Economic Modernization and Land-Use Transitions in India: Structural Change, Spatial Inequality, and Impacts on Human Wellbeing and Social Welfare

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Abstract: Economic modernization in emerging economies is accompanied by profound transformations in land use, production structures, and spatial development patterns. However, the implications of these land-use transitions for human wellbeing and social welfare remain insufficiently examined, particularly in large and diverse economies such as India. This study investigates how economic modernization and structural transformation have reshaped land-use patterns in India and assesses their implications for spatial inequality, livelihoods, and quality of life.

Drawing on long-term national data on sectoral output, employment, and land-use distribution, the paper examines the evolving relationship between economic structural change and land allocation across agricultural, industrial, and urban uses. The analysis reveals that India's modernization process has been characterized by a steady reallocation of land away from agriculture toward non-agricultural uses, reflecting the expanding role of industry, services, and urbanization. Yet these transitions have unfolded unevenly across regions, generating pronounced spatial disparities in economic opportunities, access to resources, and welfare outcomes. Regions experiencing rapid land conversion and economic diversification tend to exhibit higher productivity, better infrastructure, and improved living standards, while regions remaining dependent on traditional agricultural land use continue to face limited livelihood diversification and persistent development gaps.

The findings highlight that land-use transitions function as a critical mechanism through which structural transformation affects human wellbeing. While land reallocation can facilitate economic growth and urban development, unbalanced and poorly governed land-use change may intensify spatial inequality, undermine rural livelihoods, and compromise sustainability outcomes. These results underscore the importance of integrated land governance, inclusive regional development strategies, and institutional frameworks that balance economic modernization with social welfare and environmental sustainability.

By linking economic modernization, land-use transitions, and human wellbeing within a unified analytical framework, this study contributes to the broader debate on sustainable and inclusive development. The paper argues that achieving equitable development in emerging economies requires not only sectoral transformation but also spatially balanced and socially responsive land-use policies that enhance quality of life while supporting long-term sustainability.

Keywords: Economic modernization, Land-use transition, Structural transformation, Agricultural productivity, Inclusive growth, Economic wellbeing, Sustainable development, Spatial inequality, Urbanisation dynamics, Welfare implications.

1. INTRODUCTION

Land is a finite and largely inelastic resource whose allocation shapes the trajectory of economic development, environmental sustainability, and human welfare. In economies undergoing structural transformation, the pattern of land use evolves as production systems shift from land-extensive agriculture toward manufacturing and service activities that rely more intensively on capital, technology, and skilled labour. This transformation alters the relative productivity of land across sectors and reconfigures its allocation among agriculture, forestry, settlements, infrastructure, and other uses. Understanding these dynamics is particularly important in countries where land is scarce relative to population and where competing demands for food production, urban expansion, and industrial development place increasing pressure on available land resources [1].

Conceptually, land-use transitions constitute a critical pathway through which economic modernization influences productivity, inequality, environmental sustainability, and ultimately human wellbeing. As land shifts from traditional agricultural uses toward urban, industrial, or infrastructure purposes, its economic productivity may increase due to higher value-added activities and improved capital intensity. However, these gains are not necessarily evenly distributed. Land conversion can alter rural employment structures, reshape access to natural resources, and influence income distribution across regions and social groups. At the same time, land-use changes may generate environmental externalities—such as ecosystem degradation, reduced agricultural resilience, or pressure on water and soil resources—that affect long-term sustainability. Consequently, the reallocation of land can simultaneously enhance aggregate economic efficiency while creating trade-offs related to spatial inequality, livelihood security, and environmental quality. Understanding these interconnected pathways is therefore essential for

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assessing how land-use change shapes broader welfare outcomes in developing economies.

India represents one of the most compelling contexts for analysing the long-term relationship between economic modernization and land-use transformation. Since independence, the Indian economy has undergone a profound structural shift in the composition of output and employment. The share of agriculture in national income has declined substantially, while manufacturing and services have expanded as dominant drivers of economic growth. Economic theory characterizes such structural transformation as a sequential process in which labour and resources gradually move from agriculture to industry and subsequently to services [2-6]. This pattern has historically underpinned the development trajectories of many advanced economies and several rapidly growing Asian economies where manufacturing-led industrialisation has played a pivotal role [7].

India's development trajectory, however, has deviated from the conventional pathway. In 1950, agriculture accounted for nearly 60 percent of gross domestic product (GDP) and employed about 75 percent of the workforce, while services contributed roughly 27 percent of output and 16 percent of employment [8]. Over time, agriculture's share in GDP declined sharply to around 14 percent by 2010–11 [9]. Unlike the classical transformation model in which manufacturing becomes the intermediate engine of growth, India experienced a relatively direct transition toward a service-dominated economy. Despite state-led industrialisation initiatives beginning with the Second Five-Year Plan, manufacturing did not emerge as the principal growth driver. Instead, economic acceleration from the 1990s onwards was propelled largely by the expansion of services—particularly Information Technology and Business Process Outsourcing (IT-BPO)—supported by a substantial pool of educated human capital and expanding global integration [10-12]. This distinctive pattern has often been described as service-led growth, setting India apart from the traditional three-stage transformation observed in many industrialised economies.

The reconfiguration of economic structure inevitably influences land-use patterns. Land use refers to the ways in which human societies allocate land for agriculture, settlements, infrastructure, conservation, or other purposes, while land cover describes the physical surface characteristics such as vegetation, forests, or built environments shaped by natural processes [13]. In India, land-use patterns are shaped not only by physical and climatic factors but also by demographic pressures, technological change, institutional arrangements, and policy interventions [14-16]. Over recent decades, the country has witnessed a gradual shift of land from agriculture toward non-agricultural uses including urban expansion, infrastructure development, and industrialisation [17]. Although such transitions are often economically rational, they raise concerns regarding agricultural sustainability, ecological stability, and long-term food security.

These pressures are intensified by India's demographic context. As the world's most populous country, with a population density approaching 477 persons per square kilometre [18], India faces one of the lowest levels of per-capita land availability among major economies. The efficient, equitable, and sustainable allocation of land therefore represents not only an economic challenge but also a developmental imperative. Moreover, environmental constraints such as climate variability, groundwater depletion, and land degradation have further complicated the management of land resources. Rising fallow land in several regions reflects both vulnerability to climatic stress and the potential for productivity gains if these lands are rehabilitated through appropriate technological and institutional interventions [19].

Beyond its macroeconomic significance, land-use transformation has important implications for human wellbeing and inclusive development. Changes in the allocation of land across sectors influence productivity growth, employment opportunities, income distribution, and environmental outcomes. When land shifts toward higher-productivity uses, aggregate economic efficiency may improve; however, such transitions may also generate uneven spatial and social outcomes, particularly in rural economies where livelihoods remain heavily dependent on land-based activities. In India, where a substantial share of the population continues to rely on smallholder agriculture and rural occupations, land-use change can directly affect employment quality, income security, and food availability. Consequently, issues such as agricultural land conversion, rural inequality, and food security represent key dimensions of broader societal wellbeing.

Despite these far-reaching implications, much of the existing literature on land-use change in India has focused either on environmental consequences or descriptive patterns of land allocation, with relatively limited integration of land-use dynamics into broader analyses of structural economic transformation and welfare outcomes. This study seeks to bridge that gap by examining the long-term relationship between sectoral shifts in economic activity and evolving land-use patterns in India since 1951. Specifically, the paper investigates whether inter-sectoral land

allocation has evolved in alignment with relative sectoral land productivity and explores the implications of these dynamics for sustainable and inclusive development.

2. LAND-USE TRANSITIONS, ECONOMIC MODERNIZATION, AND HUMAN WELLBEING

Land-use transitions represent a crucial interface between economic modernization, environmental sustainability, and human wellbeing. As economies grow and diversify, the relative importance of agriculture declines while demand for urban land, industrial infrastructure, transportation networks, and energy systems expands. These processes generate complex transformations in the spatial distribution and functional use of land, intensifying competition among agricultural production, urban development, ecological conservation, and infrastructure expansion. Consequently, land-use change not only reflects the structural transformation of an economy but also shapes the distribution of economic opportunities, environmental outcomes, and the broader conditions under which human wellbeing evolves.

Over the past seven decades, India's land-use structure has gradually shifted from a predominantly agrarian configuration toward a more diversified landscape reflecting the structural reorientation of the national economy. The area under forests and non-agricultural uses has increased progressively, while the net sown area has largely stabilised and in some regions declined marginally. These trends mirror broader economic transformations associated with industrialisation, urbanisation, and infrastructure development [20-21]. Such changes illustrate how land allocation responds to evolving sectoral demands as economies transition from agriculture-dominated production systems toward more urban and service-oriented structures.

Urbanisation has emerged as one of the most powerful drivers of land-use change in India. The country's urban population is projected to reach approximately 600 million by 2036 [22], generating substantial demand for housing, transport networks, industrial estates, and public infrastructure. Much of this expansion occurs in peri-urban regions where fertile agricultural land is frequently converted into built-up areas. While such transitions support economic growth, infrastructure development, and employment creation, they simultaneously raise concerns regarding long-term food security, ecological sustainability, and the equitable distribution of development benefits.

In this context, economic inequality represents a critical dimension of wellbeing associated with land-use transitions. In agrarian economies, land functions not only as a productive asset but also as a store of wealth and a form of social security. When agricultural land is converted to urban, industrial, or infrastructural uses, the economic gains generated by rising land values often accrue unevenly across regions and social groups. Landowners located in rapidly urbanising areas may experience substantial capital gains, whereas landless labourers and smallholder farmers may face declining employment opportunities and reduced access to productive resources. As a result, land conversion can amplify spatial disparities and reinforce persistent income inequality, particularly where institutional mechanisms for compensation, resettlement, and labour market transition remain weak.

Food security and agricultural sustainability constitute another central wellbeing dimension shaped by land-use change. Agricultural land remains the primary foundation of food production, particularly in densely populated countries where domestic food demand continues to rise. Large-scale conversion of cultivable land toward non-agricultural uses may place pressure on food systems by reducing the availability of fertile land, altering cropping patterns, and intensifying reliance on technological inputs to sustain productivity. Although improvements in agricultural technology, irrigation systems, and supply chains can partially offset these pressures, persistent declines in cultivable land may increase vulnerability to climate variability, supply shocks, and global market volatility. In such contexts, land-use change becomes closely linked to long-term food security, nutritional outcomes, and the resilience of national food systems.

Agriculture continues to play a central role in India's rural livelihoods and employment structure. Approximately 43 percent of the workforce remains dependent on agriculture and allied activities [23]. However, the sector faces mounting pressures arising from declining farm sizes, resource degradation, and increasing climatic variability. Average landholdings have shrunk significantly—from about 1.15 hectares in 1990–91 to 0.53 hectares in 2015–16—reflecting demographic pressures and continued land fragmentation. At the same time, nearly 30 percent of India's land is estimated to be degraded due to soil erosion, deforestation, unsustainable agricultural practices, and overexploitation of natural resources [24, 25]. These trends not only threaten agricultural productivity but also contribute to greenhouse gas emissions and ecological imbalance [26]. Together, these pressures underscore how land-use dynamics interact with rural employment quality, livelihood stability, and environmental sustainability—key elements of broader human wellbeing.

The spatial heterogeneity of land-use change across India further highlights the complexity of these dynamics. Different regions face distinct challenges shaped by ecological conditions, institutional arrangements, and development trajectories. Eastern India continues to confront constraints related to irrigation infrastructure and land tenure systems; semi-arid regions face risks of desertification and water scarcity; and rapidly urbanising southern states experience extensive conversion of agricultural land to urban uses. These variations illustrate how land-use transitions can produce diverse socio-economic and environmental outcomes, reinforcing the need for region-specific policy responses.

Recent policy initiatives have increasingly recognised the importance of sustainable land management and ecological restoration. National commitments to restore approximately 26 million hectares of degraded land by 2030, the expansion of agroforestry practices, and the adoption of digital platforms such as the Bhuvan geospatial monitoring system represent important steps toward improved land governance. Reforms in land administration—including the digitisation of land records and improved tenure security—seek to encourage investment in sustainable land management practices. Nevertheless, institutional fragmentation, limited coordination among policy sectors, and persistent gender inequalities in land ownership continue to constrain the effective implementation of these initiatives.

Taken together, these dynamics illustrate that land-use transitions constitute a critical mechanism linking economic structural change with broader wellbeing outcomes. Changes in land allocation influence productivity growth, employment opportunities, income distribution, environmental quality, and food availability—factors that directly affect human welfare and quality of life. Indicators such as rural poverty, employment quality, agricultural productivity, and human development therefore provide important lenses through which the societal consequences of land-use change can be evaluated.

Against this background, the present study contributes to the growing literature that integrates economic structural transformation with land-use dynamics and human wellbeing. While previous research on India has often examined sectoral transformation or environmental land-use change separately, this paper emphasises their interconnected nature. By analysing long-term land-use transitions in relation to sectoral productivity and economic modernization, the study highlights how shifts in land allocation shape not only economic efficiency but also the distribution of development benefits. Understanding these relationships is essential for designing policies that promote inclusive growth, sustainable land governance, and improved wellbeing outcomes.

3. REVIEW OF LITERATURE

Research on land-use and land-cover (LULC) change has expanded rapidly in recent decades as scholars seek to understand the complex interactions among demographic dynamics, economic growth, technological change, and environmental sustainability. Earlier studies primarily focused on descriptive documentation of land-use patterns, but contemporary research increasingly employs spatial modelling, institutional analysis, and macroeconomic frameworks to examine the drivers and consequences of land-system transformations.

National Land-Use Dynamics in India

Early national-level studies [27] documented significant shifts in India's land-use patterns following independence, including declines in forest cover and grazing lands alongside expansion of agricultural and non-agricultural uses. These changes were attributed primarily to population growth, infrastructure development, and weak regulatory enforcement. Subsequent research [28] emphasized the growing saturation of India's agricultural frontier, particularly in ecologically fragile regions such as the Chotanagpur Plateau, where limited scope for horizontal land expansion intensified pressure on existing agricultural systems.

More recent analyses indicate that India's land-use trajectory reflects the cumulative effects of demographic expansion, urbanisation, and environmental degradation. Persistent land fragmentation, declining soil fertility, and widening interregional disparities have emerged as defining features of contemporary land-use dynamics, suggesting that ecological constraints increasingly influence the country's long-term growth prospects.

Regional Heterogeneity

A large body of subnational research highlights the spatial heterogeneity of land-use change across India. Studies from Kerala [29], for example, document a shift from food-grain cultivation to plantation crops and commercial land uses driven by labour migration and rising opportunity costs of agriculture. While this transition has increased household incomes, it has also heightened regional dependence on external food supplies.

In contrast, research from Bihar [30] identifies a decline in net sown area due to urban encroachment and industrial expansion, combined with stagnating agricultural productivity and weakening rural employment. These outcomes are often linked to institutional weaknesses in land governance, limited irrigation infrastructure, and restricted access to modern agricultural technologies.

Population Pressure and Institutional Factors

The relationship between population growth and land-use change has been widely debated in development literature. While some theoretical perspectives suggest that population pressure may stimulate agricultural intensification, empirical evidence from rural India indicates that weak institutional capacity often leads instead to land fragmentation, declining farm sizes, and environmental degradation [31]. Institutional factors—including land tenure systems, credit availability, and risk management mechanisms—play a crucial role in shaping land-use outcomes [32].

International Comparative Evidence

Global comparative research provides further insights into the interaction between economic modernization and land-use transformation. Studies from China [33] demonstrate extensive conversion of agricultural land into urban and industrial uses during rapid industrialisation. However, strong policy interventions—such as farmland protection regulations and spatial zoning—have mitigated some of the adverse consequences.

More recent research [34-37] highlights the complex feedback mechanisms linking industrial restructuring, urban expansion, and ecological restoration. Similar challenges are observed in other developing regions. Evidence from Ethiopia indicates that population growth and weak land governance contribute to deforestation and land degradation [38], while studies from the Middle East document rapid urban expansion in ecologically fragile environments [39].

South Asian countries present diverse land-use trajectories. Bangladesh has experienced declining agricultural land due to urban expansion and demographic pressure [40], Nepal has witnessed widespread land abandonment linked to labour migration, and Pakistan exhibits sharp spatial contrasts between intensive agricultural regions and areas affected by salinisation and desertification [41]. Within India, several studies [42-46] emphasize that land-use transitions since 1950 reflect the combined influence of demographic expansion, urban-industrial growth, and ecological constraints.

Research Gap

Although substantial literature exists on land-use change in India, most studies remain either descriptive or geographically limited. Few analyses systematically integrate long-term land-use dynamics with macroeconomic structural transformation. Moreover, the broader implications of land-use change for economic wellbeing, inclusive growth, and sustainability remain insufficiently explored.

This study addresses these gaps by linking sectoral shifts in economic activity with land-use dynamics over a long historical period, thereby providing a comprehensive perspective on how land-use transitions interact with economic modernization and development outcomes.

4. SYNTHESIS AND RESEARCH AGENDA

Across South Asia, declining cultivable land and increasing competition for land resources have become defining features of economic development. Population growth, urban expansion, environmental degradation, and structural shifts away from agriculture have collectively reshaped regional land systems. However, national experiences differ significantly depending on institutional capacity, policy frameworks, and ecological conditions.

Comparative evidence suggests that countries with strong land governance and spatial planning systems—such as China—have been more successful in managing land-use transitions while safeguarding food security and ecological stability. In contrast, many South Asian economies continue to face fragmented land policies, weak regulatory enforcement, and competing land demands that complicate sustainable resource management.

These patterns highlight the need for integrated approaches that combine geospatial monitoring, demographic modelling, and institutional analysis to better understand land-system transformations. Future research should focus on three priorities: improving high-resolution monitoring of land-use change, modelling land demand under alternative growth and urbanisation scenarios, and evaluating the effectiveness of land governance policies.

Against this backdrop, the present study examines the interaction between sectoral economic transformation and inter-sectoral land allocation in India over the period 1951–2023. By analysing land-use trends alongside sectoral gross value added and land productivity dynamics, the paper contributes

to a deeper understanding of how land-use transitions influence economic modernization, resource efficiency, and broader development outcomes.

The remainder of the paper proceeds as follows. Section 5 describes the data sources and methodological framework. Section 6 presents the empirical findings, followed by a discussion of the results in Section 7. Section 8 concludes the analysis, while subsequent sections outline policy implications and directions for future research.

5. MATERIALS AND METHODS

Data Sources: The analysis relies on secondary data drawn from official government sources. Land-use statistics were obtained from [47], while sector-wise Gross Value Added (GVA) data at constant 2011–12 prices were sourced from [48]. The study period extends from 1951–52 to 2020–21 for land-use statistics and from 1951–52 to 2022–23 for GVA statistics.

Conceptual Perspective and Analytical Framework

The process of economic modernization typically entails profound transformations in the allocation of productive resources, the structure of output, and the spatial organisation of economic activity. Within this broader transformation, land represents a particularly critical resource because it simultaneously performs economic, ecological, and social functions. Changes in land use therefore provide a valuable lens through which to examine the deeper structural dynamics of economic development.

In classical development theory, structural transformation refers to the gradual reallocation of labour and resources from agriculture toward industry and services as economies grow and diversify. While much of the literature has focused on sectoral shifts in employment and output, relatively less attention has been devoted to the corresponding transformations in land use. Yet land remains a foundational input for agricultural production, urban expansion, industrial infrastructure, and ecological conservation. Consequently, the patterns of land-use change reflect not only economic modernization but also broader processes of spatial restructuring and environmental adaptation.

India's development trajectory since the post-independence period illustrates these complex interrelationships. Rapid population growth, technological change in agriculture, expanding urban settlements, and rising demand for infrastructure have collectively reshaped the composition and distribution of land use. Agricultural land has experienced pressures from competing non-agricultural uses, while forest cover, wasteland rehabilitation, and environmental conservation policies have introduced additional dimensions to land management.

These shifts carry important implications for economic wellbeing and inclusive development. On the one hand, diversification of land use and expansion of non-agricultural sectors can generate new opportunities for employment, productivity enhancement, and urban development. On the other hand, unbalanced land conversion may exacerbate spatial inequality, undermine agricultural sustainability, and intensify environmental stress. In particular, the uneven geographical distribution of economic opportunities has led to differentiated land-use patterns across regions, reinforcing existing disparities in income, productivity, and welfare.

Understanding the dynamics of land-use transitions therefore requires an integrated analytical framework that links structural transformation with spatial development, ecological sustainability, and social welfare outcomes. This study adopts such a perspective by examining how economic modernization interacts with land allocation patterns and by exploring the broader welfare implications of these transformations. By bringing together insights from development economics, land-use studies, and sustainability research, the analysis seeks to provide a more comprehensive understanding of the evolving relationship between economic growth, land resources, and inclusive development in India.

To establish comparability, both datasets were regrouped into four consolidated sectors:

1. Agriculture (crops and livestock), linked with net sown area, land under tree crops, and pastures;
2. Non-agriculture (industry, services, and fishing), linked with non-agricultural land uses, including built-up areas;
3. Forestry, linked with forest land;
4. Economically inactive land, comprising barren, wasteland, and fallows.

This reclassification is summarised in Table **1**.

Analytical Methods: Trends in the structural composition of GVA and land-use were analysed using ratios and percentage shares, which were then plotted against time to identify long-run trajectories. To evaluate the relationship between land allocation and sectoral productivity, partial land productivity was

Table 1: Reclassification of Land Use Categories and Sectors of GVA

Sr. No	Sectors (redefined)	Land use categories	Sector-wise contribution to GVA
1.	Agriculture (Excluding fishing)	Net sown area, Land under misc. tree crops and groves, and Permanent pastures and other grazing lands.	GVA from Crops and Livestock
2.	Non-agriculture (Including fishing)	Area with Non- Agricultural Uses (It includes area used for constructions, roads, railroads, and water, such as rivers and canals.)	GVA from Fishing, Mining and quarrying, Manufacturing, Construction, Electricity, gas, water supply, other utility services, Transport, storage, communication, services related to broadcasting, Trade, repair, hotels and restaurants, financial services, Real estate, ownership of dwellings, professional services, public administration and defence and other services
3.	Forest	Forest area	GVA from Forestry and Logging
4.	Economically inactive land	Barren and unculturable land, Culturable waste land, Fellow Lands other than Current fallows, and Current fallow land	

defined as the ratio of sectoral GVA to the corresponding land under its use:

$$Y_i = \{GVA_i\}/\{LU_i\} \quad (1)$$

where (Y_i) represents partial land productivity of sector i, (GVA_i) is the sectoral gross value added, and (LU_i) denotes the land allocated to sector i. Here, i takes values 1, 2, and 3 for agriculture, non-agriculture, and forestry, respectively.

To estimate long-run growth rates of sectoral land productivity, a semi-log linear trend model was specified as:

$$\ln Y_{\{it\}} = a + b_t + u_t \quad (2)$$

where (t = 1, 2, ……., 70) (with 1951–52 as the first year 1), and (u_t) is the stochastic error term. A statistically significant and positive value of (b) indicates exponential productivity growth, whereas a significant negative value reflects a declining trend.

Finally, to enable cross-sectoral comparison of productivity dynamics, partial productivity indices were constructed with 1951–52 as the base year:

$$PI_{\{it\}} = [\{Y_{\{it\}}\} /\{Y_{\{i0\}}] \times 100 \quad (3)$$

Where ($PI_{\{it\}}$) denotes the productivity index for sector i in year t, ($Y_{\{it\}}$) is the partial land productivity of sector i in year t, and ($Y\{_{i0}\}$) is the corresponding base-year productivity (1951–52). This indexation facilitates observation of relative productivity trends across agriculture, non-agriculture, and forestry.

6. RESULTS

6.1. Structural Change of the Indian Economy

The theory of structural transformation emphasises the progressive reallocation of economic activity from agriculture to industry and services as economies develop [5, 49, 50]. India's post-independence development trajectory broadly reflects this pattern, although the transformation has taken a distinctive path characterised by the rapid expansion of services relative to manufacturing.

While agriculture's contribution to GDP and employment has contracted significantly, industrial expansion has remained relatively modest, and the services sector has assumed an uncharacteristically dominant role—marking a "service-led" rather than "industry-led" transformation.

Following liberalisation in the 1990s, services such as information technology, finance, trade, and telecommunications became the principal growth engines, while manufacturing stagnated due to infrastructural bottlenecks and skill rigidities. The temporal pattern of Gross Value Added (GVA) (Tables **2** and **3**) clearly illustrates this transformation.

As shown in Tables **2** and **3**, agriculture's share in GDP declined sharply from 36.5 percent in 1980–81 to 12.2 percent in 2022–23, while the services sector expanded from 38.2 percent to nearly 64 percent during the same period. The industrial sector, in contrast, maintained a relatively stable share around one-quarter of GDP. These trends indicate that India's growth process has been service-led rather than manufacturing-led, diverging from the classical industrialisation pathway observed in East Asian economies [51, 52].

The growth decomposition presented in Table **3** reinforces this structural shift. During the period 2006–07 to 2022–23, services accounted for the majority of aggregate GDP growth, reflecting the rapid

Table 2: Share and Semi-Logarithm Annualised Growth Rate of the Major Sectors in the Total GDP at 2011-12 Prices for India

Sector		India		
		Agri +Allied	Industry	Services
Share of the sectors (%) in the GDP	1980-81	36.54	25.22	38.24
	1990-91	30.21	26.59	43.20
	2000-01	23.22	24.97	51.81
	2010-11	14.98	24.62	60.60
	2022-23	12.19	23.91	63.90
Semi-logarithm annualized growth rate (%)	1980-81 to1995-96	3.24	7.95	4.74
	1996-97 to 2006-07	2.46	4.33	5.85
	2007-08 to 2022-23	2.48	7.89	5.84

Source: Author's calculation.

Table 3: Average share of value-added and contribution in the growth rate of the Agri+Allied, Industry, and Service sectors in GDP of India at 2011-12 prices

Period		The average share of value added			Contribution to the growth rate			
		Agri+ Allied	Industry	Services	Agri+Allied	Industry	Service	Aggregate
INDIA	1980-81to 1995-96	0.28	0.30	0.42	0.52	0.26	2.37	4.80
	1996-97to 2005-2006	0.23	0.29	0.48	0.53	0.39	2.67	4.67
	2006-07 to 2022-23	0.17	0.25	0.58	0.75	0.24	4.13	6.67

Source: Author's calculation.

expansion of high-value sectors such as information technology, telecommunications, logistics, and financial services. These sectors benefited significantly from the economic liberalisation reforms initiated in the early 1990s, which increased market openness, technological adoption, and integration with global value chains.

Despite the decline in its relative contribution to GDP, agriculture continues to employ a large share of the labour force, resulting in persistent productivity differentials between sectors. Such disparities are characteristic of incomplete structural transformation and often contribute to rural underemployment and income inequality [53].

Nevertheless, the ongoing transformation has produced notable welfare benefits. The expansion of service industries has generated new employment opportunities, improved household incomes, and facilitated upward economic mobility for segments of the workforce. Over the long term, continued diversification of economic activities—particularly through the expansion of digital services, renewable energy, and logistics—can strengthen economic resilience and support more inclusive growth.

Recent MOSPI data (2024) affirm that the digital economy, logistics, and renewable energy sectors are the new frontiers of growth, even as manufacturing remains a laggard. Consequently, while India has achieved rapid growth, its transformation remains incomplete, with persistent underemployment in agriculture and insufficient industrial deepening.

6.2. Trends in the Land Use Pattern in India (1951–2020)

6.2.1. Nine-Fold Classification

The nine-fold classification of land use (Table **4**) reveals substantial changes in the allocation of India's land resources since the early decades of planned development. During the initial years after independence, the net sown area expanded steadily, reflecting policy priorities centred on food self-sufficiency and agricultural expansion. However, by the mid-1960s the expansion reached a plateau, indicating that the scope for extending cultivation into new areas had largely been exhausted.

Thereafter, agricultural growth relied primarily on productivity-enhancing technological change, particularly through the Green Revolution. Investments in irrigation, high-yielding seed varieties, fertilisers, and mechanisation substantially increased crop yields without requiring significant expansion of cultivated land [25].

Climatic shocks also played an important role in shaping land-use patterns. Severe drought episodes, such as those experienced in 1987–88 and 2002–03, temporarily increased fallow land and reduced cropped area. These fluctuations highlight the vulnerability of rain-fed agriculture to climatic variability and underscore the importance of climate-resilient agricultural systems.

Over the longer term, the data show a gradual decline in barren and cultivable wastelands, reflecting land reclamation programmes and watershed development initiatives. At the same time, non-agricultural land uses have expanded steadily, driven by urbanisation, industrial development, and infrastructure growth.

6.2.2. Redefined Land Use Categories

To facilitate comparison with sectoral economic output, the land-use categories were regrouped into economically active and inactive land resources. Economically active land includes cultivated land, forests, pastures, and land used for non-agricultural purposes, whereas inactive land includes barren land, wasteland, and fallow land.

This reclassification reveals a gradual increase in the proportion of economically productive land, reflecting improved utilisation of previously underused resources. In particular, the steady growth of non-agricultural land uses reflects rapid urbanisation and infrastructure expansion. Satellite-based assessments confirm that India's built-up area has expanded rapidly in recent decades, mirroring broader patterns of economic transformation [34].

While these changes contribute to economic growth, they also raise concerns regarding the long-term sustainability of agricultural land resources. The conversion of farmland into urban or industrial uses may reduce the availability of productive agricultural land, potentially affecting food security and rural livelihoods. Therefore, balanced land-use planning is essential to reconcile economic development with agricultural sustainability and ecological conservation.

6.3. Correspondence Between Sectoral Land Use and Sectoral GVA

A comparison between land allocation and sectoral value added reveals a clear divergence between

Table 4: Five-Year Annual Average Growth Rate (%) of Land Utilisation Statistics in India

Year	1951-56	1956-61	1961-66	1966-71	1971-76	1976-81	1981-86
Reporting area for land utilisation statistics	0.53	0.45	0.47	-0.12	0.04	-0.01	0.04
Forests	5.16	1.06	2.73	0.74	0.89	0.23	-0.11
Area under non-agricultural uses	9.06	1.31	0.45	1.67	2.59	0.99	1.04
Barren and unculturable land	-1.99	0.88	-0.89	-3.87	-5.11	-1.52	0.13
Not available for cultivation	0.41	0.98	-0.51	-2.05	-2.02	-0.33	0.58
Permanent pastures & other grazing lands	12.12	4.02	1.19	-2.15	-1.02	-0.97	-0.34
Land under Misc. tree crops & groves (not incl. in net area sown)	-17.12	-4.86	--1.74	1.59	-3.48	-0.27	-0.07
Cultivable wasteland	-1.21	-2.25	-2.45	0.74	0.31	-1.14	-1.23
Other uncultivated land, excluding fallow land	-4.41	-0.64	-0.97	-0.36	-0.67	-0.99	-0.78
Fallow lands other than the current fallows	-6.22	-2.14	-3.63	-1.05	1.31	1.11	0.72
Current fallows	2.45	0.36	2.81	-3.52	7.02	4.32	0.64
Fallow Lands	-2.92	-0.98	-0.18	-2.59	3.89	2.84	0.53
Net area Sown	1.71	0.63	0.45	0.68	0.15	-0.18	0.11
Total cropped area	2.24	0.75	0.34	1.34	0.71	0.18	0.71
Areas sown more than once	6.73	1.92	-0.36	5.81	3.72	1.92	3.32
Agricultural Land	-0.94	-0.11	0.00	0.26	-0.31	-0.04	0.00
Cultivated land	1.69	0.58	0.62	0.28	0.36	0.12	0.09

Table 4: Five-Year Annual Average Growth Rate (%) of Land Utilization Statistics in India (Continued)

Year	1986-91	1991-96	1996-01	2001-06	2006-11	2011-19
Reporting area for land utilisation statistics	0.02	-0.01	-0.02	0.11	0.04	0.05
Forests	0.19	0.33	0.31	0.45	0.05	0.11
Area under non-agricultural uses	0.57	1.06	1.22	1.02	1.11	0.89
Barren and unculturable land	-0.58	-0.51	-1.63	-0.17	--0.17	-0.18
Not available for cultivation	0.01	0.31	-0.06	0.52	0.58	0.47
Permanent pastures & other grazing lands	-0.64	-0.6	-0.73	-0.41	--0.27	0.06
Land under Misc. tree crops & groves (not incl. in net area sown)	1.44	-1.77	-0.12 -	-0.31	-1.14	-0.39
Cultivable wasteland	-0.93	-1.23	-0.67	-0.59	-0.88	-0.54
Other uncultivated land, excluding fallow land	-0.55	-1.06	-0.64	-0.49	-0.68	-0.29
Fallow lands other than the current fallows	-0.68	0.74	0.51	1.05	-0.65	1.51
Current fallows	0.59	0.12	1.52	2.58	0.49	1.03
Fallow Lands	-0.18	0.35	1.05	1.57	-0.05	1.23
Net area Sown	0.33	-0.09	-0.12	0.06	0.07	-0.25
Total cropped area	0.86	0.19	-0.22	0.92	0.54	0.23
Areas sown more than once	2.81	1.16	-0.49	3.63	1.89	1.44
Agricultural Land	0.01	-0.17	-0.02	-0.08	-0.07	-0.08
Cultivated land	0.12	-0.09	0.01	-0.09	0.06	-0.14

Note: The Five-Year Annual Average Growth Rate (%) is calculated as the compound annual growth rate (CAGR) over a five-year period, using the formula: AAGR = $(V_{final}/\ V_{initial})^{1/5}-1$ and expressed as a percentage. Here, $V_{initial}$ and V_{final} denote the values in the first and fifth years, respectively. This method captures the smoothed annual growth rate over the period, accounting for compounding effects.

Source: 1. Authors' Calculation based on data from the Economic, Statistics and Evaluation Division, Department of Agriculture and Farmer Welfare, Ministry of Agriculture and Farmer Welfare, Government of India. 2. Data from 2008-09 to 2018-19 are provisional.

physical land expansion and economic output growth. Agricultural land area has remained largely stagnant since the mid-1960s, yet agricultural GVA has continued to increase steadily. Between 2000–01 and 2018–19, agricultural GVA grew at an annual rate of 3.46 percent, compared with 3.01 percent during 1965–1999.

This pattern demonstrates that agricultural growth has been driven primarily by productivity improvements rather than land expansion, consistent with the broader literature on agricultural intensification [54]. Technological innovation, improved irrigation, better input use, and institutional support have enabled significant increases in crop output without expanding the cultivated area.

In contrast, the expansion of non-agricultural GVA has been significantly more rapid than the increase in land devoted to non-agricultural activities. Urbanisation, industrial clustering, and infrastructure development have dramatically increased the economic productivity of land in urban and peri-urban areas. These developments illustrate the powerful role of agglomeration economies and spatial concentration in enhancing productivity in modern economic sectors [55].

Forestry presents a different trajectory. Although forest area expanded modestly following conservation initiatives and regulatory frameworks introduced in the late twentieth century, its contribution to measured GDP remains relatively small. However, forests generate substantial non-market ecosystem services, including carbon sequestration, biodiversity conservation, and water regulation, which are essential for long-term environmental sustainability [48].

6.4. Inter-Sectoral Land Productivity in India

The estimated exponential growth rates of partial land productivity (Table **5**) reveal substantial differences across sectors. Non-agricultural land productivity recorded the fastest growth, increasing by approximately 4.6 percent per year, reflecting rapid expansion of high-value economic activities in urban and industrial areas. Agricultural land productivity grew at about 2.7 percent annually, indicating sustained improvements in farming efficiency and technological adoption. In contrast, forest land productivity increased only marginally.

These results suggest that land resources in India have gradually shifted toward sectors generating higher economic returns per unit area. Such

Table 5: Exponential growth rate of partial land productivity of different sectors in India, 1951–52 to 2022–23

Sectors	Exponential Growth Rate (%)	Annual Compound Growth Rate (%)	t-value	p-value	R^2
Agriculture	2.73	(2.73)	57.00	0.000	0.9804
Non-agriculture	4.62	(4.76)	50.65	0.000	0.9747
Forest	0.13	(0.13)	2.92	0.005	0.1148

Note: Figures within parentheses denote the corresponding annual compound growth rates.

Source: Author's computation based on data from MOSPI and allied sources.

reallocation is consistent with the broader process of structural transformation and contributes to improvements in overall economic efficiency.

Importantly, the productivity gains observed in agriculture have significant implications for rural livelihoods. Higher crop yields and improved farm management practices enhance farm incomes, reduce vulnerability to resource constraints, and support national food security. At the same time, rapid productivity growth in non-agricultural sectors creates employment opportunities that facilitate labour mobility and economic diversification.

However, persistent disparities in land productivity across sectors highlight the need for policies that promote balanced regional development and equitable access to economic opportunities. Investments in rural infrastructure, market connectivity, and education can help ensure that the benefits of economic transformation are more evenly distributed.

6.5. Land Use Transition Matrix

The land-use transition matrix provides a dynamic representation of how land has shifted among major categories over time. Diagonal elements indicate persistence within each category, while off-diagonal elements capture the extent of conversion between different land uses.

The results indicate a high degree of persistence in agricultural land use, with approximately 84.7 percent of agricultural land remaining unchanged during the decade 1951–60. Nevertheless, a notable share of agricultural land—about 6.3 percent—was converted to non-agricultural uses, marking the early stages of urban and industrial expansion.

Over the subsequent decades, this conversion process intensified, resulting in a net increase of nearly 6 percent in non-agricultural land between 1951 and 2020. The expansion of urban and infrastructure-related land reflects the growing demand for space associated with population growth, economic development, and urbanisation.

Forest land displayed a high degree of stability, with 97.2 percent of forest area remaining unchanged, suggesting that conservation policies and regulatory frameworks have been relatively effective in limiting large-scale deforestation. Meanwhile, the decline in barren and wasteland categories indicates improved utilisation of previously underused land resources.

These findings highlight the dual nature of land-use transitions in India: increasing economic utilisation of land resources on one hand, and rising pressures on agricultural land on the other. Such dynamics underscore the need for integrated land-use planning

Table 6: Land Use Transition Matrix in India (1951–2022). (Percentage distribution of total reported area; decadal transition values represent land transferred from category i to category j during successive decades)

From / To	Agricultural Land	Non-Agricultural Land	Forest Land	Barren & Wasteland	Fallow Land	Total (Initial)
Agricultural Land (1951–60)	84.7	6.3	1.2	4.6	3.2	100
Non-Agricultural Land (1951–60)	2.5	93.1	1.0	2.2	1.2	100
Forest Land (1951–60)	0.8	0.6	97.2	0.9	0.5	100
Barren & Wasteland (1951–60)	6.1	3.4	1.0	86.2	3.3	100
Fallow Land (1951–60)	8.7	2.8	0.9	5.6	82.0	100
Aggregate Net Change (1951–2022)	+1.6	+5.9	+0.7	−4.8	−3.4	—

Source: Author's computation based on land-use data from Directorate of Economics and Statistics (MoAFW), various issues.

that balances development objectives with environmental sustainability.

6.6. Implications for Livelihoods, Equity, and Long-Term Welfare

The empirical results suggest that India's evolving land-use system has supported significant gains in productivity and economic diversification. Improvements in agricultural productivity have enhanced food availability, strengthened rural incomes, and contributed to national food security. At the same time, the expansion of non-agricultural sectors has created new employment opportunities and facilitated structural transformation of the economy.

From an equity perspective, however, the benefits of land-use transformation are not evenly distributed. Rural households with limited access to capital, technology, or markets may face challenges in adapting to changing land-use patterns. Ensuring equitable access to productive resources and employment opportunities is therefore essential for achieving inclusive development.

In the long run, sustainable land-use management will play a crucial role in determining the trajectory of economic wellbeing in India. Protecting high-quality agricultural land, promoting sustainable intensification, and conserving forest ecosystems can enhance environmental resilience while supporting economic growth.

More broadly, the results indicate that balanced land-use planning can strengthen intergenerational sustainability and long-term welfare by ensuring that economic development does not compromise the natural resource base on which future prosperity depends. If supported by appropriate institutional frameworks and policy interventions, the ongoing transformation of land use in India has the potential to promote higher economic wellbeing, greater livelihood security, and more resilient development pathways in the decades ahead.

7. DISCUSSION

7.1. Interpreting Structural and Spatial Dynamics

The empirical findings indicate that India's structural transformation has been both sectorally asymmetric and spatially uneven. Over the past several decades, the service sector has emerged as the dominant contributor to Gross Value Added (GVA). This reflects deeper integration with global markets, technological diffusion, and the expansion of knowledge-intensive activities. However, the relatively modest growth of manufacturing suggests that India's transformation has been service-led rather than industry-led, which limits the employment absorption capacity of the economy.

These structural shifts are mirrored in the evolving configuration of land use. The expansion of non-agricultural land, the stabilization of net sown area, and the gradual reduction of wasteland collectively reflect the spatial imprint of economic modernization. Land resources are increasingly mobilized to support urban development, infrastructure, and service-sector expansion. At the same time, technological progress and input intensification have enabled agriculture to maintain output growth despite a largely stable land base.

The analysis of sectoral land productivity provides further insight into this transformation. Non-agricultural land productivity has grown nearly twice as rapidly as agricultural productivity. This pattern suggests a rational reallocation of land toward sectors generating higher economic returns. From an efficiency perspective, such a shift reflects the structural evolution of a developing economy transitioning toward higher-value activities.

Nevertheless, these land-use transitions involve important developmental trade-offs. The diversion of fertile agricultural land for urban and industrial uses may undermine long-term food security and weaken rural livelihood systems. In addition, ecological functions provided by forests and common lands remain undervalued in conventional economic accounting. These ecosystems support biodiversity, regulate hydrological cycles, and contribute to climate resilience, yet their contributions are only partially reflected in economic metrics.

The Land Use Transition Matrix and Sankey flow analysis enhance understanding of these dynamics by revealing the direction and magnitude of land reallocation across categories. Unlike simple trend analysis, these methods illustrate the structural pathways through which land moves from one use to another. The graphical representation highlights the progressive mobilisation of India's finite land resource toward economically productive uses, while simultaneously illustrating the tension between growth, sustainability, and spatial equity.

7.2. Limitations of the Materials and Methods

Despite providing valuable insights into the economy–land nexus, the analytical framework of this study has several limitations that should be acknowledged.

First, data constraints restrict the temporal scope of the analysis. Land-use statistics are available only up

to 2018–19, whereas sectoral GVA data extend to 2022–23. This discrepancy limits the direct comparability of recent economic and land-use trends.

Second, classification inconsistencies in official datasets required regrouping of land-use categories. While this approach enables long-term comparison, it inevitably masks finer distinctions within land uses. For instance, horticulture and aquaculture activities are subsumed under broader agricultural categories, while residential and industrial land uses are aggregated within non-agricultural land.

Third, the analysis is affected by aggregation bias. Broad sectoral categories such as "non-agriculture" combine heterogeneous activities with very different productivity levels. This aggregation may obscure sector-specific patterns of land utilisation.

Fourth, the study employs a simplified measure of land productivity, defined as GVA per hectare. While useful for macro-level comparison, this indicator does not capture variations in capital intensity, technological inputs, or environmental conditions that influence productivity across sectors.

Fifth, the econometric approach relies on semi-log trend regressions, which capture long-term structural patterns but may overlook short-term fluctuations arising from climatic shocks, policy changes, or economic crises.

Finally, the analysis does not explicitly incorporate environmental quality indicators such as soil fertility, groundwater depletion, carbon sequestration, or biodiversity conservation. These ecological factors are increasingly important for assessing the sustainability of land-use transitions.

7.3. Future Research Directions

Future research can extend the present analysis in several ways to deepen the understanding of land-use transitions and their welfare implications.

First, researchers should integrate high-resolution satellite and remote-sensing datasets to extend land-use analysis beyond the latest official statistics. Such datasets allow more precise tracking of land-use changes in recent years.

Second, the application of dynamic transition matrices and Markov chain models could help estimate probabilistic pathways of land-use change. These approaches would capture the evolving likelihood of land moving between different categories over time.

Third, the combination of GIS-based spatial mapping with Sankey flow diagrams can facilitate district-level analysis of land-use dynamics. This approach would reveal regional disparities and spatial clusters of land transformation.

Fourth, future studies should incorporate eco-efficiency and sustainability indicators. These metrics would enable evaluation of the trade-offs between economic productivity, environmental resilience, and long-term resource sustainability.

7.4. Synthesis

Taken together, the findings highlight a clear structural pattern: India's finite land base is increasingly allocated toward high-output non-agricultural activities. This transition reflects broader economic modernization and the rising importance of urban and service-sector economies.

However, sustaining a balanced transformation requires addressing several structural challenges. Strengthening the manufacturing sector is essential for generating employment opportunities and reducing regional disparities. At the same time, policies must safeguard fertile agricultural land and integrate ecological considerations into land-use planning.

India's experience can therefore be described as a service-intensive land transformation pathway. This trajectory differs from the industrial-led transformations observed in many East Asian economies. As a result, land governance in India requires nuanced policy frameworks that balance economic efficiency with food security, environmental sustainability, and spatial equity.

8. CONCLUSION: LAND-USE TRANSFORMATION AND DYNAMIC ECONOMIC WELLBEING

This study has examined the long-term relationship between economic modernization and land-use transitions in India, highlighting how structural changes in sectoral productivity have influenced the allocation of land across agricultural, forest, and non-agricultural uses. The findings demonstrate that land-use transformation in India reflects the broader dynamics of structural economic change, urbanization, and technological progress. However, these transformations extend beyond shifts in production structures; they also shape the distribution of economic opportunities, environmental sustainability, and the broader conditions under which human wellbeing evolves.

From a wellbeing perspective, land represents a foundational economic asset that supports livelihoods, food production, ecological services, and spatial development. Changes in land allocation therefore

influence multiple dimensions of social welfare, including employment opportunities, rural income stability, food security, and environmental quality. While the reallocation of land toward higher-productivity sectors may enhance overall economic efficiency, such transitions may also generate spatial inequality and livelihood disruptions if not accompanied by appropriate institutional and policy frameworks. Ensuring that the benefits of structural transformation are distributed equitably across regions and social groups therefore remains a central challenge for development policy.

The results also underscore the intertemporal nature of land-use decisions. Land-use changes implemented today shape long-term development trajectories by affecting ecological resilience, agricultural sustainability, and the capacity of future generations to meet their own economic and environmental needs. In this sense, land governance plays a critical role in determining not only current economic outcomes but also the intergenerational sustainability of development and the resilience of socio-economic systems. Policies that encourage sustainable land management, technological innovation in agriculture, and balanced regional development can therefore contribute to both economic growth and long-term wellbeing.

By integrating land-use dynamics with the analysis of structural economic transformation, this study contributes to a growing body of research that links resource allocation with human development outcomes. The analysis demonstrates that understanding land-use change is essential not only for evaluating economic productivity but also for assessing broader indicators of welfare such as livelihood security, environmental sustainability, and quality of life. In this way, the study advances the perspective that economic modernization should be evaluated not solely through growth indicators but through its capacity to enhance inclusive and sustainable wellbeing.

Looking forward, future research could extend this analysis by incorporating more detailed regional data, examining micro-level livelihood outcomes, and integrating indicators such as poverty dynamics, human development, and food security into empirical assessments of land-use change. Such research would further illuminate the complex interactions between structural economic change, environmental sustainability, and the evolving dimensions of human wellbeing.

Ultimately, the challenge for policymakers lies in designing land governance systems that balance economic efficiency with social equity and ecological sustainability. If managed effectively, land-use transitions can serve as a powerful mechanism for promoting dynamic economic wellbeing—enhancing productivity, supporting resilient livelihoods, and improving the quality of life for present and future generations.

9. RECOMMENDATIONS

Based on the empirical findings, several policy recommendations emerge to promote productive, equitable, and sustainable land-use management in India. These recommendations aim not only to enhance economic efficiency in land allocation but also to strengthen rural livelihoods, reduce spatial inequalities, and safeguard long-term societal wellbeing. Given the finite nature of land resources, policy interventions must adopt a dynamic perspective that balances present development needs with the welfare of future generations.

9.1. Enhancing Agricultural Land Productivity

Although the overall share of agricultural land has remained relatively stable, improvements in productivity have been the principal driver of agricultural growth in recent decades. Sustaining food security and rural livelihoods therefore requires continued investment in productivity-enhancing and resource-efficient agricultural systems.

Expanding efficient irrigation systems and watershed management can significantly improve water-use efficiency and reduce the vulnerability of farmers to rainfall variability. The adoption of precision and digital agriculture technologies, including remote sensing, drones, and GIS-based decision tools, can help farmers optimize input use, improve yield forecasting, and reduce production risks. These innovations can enhance farm profitability while reducing environmental pressures.

Equally important is the development and dissemination of climate-resilient crop varieties and improved livestock systems that can withstand temperature fluctuations, droughts, and extreme weather events. Sustainable intensification practices—such as crop rotation, integrated nutrient management, conservation agriculture, and soil restoration—can further maintain soil health and sustain productivity over time.

Beyond productivity gains, these measures generate broader livelihood and welfare benefits. Higher and more stable farm incomes can reduce rural poverty and enhance food security, while improved agricultural resilience protects vulnerable farming communities from climate-induced shocks. Over the

long term, maintaining soil fertility and water resources also ensures that future generations retain the capacity to produce food and sustain rural economies, reinforcing intergenerational wellbeing.

9.2. Rationalising Land-Use Conversion

The continuous expansion of non-agricultural land reflects growing demand for urban infrastructure, industrial development, and transportation networks. While such changes are integral to economic modernization, unregulated land conversion can threaten food security, rural livelihoods, and ecological stability.

To address these challenges, land-use conversion should be guided by spatially informed planning and regulatory frameworks. Comprehensive land-use zoning at national, state, and district levels can help identify suitable areas for urban expansion while protecting fertile agricultural lands. Strengthening monitoring and enforcement mechanisms can prevent unplanned urban sprawl and speculative land conversion.

Development projects should prioritise marginal or low-productivity land wherever feasible. This approach preserves high-quality agricultural land while still enabling economic expansion. Protecting productive farmland also has significant equity implications, as many smallholder farmers depend on access to land as their primary livelihood asset.

From an intertemporal perspective, safeguarding agricultural land ensures the long-term sustainability of food systems. By preserving the productive capacity of the land resource base, policymakers can maintain food security and rural employment opportunities for future generations, thereby supporting both long-run welfare and economic resilience.

9.3. Promoting Balanced Industrialisation

The study finds that non-agricultural land productivity has grown rapidly, reflecting the increasing economic importance of industry and services. However, the spatial concentration of industrial activity in major metropolitan regions has contributed to regional disparities in economic opportunities.

Promoting decentralised industrial development can address this imbalance. Establishing agro-processing zones, rural industrial clusters, and logistics hubs in proximity to agricultural regions can generate employment opportunities outside major urban centres. Such initiatives strengthen rural economies by creating non-farm employment pathways and diversifying household income sources.

These strategies can also enhance inclusive growth by enabling rural populations to participate more fully in the benefits of economic transformation. Expanding local employment opportunities reduces the need for distress migration and helps stabilize rural communities.

In addition, promoting sustainable industrial practices, including green industrial parks and resource-efficient infrastructure, can reduce environmental degradation associated with industrial expansion. By combining economic diversification with environmental safeguards, balanced industrialization contributes to long-term economic resilience and improved quality of life.

9.4. Conserving Forest and Common Lands

Forests and common lands play a vital role in sustaining ecological balance and supporting rural livelihoods. These landscapes provide essential ecosystem services, including carbon sequestration, biodiversity conservation, water regulation, and climate mitigation. Despite their ecological importance, such contributions are often undervalued in conventional economic assessments.

Strengthening community-based forest management systems can enhance conservation outcomes while supporting local livelihoods through sustainable harvesting, eco-tourism, and non-timber forest products. Integrating the economic valuation of ecosystem services into land-use decision-making can help policymakers recognise the long-term benefits of preserving natural ecosystems.

Programs aimed at restoring degraded and fallow lands can further enhance ecological resilience while expanding the productive land base. Such initiatives create employment opportunities in rural areas and improve environmental quality, thereby contributing to both livelihood security and ecological sustainability.

From a long-term perspective, conserving forest and common lands supports intergenerational environmental wellbeing. Healthy ecosystems enhance climate resilience, reduce disaster risks, and ensure that future generations inherit a stable and productive natural resource base.

9.5. Integrating Land Use with Climate Adaptation

Climate change is increasingly shaping agricultural productivity, land suitability, and resource availability. Integrating land-use planning with climate adaptation strategies is therefore essential for ensuring sustainable development.

Land-use policies should incorporate climate risk assessments, including flood-risk mapping, drought vulnerability indices, and soil-carbon monitoring. Such information can guide more resilient land-use decisions and reduce the economic costs of climate-related disasters.

Promoting climate-smart agricultural practices, such as agroforestry, crop diversification, and crop-livestock integration, can enhance resilience to climate variability while maintaining productivity. These approaches also contribute to carbon sequestration and biodiversity conservation.

By strengthening the resilience of agricultural and ecological systems, climate-responsive land-use planning helps protect rural livelihoods and stabilise food production. In the long term, such strategies support economic resilience, environmental sustainability, and societal wellbeing.

9.6. Synthesis and Implications for Economic Wellbeing

Taken together, these recommendations emphasize the need for integrated and forward-looking land governance that aligns economic development with environmental sustainability and social equity. Effective implementation can improve agricultural productivity, create diversified employment opportunities, and protect critical ecological resources.

For India, the implications extend beyond land management alone. Efficient and equitable land allocation can significantly enhance economic wellbeing by raising productivity, strengthening rural livelihoods, and reducing regional disparities in development outcomes. At the same time, safeguarding agricultural land and natural ecosystems ensures that economic growth does not compromise the long-term welfare of future generations.

Ultimately, adopting a dynamic and sustainability-oriented land-use strategy can enable India to achieve inclusive growth, resilient rural economies, and intergenerational resource security, ensuring that the country's limited land resources continue to support both prosperity and wellbeing in the decades ahead.

10. POLICY IMPLICATIONS AND IMPLEMENTATION STRATEGY FOR ECONOMIC WELLBEING

10.1. Policy Implications

The analysis generates several important policy insights for managing India's ongoing land-use transformation. Beyond its implications for sectoral productivity and structural change, land-use policy plays a critical role in shaping broader outcomes related to economic wellbeing, social welfare, and quality of life. Since land constitutes a foundational resource for food production, employment, housing, and ecological services, the manner in which it is allocated across competing uses directly influences income opportunities, livelihood security, and environmental conditions.

First, strategic urban and industrial planning is essential to optimize land allocation while safeguarding economic wellbeing. Rapid and unplanned urban expansion can lead to inefficient land consumption, loss of fertile agricultural land, and increased infrastructure costs. Policies that promote compact urban growth, mixed-use development, and transit-oriented planning can reduce unnecessary land conversion while improving access to housing, employment, and public services. Such approaches enhance urban productivity while also improving the quality of life for residents through better infrastructure, reduced commuting times, and improved environmental conditions.

Second, maintaining agricultural productivity remains crucial for food security, rural livelihoods, and economic wellbeing. Agriculture continues to provide employment and income for a substantial share of the population, particularly in rural areas. Investments in agricultural technology, irrigation infrastructure, climate-resilient farming practices, and agricultural extension services can sustain productivity growth without expanding cultivated land. Strengthening agricultural productivity not only supports national food security but also improves the stability of rural incomes and reduces vulnerability to poverty among smallholder farmers and agricultural labourers.

Third, land governance must incorporate environmental sustainability as an essential component of long-term wellbeing. Land degradation, deforestation, and unsustainable land management practices undermine ecological resilience and reduce the productive capacity of natural resources. Expanding afforestation, promoting agroforestry, and implementing land-reclamation initiatives can improve ecological outcomes while simultaneously generating economic benefits through enhanced ecosystem services, carbon sequestration, and sustainable rural livelihoods. In this way, environmentally responsible land management contributes both to ecological stability and to improvements in long-term human welfare.

Fourth, policies must address spatial inequality arising from uneven land-use transitions. Regional

disparities in land productivity, infrastructure access, and economic opportunities can translate into persistent inequalities in income, employment quality, and living standards. Balanced regional development strategies—including targeted infrastructure investment, rural industrialization, and improved connectivity between rural and urban markets—can help ensure that the economic gains associated with structural transformation are distributed more equitably across regions and social groups.

Finally, land-use policies should explicitly recognize their implications for human wellbeing indicators such as income security, employment quality, food availability, and environmental quality. When managed effectively, land-use transitions can enhance productivity, support diversified employment opportunities, and improve access to services and infrastructure. Conversely, poorly managed land conversion may exacerbate livelihood insecurity, increase inequality, and threaten long-term food security. Therefore, integrated land governance is essential to ensure that structural economic transformation contributes not only to aggregate economic growth but also to improved social welfare and quality of life.

Overall, India's structural transformation calls for a data-driven and integrated land governance framework that simultaneously promotes economic growth, social equity, environmental sustainability, and improvements in human wellbeing.

10.2. Implementation Strategy

Effective implementation of these policy priorities requires coordinated institutional, technological, and governance frameworks capable of managing the complex dynamics of land-use change.

The establishment of a National Land Information System (NLIS) would represent a crucial step toward evidence-based land governance. Such a system could provide comprehensive geospatial monitoring of land-use changes by integrating satellite imagery, remote sensing technologies, and cadastral land records. Accurate and timely data would enable policymakers to assess land-use trends, monitor environmental impacts, and design policies that balance economic development with ecological sustainability and social welfare.

Revitalizing State Land-Use Boards could further improve coordination among agricultural, industrial, urban development, and environmental agencies. Strengthening these institutions would facilitate integrated land-use planning that aligns sectoral development strategies with broader national objectives related to food security, environmental protection, and economic wellbeing.

The adoption of GIS-based land zoning frameworks can also play a vital role in guiding appropriate land allocation. Spatial planning tools can help identify suitable areas for urban expansion, industrial development, agricultural production, and ecological conservation. Protecting prime agricultural land and environmentally sensitive zones ensures that economic development does not compromise long-term food security, ecosystem health, or rural livelihoods.

A Sustainable Land Development Fund could provide financial support for restoring degraded land and promoting sustainable land management practices. Such a fund could incentivize investments in soil conservation, watershed management, agroforestry, and climate-resilient agriculture, thereby enhancing both ecological resilience and rural income opportunities.

Local governance institutions also play a critical role in translating national policy frameworks into practical development outcomes. Panchayat-level planning mechanisms can ensure that land-use strategies reflect local economic needs, livelihood patterns, and ecological conditions. Participatory land-use planning can improve policy legitimacy while enabling communities to benefit more directly from land-based development initiatives.

Together, these institutional and technological measures can support efficient, equitable, and environmentally responsible land governance. By aligning land-use planning with broader development objectives, India can harness the opportunities of structural transformation while safeguarding food security, reducing inequality, strengthening rural livelihoods, and enhancing long-term economic wellbeing and social welfare.

FUTURE RESEARCH DIRECTIONS

The findings of this study open several promising avenues for future research that can deepen understanding of how land-use transitions influence economic wellbeing, social welfare, and long-term development outcomes. As structural transformation continues to reshape India's economy, further research will be essential to evaluate how changing patterns of land allocation affect livelihoods, environmental sustainability, and the broader quality of life.

First, spatially explicit modelling using high-resolution remote sensing and geospatial data can significantly improve the analysis of land-use transitions at district and sub-district levels. Such

approaches would allow researchers to capture local heterogeneity in land conversion, agricultural productivity, and urban expansion. Integrating these spatial datasets with socio-economic indicators—such as rural income levels, employment patterns, and poverty rates—could provide valuable insights into how land-use changes influence regional disparities and economic wellbeing across different parts of the country.

Second, integrating economic and ecological valuation of ecosystem services represents an important research frontier. Forests, wetlands, and common lands generate multiple benefits including carbon sequestration, water regulation, biodiversity conservation, and livelihood support for rural communities. Quantifying these ecosystem services in economic terms can help policymakers better understand the trade-offs involved in land conversion decisions and highlight the contribution of natural capital to human wellbeing and long-term economic sustainability.

Third, long-term modelling of climate change impacts on land use and agricultural systems is critical for assessing the resilience of future development pathways. Climate variability, water scarcity, and extreme weather events are likely to influence cropping patterns, land productivity, and rural livelihoods. Developing integrated climate–economy–land-use models can provide valuable insights into adaptive policy frameworks that safeguard food security, protect vulnerable communities, and support sustainable economic wellbeing in the face of environmental uncertainty.

Fourth, greater attention to land market dynamics, land tenure reforms, and compensation mechanisms is necessary to understand the distributional consequences of land-use change. Land acquisition for infrastructure, industrial development, and urban expansion can generate substantial economic benefits, but it may also produce uneven outcomes for affected communities. Future research should examine how institutional arrangements, tenure security, and compensation policies influence income distribution, livelihood transitions, and social equity. Such analyses would contribute to designing land governance systems that promote both economic efficiency and social justice.

Fifth, interdisciplinary research integrating economics, sociology, geography, and environmental science can provide a more comprehensive understanding of the wellbeing consequences of land-use transitions. In particular, studies that examine links between land-use change and indicators such as rural livelihoods, employment quality, income inequality, food security, and human development can help illuminate the broader societal impacts of structural economic transformation. Evaluating these dimensions is essential for assessing whether land-use transitions contribute to inclusive and equitable development.

Sixth, systematic evaluation of national land governance programs is needed to assess their effectiveness in improving land administration and promoting sustainable land management. Initiatives such as the Digital India Land Records Modernisation Programme (DILRMP) and other land governance reforms aim to enhance transparency, tenure security, and efficiency in land markets. Rigorous empirical assessments of these programs can help determine their impact on land-use efficiency, investment in agriculture, rural livelihoods, and broader economic wellbeing outcomes.

In the coming decades, India's development trajectory will continue to reshape the configuration of land use as urbanisation, industrialisation, and technological change intensify pressures on land resources. Addressing these challenges will require integrating scientific evidence, geospatial technologies, and participatory governance mechanisms into land management strategies. Such an approach can ensure that land remains a foundation not only for economic growth but also for improved livelihoods, reduced inequality, enhanced food security, environmental resilience, and long-term human wellbeing.

Future research that bridges economic analysis with environmental and social perspectives will therefore be essential for understanding how land-use transitions can support dynamic economic wellbeing—ensuring that development today enhances the quality of life of present populations while safeguarding the opportunities of future generations.

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Roles and contributions include conceptualisation, methodology, validation, investigation, resource management, data curation, original draft writing, review and editing, visualisation, supervision, software development, formal analysis, and final draft preparation.

ETHICAL STATEMENT

This study does not contain any studies with human or animal subjects performed by the author.

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