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Urban Sustainability in Jaipur: An Analysis of SDG 11 Indicators in Its Urban Landscape

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ABSTRACT

The rapid pace of urbanization has positioned cities at the center of sustainable development debates. Sustainable Development Goal 11 (SDG 11), which aims to "make cities and human settlements inclusive, safe, resilient, and sustainable," provides an integrated framework to evaluate and guide urban growth. Jaipur, the capital of Rajasthan and a UNESCO World Heritage City, represents the dual challenge of preserving cultural heritage while coping with rising urbanization pressures. This study evaluates Jaipur's progress towards SDG 11 using secondary data from authentic sources such as the Census of India, NITI Aayog's SDG India Index, Jaipur Municipal Corporation (JMC), Jaipur Metro Rail Corporation (JMRC), Rajasthan State Pollution Control Board (RSPCB), WHO, UN-Habitat, and the World Bank. The analysis covers five domains: housing and slums, transport and mobility, land use and urban planning, air quality and waste management, and access to green spaces. Findings reveal that while Jaipur has made strides in heritage preservation, smart city projects, and partial progress in affordable housing, significant challenges persist. Nearly 15% of the population lives in slums, public transport usage is declining, air quality consistently breaches WHO safe limits, and green space availability is far below international standards. Comparative benchmarks with Delhi and Ahmedabad further highlight Jaipur's mixed progress. The paper concludes that Jaipur must prioritize integrated land use planning, expansion of public and non-motorized transport, strict air quality measures, and a dedicated urban green mission. Such reforms will not only elevate Jaipur's sustainability credentials but also contribute to Rajasthan's ranking in the SDG India Index and India's long-term vision of Viksit Bharat 2047.

***Keywords**: SDG 11, Jaipur, Urban Sustainability, Housing, Transport, Air Quality, Green Spaces.*

Introduction

Urbanization is one of the defining processes of the 21st century. Today, more than half of humanity resides in cities, and by 2050, nearly 70% of the global population will live in urban areas (UN-Habitat, 2022). While cities generate over 80% of global GDP, they are also responsible for 75% of carbon emissions and nearly two-thirds of global energy consumption. This makes urban areas both engines of growth and hotspots of unsustainability.

In recognition of these challenges, the United Nations adopted the Sustainable Development Goals (SDGs) in 2015 as part of the 2030 Agenda. SDG 11 specifically addresses the urban question: "Make cities and human settlements inclusive, safe, resilient, and sustainable." The goal encapsulates key targets such as affordable housing (11.1), sustainable transport (11.2), participatory urban planning (11.3), cultural heritage protection (11.4), reduction of environmental impacts (11.6), and universal access to green spaces (11.7).

India, home to the second largest urban population in the world, faces mounting challenges in managing its urban centres. The share of urban residents increased from 27.8% in 2001 to 34% in 2011, and is projected to cross 50% by 2050 (Census of India, 2011; UN World Urbanization Prospects, 2023). Jaipur, a Tier-II city, exemplifies these transformations. With a population of 4.1 million in 2023 and an annual growth rate of 3.5%, the city confronts mounting pressures on housing, transport, air quality, and ecological balance.

As Rajasthan's capital and a UNESCO World Heritage City, Jaipur is uniquely positioned. On the one hand, it benefits from tourism, smart city investments, and heritage status. On the other, it faces the dual burden of rapid population growth and fragile ecosystems. This paper analyses Jaipur's performance on SDG 11 indicators using reliable secondary data, with an emphasis on identifying gaps and proposing actionable pathways for achieving sustainable urbanism.

Importance of SDG 11

Cities are at once drivers of development and sources of vulnerability. They occupy just 2% of Earth's land but account for over 60–80% of energy use and 75% of carbon emissions (World Bank, 2021). In India, cities contribute over 60% of GDP, yet they also grapple with slums, air pollution, waste accumulation, and mobility bottlenecks.

SDG 11 is particularly relevant for India because:

- It addresses housing shortages, which affect millions in informal settlements.
- It emphasizes sustainable mobility, critical for Indian cities plagued by congestion.
- It promotes inclusive planning, countering historically top-down approaches.
- It underscores environmental sustainability, crucial given India's urban air pollution crisis.
- It highlights green and public spaces, which enhance liveability and resilience.

For Jaipur, SDG 11 offers a blueprint to balance modernization with heritage conservation and ecological resilience.

Study Area: Jaipur City

Jaipur is located at 26°55′N latitude and 75°49′E longitude, covering approximately 485 km². Established in 1727, the city is globally recognized for its planned architecture and pink sandstone heritage, earning it UNESCO World Heritage status in 2019. Jaipur is divided into 11 zones under Greater Jaipur and Heritage Jaipur.

Key demographic and environmental features include:

- Population: 3.1 million (2011 Census) → 4.1 million (2023 estimate).
- Urban growth rate: ~3.5% annually.
- Slum population: 15% of total residents (JMC, 2023).
- Air quality: Annual PM2.5 average ~90 µg/m³ (RSPCB, 2022), exceeding WHO's safe limit of 25 µg/m³.
- Green cover: Declined from 9.5% (2010) to 7.2% (2020).
- Tourism: Over 4 million annual visitors.

Jaipur's unique combination of heritage preservation and rapid urbanization makes it an ideal case for evaluating SDG 11 progress.

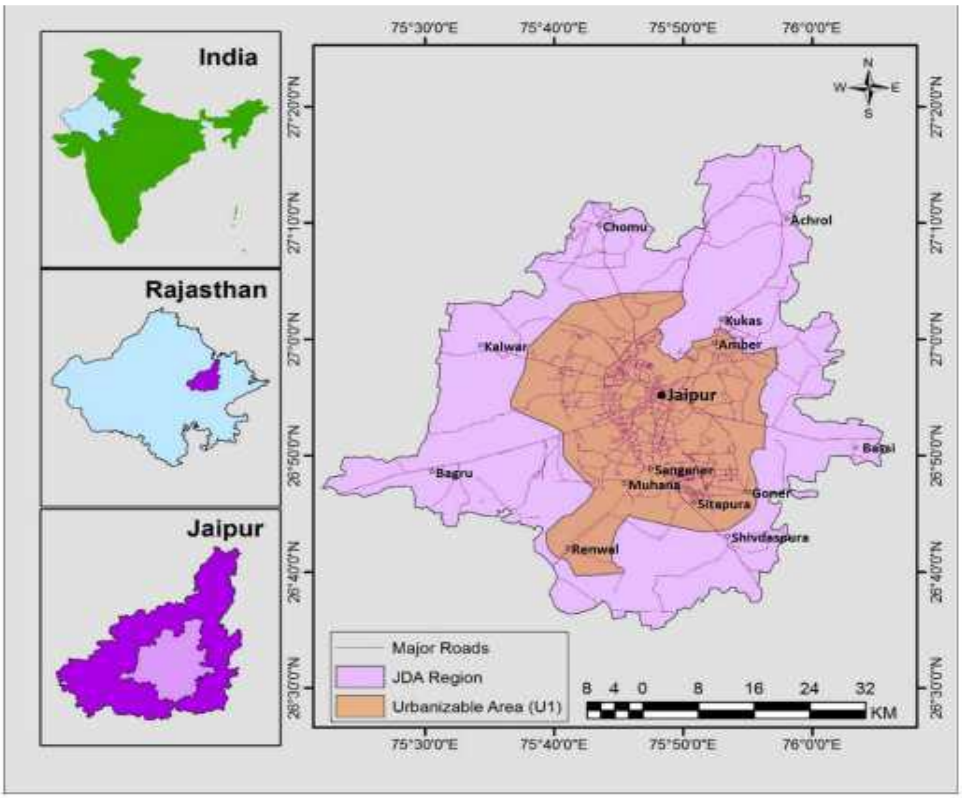

Figure: Study area Map
Source: Jaipur Municipal Corporation

Methodology

The study employs a mixed-method approach relying on secondary data analysis.

Data Sources

- Housing & Slums: Census of India (2011), JMC (2023), Ministry of Housing & Urban Affairs (PMAY Dashboard, 2022).
- Transport & Mobility: Jaipur Metro Rail Corporation (JMRC, 2022), Jaipur City Transport Services Ltd. (JCTSL, 2022).
- Land Use: Jaipur Master Plan 2025, JDA (2021).
- Air Quality & Waste: RSPCB (2022), CPCB (2022).
- Green Spaces: Remote sensing data, WHO standards, JMC reports.
- Comparisons: Delhi and Ahmedabad urban datasets, UN-Habitat World Cities Report (2022).

Analysis Tools

- Descriptive statistics.
- GIS-based mapping of land use and green cover.
- Comparative benchmarks with national and global cases.

Analysis and Discussion

The analysis is organized under five SDG 11 domains.

- **Housing and Slums (Target 11.1)**

Jaipur's housing deficit is evident in the persistence of slums. Despite policy interventions, affordable housing delivery lags behind demand.

Table 1: Housing Indicators in Jaipur

Indicator	Jaipur Data	Source
Slum population (% of total)	15% (2023)	Jaipur Municipal Corporation, 2023
Number of recognized slums	450+	JMC, 2023
PMAY houses sanctioned	24,000	MoHUA, 2022
PMAY houses completed	~14,400 (60%)	MoHUA, 2022
Average monthly rental cost (2BHK, middle-income locality)	₹12,000–15,000	Housing.com, 2022

- **Transport and Mobility (Target 11.2)**

Table 2: Transport Indicators in Jaipur

Indicator	Jaipur Data	Source
Metro length	12 km (Phase 1)	JMRC, 2022
Population served by metro	<5%	JMRC, 2022
Daily bus ridership	150,000 (down from 250,000 in 2015)	JCTSL, 2022
Registered private vehicles	1.9 million (2022)	Transport Dept., Rajasthan
Growth in private vehicles (2010–2020)	+45%	Transport Dept., Rajasthan

- **Land Use and Urban Planning (Target 11.3)**

Urban sprawl in Jaipur is evident, with built-up area expanding faster than population growth.

Table 3: Land Use Change in Jaipur (2010–2020)

Category	2010 (%)	2020 (%)	Change	Source
Residential	32	41	+9	JDA, 2021; GIS analysis
Commercial	8	12	+4	JDA, 2021
Green cover	9.5	7.2	-2.3	RSPCB, 2022
Agricultural/peri-urban	28	21	-7	JDA, 2021

- **Air Quality and Waste Management (Target 11.6)**

Air quality is one of Jaipur's most severe sustainability challenges.

Table 4: Air Quality and Waste Indicators in Jaipur

Indicator	Jaipur Data	WHO/India Standard	Source
Average annual PM2.5	90 µg/m³	WHO: 25 µg/m³; CPCB: 40 µg/m³	RSPCB, 2022
Average AQI (2022)	180–200 ("Poor")	AQI < 50 is "Good"	CPCB, 2022
Daily waste generation	1,200 tons/day	—	JMC, 2022
Waste scientifically processed	70%	Target: 100%	JMC, 2022

- **Green Spaces and Public Access (Target 11.7)**

Green spaces in Jaipur are declining both in quantity and accessibility.

Table 5: Green Space Indicators in Jaipur

Indicator	Jaipur Data	Global Benchmark	Source
Green cover (% of city area)	7.2% (2020)	WHO recommends 15–20%	RSPCB, 2022
Per capita green space	2.6 m²	WHO minimum: 9 m²	JMC, 2022
Major public parks	~100	—	JDA, 2021
Urban heat island effect	+2–3°C in city core vs outskirts	—	Remote sensing (2020)

Jaipur's per capita green space falls far below WHO's recommended levels. Loss of peri-urban green belts worsens ecological stress and heat vulnerability.

Conclusions and Recommendations

The analysis of Jaipur's progress on SDG 11 paints a picture of partial success and significant challenges. Jaipur has benefitted from its designation as a Smart City and its UNESCO World Heritage status, attracting funding and tourism. Investments in infrastructure and heritage preservation have strengthened its profile as a global city. However, the city's urban sustainability indicators reveal structural gaps.

Key Conclusions

- **Housing and Slums:** Despite PMAY interventions, Jaipur still faces a large slum population. Housing affordability remains a major issue due to rising land prices and slow execution of housing schemes.
- **Transport and Mobility:** Public transport infrastructure has stagnated, with metro coverage minimal and bus ridership declining. Private vehicle dependence is unsustainable. Jaipur lags behind comparable Indian cities in transport integration.
- **Land Use and Urban Planning:** Urban sprawl continues unchecked, consuming agricultural land and reducing green cover. The Jaipur Master Plan's compact growth vision is not fully realized. Citizen participation in planning is limited, weakening inclusivity.
- **Air Quality and Waste:** Jaipur consistently records poor air quality, exceeding WHO and CPCB standards. Vehicular emissions and dust dominate pollution sources. Waste generation is rising, and only 70% is scientifically treated.
- **Green Spaces:** Jaipur's per capita green space (2.6 m²) is far below WHO's recommendation (9 m²). The decline in urban greenery intensifies heat island effects, undermining resilience.

Recommendations

- Housing: Accelerate PMAY housing projects, incentivize affordable rental housing, and integrate slum rehabilitation with social infrastructure.
- Transport: Expand Jaipur Metro to at least 30 km by 2035, modernize bus fleets, and invest in cycling and pedestrian infrastructure.
- Land Use: Strictly enforce Jaipur Master Plan 2025 provisions to curb sprawl; adopt mixed-use zoning and participatory planning mechanisms.
- Air Quality: Implement stricter vehicular emission norms, promote electric mobility, and create urban green buffers.
- Waste Management: Mandate segregation at source, expand recycling, and invest in waste-to-energy facilities.
- Green Spaces: Launch an Urban Green Jaipur Mission to increase per capita green space to 9 m² by 2035, restoring peri-urban forests and expanding public parks.
- Governance: Ensure coordination among JDA, JMC, and Smart City Mission with strong citizen participation in planning.

Final Note: Jaipur's ability to achieve SDG 11 depends on a balance between its cultural heritage and future aspirations. If it aligns development policies with sustainability principles, Jaipur can become a model city for medium-sized urban centers in India and a significant contributor to the national goal of Viksit Bharat 2047.

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