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A study of sustainable development of Pune City: A secondary analysis

Parag Suryawanshi[1], Shubhangi Mature[1], Deepika Mirchandani[2]
[1] Department of Management, Trinity Institute of Management and Research, Maharashtra, India
[2] Assistant Professor, Department of Management, Trinity Institute of Management and Research, Maharashtra, India

Abstract
Rapid urbanization and population growth have positioned Pune as a crucial metropolitan area in India, simultaneously fostering economic prosperity (IT, manufacturing) and escalating environmental and social pressures. This dual trajectory necessitates a critical assessment of the city's progress toward the Sustainable Development Goals (SDGs). This paper conducts a secondary analysis of existing reports, policy documents (e.g., Pune Smart City Development Corporation Ltd. reports, Development Plans, Climate Action Plans), and academic literature to evaluate Pune's performance across key pillars of sustainable urban development. The research synthesizes secondary data focusing on three core thematic areas: Sustainable Mobility and Infrastructure (SDG 9, 11), Environmental Stewardship (SDG 6, 13, 15), and Inclusive Urban Governance (SDG 10, 16, 17). Quantitative indicators and qualitative policy assessments are triangulated to identify progress, shortfalls, and systemic challenges. Pune demonstrates significant advancements in select areas, notably in sustainable transport (e.g., success of the Rainbow BRT and electric bus adoption) and the implementation of a circular economy model in solid waste management (e.g., the SWaCH model). However, progress is significantly hampered by jurisdictional disconnects, the threat of encroachment on ecologically sensitive areas (hills, river floodplains), and challenges in ensuring equitable housing and service delivery amidst rapid migration. Pune's journey towards comprehensive sustainability is a complex case study of a "Smart City" initiative running parallel to deeply entrenched urban planning and enforcement issues.

Keywords: Sustainable development (SD), urbanization, sustainable development goals (SDGs), metropolitan region (PMR)

Introduction
Pune, often lauded as the "Oxford of the East" and a burgeoning IT and automotive hub, is a principal growth engine of Maharashtra. Its dynamic expansion, while driving significant economic output, exerts immense pressure on its natural resources and urban infrastructure. The need for a cohesive, long-term sustainability strategy is paramount. This paper addresses this need by conducting a secondary analysis of existing efforts and outcomes related to sustainable development in Pune City.

Background and Context
India's commitment to the UN's Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities), requires metropolitan areas like Pune to become models of resilient and inclusive growth. Pune's own initiatives, primarily through the Pune Smart City Development Corporation Limited (PSCDCL), serve as tangible policy instruments aimed at achieving these global targets. The analysis is framed by the city's unique geographical constraints (hill-valley ecosystem, river confluences) and its socio-economic character (high migrant population, growing income disparity).

Scope and Methodology
This paper is a secondary research study. Data is exclusively drawn from published sources: government reports (PMC, PSCDCL), official policy documents (Development Plans, Climate Action Plans), reports by international bodies (ITDP, WRI), and peer-reviewed academic articles. The analysis is structured around three critical, interlinked pillars of urban sustainability:

1. Sustainable Mobility and Infrastructure.
2. Environmental Stewardship and Resource Management.
3. Inclusive Urban Governance and Social Equity.

Sustainable Mobility and Infrastructure (SDG 9 & 11)
Pune's efforts in sustainable transport serve as a high-profile case study of urban transformation.

1. Public Transit Success and Challenges
The most significant initiative is the Rainbow Bus Rapid Transit (BRT) System. Secondary data indicates a degree of success in modal shift, with the BRT system successfully enticing private vehicle users to public transport [2]. the city has also shown commitment to low-carbon public transport through the increasing deployment of a fleet of electric buses [3].

- **Progress Indicators:** Increased ridership on BRT routes; allocation of a significant portion of the transport budget to sustainable modes [4].
- **Challenges:** The rapid growth in private vehicle ownership continues to negate the environmental gains; congestion remains severe due to infrastructural deficits; expansion of the BRT and Metro network is slow relative to the pace of urban sprawl.

2. Smart City Interventions in Infrastructure
PSCDCL projects have focused on smart street lighting, IT-enabled pan-city solutions, and area-based development (ABD) in neighborhoods like Aundh, Baner, and Balewadi [5].

- The goal of 'Placemaking' and creating accessible, multi-use open spaces aims to enhance livability and neighborhood-level sustainability.

- The reliance on technology (GIS-based planning, IoT sensors) in the proposed Pune Master Plan 2041 shows a clear policy direction towards modernized and efficient infrastructure management.

Environmental Stewardship and Resource Management (SDG 6, 13 & 15)

The environmental pillar highlights both Pune's globally recognized models and its most acute vulnerabilities.

1. Waste Management and Circular Economy

Pune is internationally recognized for its progressive approach to solid waste management, largely due to the unique public-private-NGO partnership model of SWaCH (Solid Waste Collection and Handling).

- **Progress Indicators:** High rates of decentralized source segregation; formal integration of informal waste pickers, promoting social equity alongside environmental recovery; significant contribution to a circular economy and reduction in landfill burden.

- **Challenge:** Despite these successes, the issue of untreated sewage (estimated at a substantial percentage of daily generation) flowing into the Mula-Mutha Rivers remains a critical failure point, posing severe risks to public health and biodiversity.

2. Ecological Preservation and Climate Risk

Pune's distinct natural geography—specifically it's surrounding hills and river floodplains—is under continuous threat from unplanned urbanization [7].

- The controversy surrounding projects like the Balbharati-Paud Phata link road passing through the ecologically sensitive ILS Hill exemplifies the conflict between development and conservation, often requiring judicial intervention (Supreme Court, NGT).

- **Climate Action Plan (CAP):** The ongoing development of a CAP, compiling a comprehensive GHG inventory and vulnerability assessment, is a proactive step (SDG 13) [8]. However, implementing effective environmental zoning and preventing encroachment in designated Biodiversity Parks (BDP) remains a primary administrative and political hurdle.

- **Water Security (SDG 6):** Water sustainability assessments point to rising water demand and the crucial need for managing hydrological footprints, particularly in the context of increasing population density.

Inclusive Urban Governance and Social Equity (SDG 10, 16 & 17)

Sustainable development must be inclusive and supported by effective governance structures.

1. Housing and Slum Rehabilitation

The secondary analysis indicates that a significant percentage of the urban population resides in slum areas. While the PMC and the state government have programs like the Slum Rehabilitation Programme (SRP) and policies for Economically Weaker Section (EWS) housing, the rapid influx of the migrant population continues to outpace the delivery of affordable and safe housing units.

- **Social Equity Challenge:** The exponential growth in real estate, coupled with an increase in migrant population density, forces low-income communities into high-risk, informal settlements (e.g., riverbanks, steep slopes), increasing vulnerability to disaster risks.

2. Governance and Policy Implementation

A recurring theme in the secondary literature is the lack of integrated governance.

- **Jurisdictional Disconnect:** Environmental issues, such as industrial pollution in suburban belts (like Chakan), are complicated by the lack of unified regional planning across the Municipal Corporation, Gram Panchayats, and industrial development zones (MIDC) [9]. This fragmentation leads to weak enforcement and an inability to address regional externalities.

- **Participatory Governance:** While the Smart City mission promotes citizen engagement and 'Place Making,' genuine citizen involvement and transparency in large-scale infrastructure and environmental decision-making need substantial strengthening.

Conclusion and Recommendations

Pune City exhibits a commendable commitment to specific facets of sustainability, particularly in sustainable mobility and solid waste circularity. These targeted successes, however, mask a deeper fragility caused by the unchecked strain of rapid urbanization on the city's natural capital and social fabric.

1. Key Findings Summary

Sustainability Pillar	Success Area (Opportunity)	Systemic Challenge (Impediment)
Mobility/Infrastructure	Successful BRT system; shift to Electric Vehicles (EVs); GIS-enabled Master Plan 2041.	Increasing private vehicle ownership; network expansion lagging population growth.
Environment/Resources	World-class informal worker integration (SWaCH); Climate Action Plan under development.	Severe river pollution (untreated sewage); encroachment on hills/BDP; inadequate environmental enforcement.
Governance/Equity	Emphasis on 'Livable City' vision; EWS housing policies.	Jurisdictional fragmentation across PMR; high percentage of population in vulnerable, informal housing; limited access to green finance.

2. Recommendations for Policy and Future Research

To achieve holistic sustainable development, Pune must transition from project-based initiatives to a framework of systemic reform:

1. **Integrated Regional Governance:** Establish a unified, legally empowered planning authority (PMRDA) with veto power over projects that violate environmental zoning (BDP, river floodplains) across all contiguous municipal and village jurisdictions [10].

2. **Environmental Enforcement:** Drastically strengthen the enforcement of the Biodiversity Park (BDP) policy and the prevention of hilltop constructions.[11] Mandate

multi-season, independent Environmental Impact Assessments (EIA) for all major infrastructure projects in ecologically sensitive zones.

3. **Financial and Institutional Capacity:** Accelerate investment in Sewage Treatment Plants (STPs) to fully treat wastewater before discharge, securing river health (SDG 6). Furthermore, enhance the capacity of financial institutions and SMEs to access and utilize green finance options.

Future secondary research should focus on quantifying the social cost-benefit ratio of the SWaCH model and conducting a comparative analysis of the enforcement efficacy of BDP regulations across different municipal jurisdictions within the Pune Metropolitan Region.

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