles and SIA reports [84]. Second, Smart Compliance Contracts are deployed on this blockchain, automatically linking the

acquired land parcels to R&R mandates, compensation payments, and legal deadlines. These contracts ensure that funds and benefits flow only when the legal requirements of the RFCTLARR Act are met [85]. Third, a Public GIS Visualization Portal aggregates the blockchain-verified data and presents it geospatially to the public. This publicly accessible dashboard displays the exact location, acquisition status, and compliance reports of every SEZ project, institutionalising the right to information and ensuring participatory scrutiny throughout the development phase [86]. This layered model effectively moves the land governance system from one reliant on fallible human discretion to one enforced by immutable code and transparent data, fundamentally rebalancing the power dynamics in favour of the affected citizens [87].

### **Paving the Way for Digital and Equitable Development**

The shift towards a digitally enabled Smart SEZ Land Governance Model represents a crucial step in aligning India's industrial ambition with its constitutional commitment to social justice and equity [88]. The technology acts as a direct enabler of rights, ensuring that the legislative spirit of the RFCTLARR Act, particularly its focus on fair compensation and consent is structurally guaranteed and executed without administrative interference [89]. By institutionalizing transparency and accountability through a combination of immutable ledger technology and visual spatial data, India can establish a globally competitive yet ethically sound framework for large-scale development [90].

## **4. Global Models And Indian Reform Pathways: Comparative Insights From China, Singapore, And The Uae**

### **The Imperative for International Benchmarking in SEZ Governance**

India's decades-long effort to establish successful Special Economic Zones (SEZs) has been marked by a conflict between rapid industrial development goals and the enduring complexity of its democratic, federal land governance [91]. The legislative shift towards the stringent social safeguards of the RFCTLARR Act, 2013, makes a critical examination of global SEZ models essential, not for mere replication, but for distilling best practices adaptable to India's unique constitutional and rights-based commitments [92]. An effective reform pathway must leverage international experience while strictly upholding federal principles, constitutional mandates on equity, and the right to livelihood [93]. By comparing the land acquisition, compensation, and environmental frameworks of successful, yet politically diverse, models in China, Singapore, and the United Arab Emirates (UAE), this section identifies key reform levers necessary for a truly sustainable Indian SEZ policy.

### **Comparative Analysis of International SEZ Land Governance**

#### **1. China: Centralized State Power and Strategic Land-Banking**

China's phenomenal SEZ success, particularly in zones like Shenzhen, was fundamentally driven by the centralised, state-controlled authority over land [94]. Land in China is state-owned or collectively-owned, enabling the government to quickly and efficiently assemble vast, contiguous parcels for industrial use through administrative allocation and

long-term leasing <sup>[95]</sup>. This strategic, large-scale land-banking often publicly funded before private investment eliminated the protracted legal fragmentation and disputes that plague India's multi-owner land system <sup>[96]</sup>. Compensation, while provided, lacked the democratic transparency and explicit rights-based focus on consent and R&R guarantees mandated by the RFCTLARR Act <sup>[97]</sup>. The paramount lesson from China is the critical role of the State as a proactive intermediary in acquiring, preparing, and de-risking land prior to involving private developers, thereby separating the contentious land acquisition process from the investment life cycle.

## 2. Singapore: Efficiency, Market Compensation, and Rules-Based Acquisition

Singapore's transformation via industrial parks, managed by bodies like the Jurong Town Corporation (JTC), offers a model of rules-based efficiency within a common law framework <sup>[98]</sup>. Singapore utilised its Land Acquisition Act 1966 to compulsorily acquire private land for public and industrial development with speed and finality <sup>[99]</sup>. The key takeaway for India is the system's focus on predictable, equitable market compensation (assessed by a Collector and subject to a structured Appeal Board process) and the State's early commitment to securing a high percentage of land under public ownership <sup>[100]</sup>. This reliance on a robust, quasi-judicial appeal mechanism and the principle of market-value payment, rather than mere statutory minimums, ensures procedural fairness in acquisition. While Singapore's political context allowed for less emphasis on community consent than is constitutionally necessary in India, the structure of its compensation dispute resolution offers a strong blueprint for strengthening India.

## 3. UAE: Free Zone Autonomy and Integrated Environmental Stewardship

The UAE's Free Zone model, particularly prominent in Dubai and Abu Dhabi, is a paradigm of creating autonomous, investor-friendly regulatory enclaves <sup>[101]</sup>. These zones are typically developed on pre-designated government or desert land, virtually eliminating the high-stakes conflict over displacement of agricultural communities that defines the Indian experience <sup>[102]</sup>. The UAE's focus shifts from compulsory acquisition to providing highly secure, long-term leasehold arrangements and guaranteeing regulatory stability for investors <sup>[103]</sup>. Furthermore, in a significant development for sustainability, Emirates like Abu Dhabi are increasingly integrating robust environmental governance and mandating vast, protected natural areas, showcasing a commitment to balancing economic growth with ecological preservation <sup>[104]</sup>. The UAE model suggests that India must minimise acquisition friction by strategically utilising existing degraded State land and, crucially, embed rigorous, non-negotiable environmental safeguards and land-use covenants directly into the SEZ development criteria, an area where the current SEZ Act remains weak.

## The Proposed Hybrid Indian SEZ Model: A Synthesis for Reform

The deficiencies in the current Indian SEZ regime, namely, its over-reliance on private acquisition, protracted social conflict, and inadequate environmental integration - demand a comprehensive Hybrid Model <sup>[105]</sup>. This proposed

framework blends the strategic efficiency of global practices with the non-negotiable legal principles of the Indian Constitution, focusing on three core reform pathways:

### Institutionalizing State-Led Land Assembly and De-risking

Borrowing from the Chinese and Singaporean experience, the most impactful reform is the shift to State-led land assembly and land-banking <sup>[106]</sup>. State governments should establish dedicated Land Management Corporations tasked with identifying, acquiring (primarily through negotiated, voluntary methods under RFCTLARR, or land pooling schemes), and preparing large tracts of non-agricultural or degraded public land <sup>[107]</sup>. This shifts the risk, time, and social burden of acquisition from the private developer to the State, effectively delivering de-risked, infrastructure-ready industrial land <sup>[108]</sup>. By making land acquisition a State function that occurs outside the SEZ development timeline, it significantly reduces the likelihood of social conflicts that stall FDI, thereby protecting the fundamental right to livelihood of agricultural populations.

### Enforcing Economic Equity through Innovative Compensation

To ensure that the social contract inherent in development is honoured, the compensation system must move beyond a simple one-time payment. First, the quasi-judicial apparatus of the Land Acquisition, Rehabilitation, and Resettlement (LARR) Authority must be dramatically strengthened to ensure swift, expert, and fair adjudication based on the principle of market-linked value and not statutory floor prices <sup>[109]</sup>. Second, drawing on best practices for shared prosperity, a mandatory provision for Structured Equity Sharing should be introduced for all SEZ land acquisitions <sup>[110]</sup>. This mechanism would legally entitle displaced families to a small, fixed percentage of the SEZ project's net revenue or a transferable share in the land's appreciating value after conversion <sup>[111]</sup>. This structural commitment transforms compensation from an economic palliative into a long-term developmental partnership, aligning the interests of the affected community with the success of the SEZ project.

### Mandating Integrated Sustainability and Federal Land-Use Coordination

Finally, the Indian model must incorporate the pro-active environmental mandates observed internationally. This requires amending the SEZ Act, 2005, to mandate a Strategic Environmental Assessment (SEA) at the initial policy and site-selection stage, ensuring that SEZ development aligns with both national sustainability goals and federal environmental protection mandates <sup>[112]</sup>. To resolve the chronic friction between Centre-regulated SEZs and State-controlled land-use, a dedicated Federal-State SEZ Coordination Council must be legally established <sup>[113]</sup>. This council would enforce standard operational protocols, harmonise land-use classifications, and ensure uniform compliance with R&R obligations across states <sup>[114]</sup>. The proposed Hybrid Indian SEZ Model is thus a comprehensive, constitutionally-sound framework designed to foster competitive economic growth that is both accountable and environmentally sustainable <sup>[115]</sup>.

### Conclusion: Reclaiming The Promise Of India's Sezs

The narrative of India's Special Economic Zones has too often been dominated by a tragic paradox: ambitious national economic growth clashing directly with the fundamental promise of justice and livelihood for its citizens. This paper has shown that the heart of this conflict is not a legal void, but an enforcement deficit - a gap between the high ethical standard set by the RFLTARR Act and the opaque, paper-based realities of its execution. Our analysis across global industrial powerhouses from the swift state centralization of China to the transparent legal efficiency of Singapore, and the site-selection wisdom of the UAE confirms that successful industrialization requires predictable land access, but sustainable success demands equity. We've established that for India, moving forward means embracing a dual strategy:

First, we must install digital guardrails. The proposed Smart SEZ Land Governance Model is the essential upgrade: it uses the unshakeable truth of Blockchain to protect land records, the automatic honesty of Smart Contracts to ensure timely and complete compensation, and the undeniable transparency of GIS maps to let every citizen see the development process in real-time. This is how we transform rights from abstract ideals into non-negotiable code.

Second, we must build a Hybrid Indian Model that institutionalizes partnership. This means the State must step up to de-risk acquisition by acquiring and preparing land itself, freeing developers from social conflict. Crucially, we must move beyond simply paying people off to making them genuine partners by mandating equity and revenue sharing—connecting the displaced family's future wealth to the SEZ's ongoing success.

Ultimately, the future of India's SEZs rests on a conscious choice: to see land as a shared resource rather than a commodity to be seized. By adopting these structural and technological reforms, India can finally achieve its goal: competitive, dynamic economic growth that stands proudly on a foundation of uncompromised social justice and constitutional integrity. This is how we reclaim the promise of inclusive development.

### Suggestions And Recommendations

#### Policy and Institutional Reforms (The Hybrid Model)

These recommendations focus on structural changes based on global best practices

- **Empower State-Led Land Banking:** The government should be the primary assembler of industrial land, focusing on degraded or unused public plots, and providing investors with de-risked, infrastructure-ready sites.
- **Mandate Equity Sharing:** Introduce a legal clause requiring SEZ developers to allocate a fixed percentage of project revenue or land appreciation shares to the directly affected families, transforming them into long-term partners.
- **Strengthen the LARR Judiciary:** Significantly enhance the independence and capacity of the Land Acquisition, Rehabilitation, and Resettlement Authority for swift, expert resolution of compensation disputes based on fair market value.

- **Integrate Proactive Environmental Assessment:** Make a Strategic Environmental Assessment (SEA) mandatory for all SEZ site selections to ensure ecological balance is prioritized before any land is formally notified.
- **Establish a Federal SEZ Council:** Create a high-level body to harmonize policy between the Central SEZ Act and State land-use laws, ensuring consistent and fair application of rules nationwide.

### Technological and Procedural Reforms (The Smart Model)

These recommendations focus on implementing the digital equalizer solutions

- **Blockchain Land Registry:** Use blockchain technology to create a permanent, tamper-proof record of original land titles and every subsequent acquisition event for SEZ land.
- **Smart Contracts for Compliance:** Deploy self-executing contracts to automatically verify digital consent from landowners and ensure the instantaneous, traceable disbursement of all compensation payments directly to bank accounts.
- **Public GIS Transparency:** Launch an accessible online GIS-mapped dashboard that visually displays SEZ boundaries, compliance status, and the location of R&R commitments, fostering public scrutiny.
- **Digital Monitoring:** Implement continuous satellite and GIS monitoring to immediately detect and flag any unauthorized use of SEZ land for non-industrial purposes, preventing real estate speculation and ensuring adherence to legal covenants.

### References

1. Misra K. An Analysis of Land Acquisition for Special Economic Zones in India, 2019. Retrieved from <https://scholarworks.umass.edu/bitstreams/55b9d98f-db6e-49bf-a0e5-81abd25f3bac/download>
2. Levien M. The land question: Special economic zones and the political economy of dispossession in India. *Journal of Peasant Studies*, 2012;39(3-4):933-969. <https://doi.org/10.1080/03066150.2012.656268>
3. Sahu KK. Displacement, land acquisition & special economic zones in India. *International Journal of Humanities and Social Science Invention*, 2013;2(3):35-40. Retrieved from <https://www.ijhssi.org/papers/v2%283%29/version-4/F233540.pdf>
4. Jenkins R, Kennedy L, Mukhopadhyay P, Pradhan K. C. Special economic zones in India: Interrogating the nexus of land, development, and urbanization. National Institute of Urban Affairs, 2015. Retrieved from [https://smarnet.niua.org/sites/default/files/resources/02\\_eua585426.pdf](https://smarnet.niua.org/sites/default/files/resources/02_eua585426.pdf)
5. Parwez S. A study on special economic zone implicated land acquisition and utilization. *International Journal of Development and Conflict*, 2016;6(2):136-153. Retrieved from

- [https://www.academia.edu/31022150/A\\_Study\\_on\\_Special\\_Economic\\_Zone\\_Implicated\\_Land\\_Acquisition\\_and\\_Utilisation](https://www.academia.edu/31022150/A_Study_on_Special_Economic_Zone_Implicated_Land_Acquisition_and_Utilisation)
6. Tewari S. Special economic zones: Location and land utilization. Institute for Studies in Industrial Development, 2020. Retrieved from <https://isid.org.in/wp-content/uploads/2022/07/WP221.pdf>
  7. Zeng DZ. The past, present, and future of special economic zones. National Institutes of Health, 2021. Retrieved from <https://pubmed.ncbi.nlm.nih.gov/articles/PMC8083530/>
  8. Srivastav S, Singh T. Greening our laws: Revising land acquisition law for coal mining in India, 2023. arXiv. Retrieved from <https://arxiv.org/abs/2304.14941>
  9. Shahariar M, Banik P, Habib MA. A secure land record management system using blockchain technology, 2023. arXiv. Retrieved from <https://arxiv.org/abs/2304.13512>
  10. Aggarwal A. Understanding SEZs: A historical perspective. In *Social and Economic Impact of SEZs in India*. Oxford University Press, 2012, 15–36. <https://doi.org/10.1093/acprof:oso/9780198077275.003.0002>
  11. Parwez S, Sen V. Special Economic Zone, land acquisition, and impact on rural India. *Emerging Economy Studies*,2016:2(2):223–239. <https://doi.org/10.1177/2394901516661104>
  12. Misra K. Political domination and economic dispossession of farmers: The case of land acquisition for Special Economic Zones in India. *Journal of Globalization and Development*,2022:12(2). <https://doi.org/10.1515/jgd-2020-0083>
  13. Kumar V. SEZs and land diversifications: Need for an alternative model. *Journal of Economics and Development Studies*,2014:2(3):215–224. <http://dx.doi.org/10.15640/jeds.v2n3a16>
  14. Sahu KK. Displacement, land acquisition & Special Economic Zones in India. *International Journal of Humanities and Social Science Invention*,2013:2(3):35–40.
  15. Tewari S. Land Utilisation in Special Economic Zones in India: A macro and micro scenario. *Indian Journal of Public Administration*,2014:60(4):607-624.
  16. Kiran SP, Gopalappa DV. Special Economic Zones and land acquisition policy in India. *International Journal of Social Science and Economic Research*,2017:2(9). <https://doi.org/10.22004/ag.econ.262873>
  17. Misra K. Political domination and economic dispossession of farmers: The case of land acquisition for Special Economic Zones in India. *Journal of Globalization and Development*,2022:12(2). <https://doi.org/10.1515/jgd-2020-0083>
  18. Aggarwal A. Understanding SEZs: A historical perspective. In *Social and Economic Impact of SEZs in India*. Oxford University Press, 2012, 15–36. <https://doi.org/10.1093/acprof:oso/9780198077275.003.0002>
  19. Parwez S, Sen V. Special Economic Zone, land acquisition, and impact on rural India. *Emerging Economy Studies*,2016:2(2):223–239. <https://doi.org/10.1177/2394901516661104>
  20. Kumar V. SEZs and land diversifications: Need for an alternative model. *Journal of Economics and Development Studies*,2014:2(3):215–224. <http://dx.doi.org/10.15640/jeds.v2n3a16>
  21. Business Standard. “India’s SEZ failures a cautionary tale for Land Acquisition Bill.” Business Standard, 2015. Retrieved from [https://www.business-standard.com/article/specials/india-sez-failures-a-cautionary-tale-for-land-acquisition-move-115052000399\\_1.html](https://www.business-standard.com/article/specials/india-sez-failures-a-cautionary-tale-for-land-acquisition-move-115052000399_1.html)
  22. Levien M. *Dispossession, Development, and the State in India*. Oxford University Press, 2018.
  23. Puri SK. The New Land Acquisition Law: A Critique. *Journal of Indian Law Institute*,2014:56(1):60–78.
  24. Varma R. Land Acquisition Laws and Displacement of Indigenous Communities. *Indian Journal of Law*,2023:1(1):1–15. (DOI: <https://10.59850/ijil.v1i1.300>).
  25. Levien M. Special Economic Zones and the logic of land acquisition in India. *New Political Economy*,2011:16(3):323–341. (DOI: <https://10.1080/13563467.2011.579621>).
  26. Parwez S, Sen T. *Special Economic Zone, Land Acquisition, and Impact on Rural India*. Research Gate, 2016.
  27. Ranganathan V. Land Acquisition, Social Costs and the Failure of Compensation in India. *The Journal of Development Studies*,2019:55(2):269–284. (DOI: <https://10.1080/00220388.2018.1466085>).
  28. Planning Commission of India. Report of the Working Group on Land Relations and Land Reforms for the Eleventh Five Year Plan (2007–2012), 2008.
  29. Ghosh S. Nandigram: The Price of Land Acquisition. *Economic and Political Weekly*,2008:43(15):10–13.
  30. Aggarwal A. *Accumulation by Dispossession and Electoral Democracies: An Analysis of Land Acquisition for Special Economic Zones in India*. UMass ScholarWorks, 2023.
  31. Government of India, Ministry of Commerce & Industry, “Special Economic Zones (Amendment) Notification 2025,” Gazette of India, 2025.
  32. Kapoor N, Prasad B. Implementation Concerns of the RFCTLARR Act, 2013: A Practitioners' Perspective. *ASCI Journal of Management*,2014:43(1):38-51.
  33. Roy P, Ray A. Social Impact Assessment under RFCTLARR Act 2013 and Social Costs – An Analysis. *Artha-Journal of Social Sciences*,2018:18(2):28–36.
  34. Government of India. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013. (Act No. 30 of 2013), S, 2013:2(2).
  35. RFCTLARR Act, and the First and Second Schedules, 2013, 26.
  36. Bhattacharya J. 12 Years of RFCTLARR in India: What Has Changed (and has not Changed) for the Stakeholders. *Journal of Constitutional Law and Social Sciences*,2024:1(1):1–12. (DOI: <https://10.18311/JCLS/2024/v1i1/48652>).
  37. Levien M. *Special Economic Zones and the logic of land acquisition in India*, 2011.
  38. Puri SK. The New Land Acquisition Law: A Critique, 2014.
  39. Roy P, Ray A. *Social Impact Assessment under RFCTLARR Act 2013 and Social Costs*, 2018.

40. Ranganathan V. Land Acquisition, Social Costs and the Failure of Compensation in India, 2019.
41. Raju BM, Rao VM. Land Acquisition and Socio-Economic Impact: A Case Study of Kakinada SEZ. *Indian Journal of Regional Science*,2020:52(1):58-72.
42. The Hindu. Andhra Pradesh govt returns 2,180 acres to original Kakinada SEZ families, 2023.
43. Sathe D. Land Acquisition Act and the Ordinance: Some issues. *Economic and Political Weekly*,2015:50(26 & 27):90-95.
44. Padel F, Das S. POSCO in Odisha: The Ultimate Reality of Dispossession. *Economic and Political Weekly*,2010:45(13):10-15.
45. Amnesty International. India: Orissa steel project threatens human rights: The POSCO case. Amnesty International Publications, 2011.
46. Cernea MM. Impoverishment Risks and Reconstruction Model (IRR) for Resettling Displaced Populations. *World Development*,2000:28(8):1545-1563. (DOI: [https://10.1016/S0305-750X\(00\)00025-2](https://10.1016/S0305-750X(00)00025-2) ).
47. Samudram M. Special Economic Zones and Displacement: A Case Study of Mundra. *International Journal of Development Research*,2015:5(9):5644-5650.
48. Comptroller and Auditor General of India (CAG), 2016. Report on Compliance Audit in Special Economic Zones.
49. Sahoo KK, Mohanty SK. The Political Economy of Land Acquisition in India: Challenges and the Way Forward. *Journal of Land and Rural Studies*,2021:9(3): 293-315. (DOI: <https://10.1177/2321024921998520> ).
50. Roy S. The Nandigram Struggle: A People's Resistance. *Socialist Alternative*,2007:5(4):18-25.
51. Fernandes W. Displacement and Development: The New Land Acquisition Law and Its Consequences. *Economic and Political Weekly*,2014:49(20), 10-14.
52. Aggarwal A, Garg A. Socioeconomic Effects of Land Use Change for Industrialization: Evidence-Informed Learnings from Sri City India. *Businesses*,2024:4(3):29 9-314. (DOI: <https://10.3390/businesses4030019> ).
53. Aggarwal A, Garg A. Socioeconomic Effects of Land Use Change for Industrialization, 2024.
54. Ali M, Hussain J. Impact of special economic zones on socioeconomics and local development in Pakistan. *Frontiers in Public Health*,2024:12:1-10. (DOI: <https://10.3389/fpubh.2024.1156347> ).
55. Agarwal B. *A Field of One's Own: Gender and Land Rights in South Asia*. Cambridge University Press, 1994.
56. Rao N. Gender and displacement: Livelihoods and entitlements in India. *Development and Change*,2005:36(1):167-182. (DOI: <https://10.1111/j.0012-155X.2005.00407.x> ).
57. Nanda P, Bhattacharya J. THE RFCTLARR ACT, 2013: Policy, Legal & Operational Challenges. The Energy and Resources Institute (TERI), 2019.
58. Fernandes W. Displaced by Development: The New Land Acquisition Act and the Fate of Tribals. *Economic and Political Weekly*,2015:50(41):58-64.
59. Hasan M. Development and Tribal Displacement in Water Sector: Experiences, Challenges and Opportunities in the Resettlement of Affected Tribal Communities. *ASCI Journal of Management*, 2014:43(1):66-80.
60. Jojan A, Das S, Sahoo K. The Spiral of Impoverishment and Land Acquisition: A Case Study from Odisha. (Cited in: Kumar, S., & Gorthi, S. (2021). Comparative Analysis of Land Acquisition Acts in India. *International Journal of Law Management & Social Science*),2013:4(2):1-14.
61. Cernea MM. Public Policy Responses to Development-Induced Population Displacement. *Economic and Political Weekly*,1996:31(24):1515-1523.
62. Chakravorty S. Whose land? A citizen's guide to land acquisition. *The Indian Express*, March 10, 2015.
63. Kumar S. Land Acquisition in India: An Examination of the 2013 Act and Options. *Journal of Emerging Technologies and Innovative Research*,2025:12(5):11-24.
64. Roy P, Ray A. Social Impact Assessment under RFCTLARR Act 2013 and Social Costs, 2018.
65. Sharma P, Sharma V. Impact of the Right to Fair Compensation and Transparency in Land Acquisition Act. *International Journal of Emerging Technologies and Innovative Research*,2024:11(3):1-9.
66. World Bank. *Involuntary Resettlement: A Framework for Policy and Practice*, 2004.
67. Levien M. *Dispossession, Development, and the State in India*. Oxford University Press, 2018. (DOI: <https://10.1093/oso/9780199486278.001.0001> ).
68. Puri SK. The New Land Acquisition Law: A Critique. *Journal of Indian Law Institute*,2014:56(1):60-78.
69. Government of India, NITI Aayog. *Strategy on National Blockchain Technology*, 2020.
70. Lemieux VL. Blockchain and the Future of Land Registration. *Journal of Land Registration*, 2017:360(6):1-25.
71. Risi S, Basti M. Securing Land Rights with Blockchain: A Review of Decentralized Land Registry Systems. *Information*,2022:13(7):332. (DOI: <https://10.3390/info13070332> ).
72. Shahi A. Immutability of Blockchain and Its Potential for Combating Land Fraud in Developing Nations. *International Journal of Law and Technology*,2023:31(2), 167-185.
73. Woytek M. The Potential of Blockchain Technology to Enhance Land Governance Transparency and Accountability in India. *Urban Science*,2021:5(2):34. (DOI: <https://10.3390/urbansci5020034> ).
74. Christidis K, Devetsikiotis M. Blockchains and Smart Contracts. *IEEE Access*,2016:4:584-595. (DOI: <https://10.1109/ACCESS.2016.2566164> ).
75. Pradhan M. Smart Contracts for Legal Compliance in Infrastructure Projects: A Case Study of the RFCTLARR Act, 2013. *Asian Journal of Legal Studies*, 2023:14(1):45-60.
76. Durgadevi A, Bhuvaneshwari P. Decentralized Consent Verification using Blockchain for Land Acquisition in India. *Journal of Network and Computer Applications*, 2024:197:103289. (DOI: <https://10.1016/j.jnca.2024.103289> ).
77. Rathi A, Gupta M. Automated Compensation Disbursal using Smart Contracts to Enforce Gender Equity in Land Acquisition. *Journal of Financial Technology*,2022:11(3):112-125.
78. Singh K. Blockchain and the Lapse Clause: Improving Retrospective Justice through Decentralized

- Timestamps. *Indian Law Review on Digital Governance*,2021:6(2):88–101.
79. Ministry of Rural Development, Government of India. *Digital India Land Records Modernization Programme (DILRMP) Progress Report*, 2022.
  80. Kumar V, Das S. Leveraging GIS and Remote Sensing for Accurate Cadastral Mapping and Dispute Resolution. *Survey Review*,2024:56(396):256–271. (DOI: <https://10.1080/00396265.2023.2201974> ).
  81. Roy P, Ray A. Social Impact Assessment under RFCTLARR Act 2013 and Social Costs – An Analysis. *Artha-Journal of Social Sciences*,2018:18(2):28–36.
  82. Sarkar P. Geo-Spatial Monitoring of SEZ Land Use Diversion and Accountability. *Journal of Regional Science and Development*,2023:35(4):189–205.
  83. Gopinath R. Participatory Mapping and Geo-Referencing of Customary Land Rights of Tribal Communities using GIS. *Indigenous Peoples Review*, 2022:15(1):77–90. (DOI: <https://10.18278/ipr.15.1.4> ).
  84. Sharda N, Sharma B. A Permissioned Blockchain Framework for Tamper-Proof Land Records in Indian States. *International Journal of Computer Science and Network Security*,2024:24(1):101-110.
  85. Pradhan M. *Smart Contracts for Legal Compliance in Infrastructure Projects*, 2023.
  86. UN-Habitat. *Leveraging Geospatial Information for Land Administration and Management*. United Nations Human Settlements Programme, 2021.
  87. Woytek M. *The Potential of Blockchain Technology to Enhance Land Governance Transparency*, 2021.
  88. Varma R. Land Acquisition Laws and Displacement of Indigenous Communities. *Indian Journal of Law*, 2023:1(1):1–15. (DOI: <https://10.59850/ijil.v1i1.300> ).
  89. Lemieux VL. *Blockchain and the Future of Land Registration*, 2017.
  90. Sahoo KK, Mohanty SK. *The Political Economy of Land Acquisition in India: Challenges and the Way Forward*. *Journal of Land and Rural Studies*,2021:9(3):293-315. (DOI: <https://10.1177/2321024921998520> )
  91. Aggarwal A. *Special Economic Zones in India: Policy, Performance and Ways Ahead*. Indian Council for Research on International Economic Relations (ICRIER) Working Paper, 2018.
  92. Levien M. *Dispossession, Development, and the State in India*. Oxford University Press, 2018. (DOI: <https://10.1093/oso/9780199486278.001.0001> ).
  93. World Bank Group. *Special Economic Zones: An Operational Review and Lessons for Policy*. Washington, D.C.: World Bank Publications, 2017.
  94. Hsing YT. The Worlding of Chinese SEZs. *International Journal of Urban and Regional Research*,2010:34(1):160–170. (DOI: <https://10.1111/j.1468-2427.2009.00868.x> ).
  95. Goodburn C, Knoerich J. Translating China’s SEZ Model: The Making of an Industrial City in Southern India. *Urban Studies*,2021:58(15):3120–3137. (DOI: <https://10.1177/0042098020945952> ).
  96. Kennedy S. The Chinese Model of SEZ Development. *China Economic Journal*,2013:6(2-3):105–124. (DOI: <https://10.1080/17538963.2013.771234> ).
  97. Zhang L, Li H. Land Acquisition, Compensation and Displacement in Urban China. *Habitat International*, 2017:60:20–28. (DOI: <https://10.1016/j.habitatint.2016.12.001> ).
  98. Lim J. Land Acquisition in Singapore: A Legal and Historical Analysis. *Singapore Academy of Law Journal*,2012:24(1):154-184.
  99. Tan BH. The Role of the Jurong Town Corporation (JTC) in Singapore’s Industrial Land Development. *Urban Planning Quarterly*,2015:3(2):67-85.
  100. *Land Acquisition Act (Singapore)*, 1966.
  101. Deloitte. *UAE Free Zones: A Guide for Foreign Investors*, 2023.
  102. Alhosani A. Regulatory Autonomy and Infrastructure: A Key to Success of UAE Free Zones. *Journal of Middle East Business*,2020:5(1):40-55.
  103. Faraj AH. Legal Framework for Land Leasing and Investor Protection in Dubai’s Free Zones. *International Law Journal of the UAE*,2019:12:112–130.
  104. Environment Agency – Abu Dhabi (EAD). *Abu Dhabi’s Protected Area Network Expansion Report*, 2023.
  105. Saxena NC. Land Acquisition in India: Issues and Challenges under the New Act. *Economic and Political Weekly*,2019:54(32):29-37.
  106. Planning Commission of India. *Report of the Working Group on Land Policy and Administration*, 2011.
  107. Kumar A, Das A. Land Pooling and Land Banking: A Sustainable Alternative to Compulsory Acquisition in India. *Land Use Policy*,2022:122:106385. (DOI: <https://0.1016/j.landusepol.2022.106385> ).
  108. *K Thimmappa v. State of Karnataka*, 2 SCC 655 (Supreme Court of India), 1998.
  109. Puri SK. The New Land Acquisition Law: A Critique. *Journal of Indian Law Institute*,2014:56(1):60–78.
  110. Roy M. The Role and Effectiveness of the LARR Authority in India: A Regulatory Gap Analysis. *Legal Review of Social Justice*,2023:8(1):22–40.
  111. Fernandes W. Land Acquisition and Equity in India: Towards a Revenue-Sharing Model. *Journal of Land and Rural Studies*,2013:1(2):173–195. (DOI: <https://10.1177/2321024913498867> ).
  112. Ministry of Environment, Forest and Climate Change, Government of India. *Environmental Impact Assessment Notification*, 2006.
  113. Varma R. Integrating Environmental Assessment into the SEZ Framework: A Call for Strategic Environmental Assessment. *Indian Journal of Environmental Law*,2023:10(3):55–70.
  114. Dhingra V. Federalism and SEZ Governance: Resolving Conflict over Land and Labour Laws. *Journal of Public Policy and Governance*,2022:20(4): 45–62.
  115. Sahoo KK, Mohanty SK. *The Political Economy of Land Acquisition in India: Challenges and the Way Forward*. *Journal of Land and Rural Studies*, 2021:9(3):293-315. (DOI: <https://10.1177/2321024921998520> ).