

# A Review of Urban Solid Waste Governance in India

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**Abstract:** *Urban solid waste management (USWM) has emerged as a major environmental governance challenge in India because of rapid urbanization, population growth, changing consumption patterns, and increasing quantities and complexity of municipal waste. Between 2010 and 2022, India experienced a significant transition from a predominantly disposal-oriented approach toward a more integrated regulatory and governance framework emphasizing source segregation, door-to-door collection, processing, recycling, resource recovery, and scientific disposal. The Municipal Solid Waste (Management and Handling) Rules, 2000 provided the initial regulatory foundation, while the Swachh Bharat Mission launched in 2014 and the Solid Waste Management Rules, 2016 strengthened institutional responsibilities and emphasized decentralized and environmentally sound management. However, evidence from research and Central Pollution Control Board (CPCB) reports indicates that substantial gaps remained between policy formulation and implementation, particularly in source segregation, processing capacity, landfill management, municipal finances, institutional coordination, data quality, and integration of informal waste workers.*

**Keywords:** Urban Solid Waste, Waste Governance, Municipal Solid Waste Management, Urban Local Bodies, Swachh Bharat Mission, Solid Waste Management Rules, India.

## I. INTRODUCTION

Urban solid waste management is an important component of sustainable urban development because the quantity and characteristics of waste are closely associated with population growth, urbanization, economic development, consumption patterns, and changing lifestyles. In India, rapid urban expansion has placed considerable pressure on Urban Local Bodies (ULBs), which are primarily responsible for the collection, transportation, processing, and disposal of municipal solid waste. Research conducted during the period under review identified inadequate infrastructure, financial constraints, institutional weaknesses, limited public participation, improper waste segregation, and inappropriate disposal practices as major barriers to effective municipal waste management.

Governance is therefore broader than simply collecting waste from households; it includes the regulatory, administrative, financial, technological, social, and institutional mechanisms through which waste is generated, segregated, collected, transported, processed, recycled, and finally disposed of. The governance perspective is particularly important in India because responsibility is distributed among the central government, state governments, pollution-control authorities, municipalities, private operators, communities, households, and informal waste workers. The 2016 regulatory framework explicitly established duties for waste generators, local authorities, State Pollution Control Boards and other agencies, thereby strengthening the institutional architecture of waste governance.

## EVOLUTION OF THE POLICY AND REGULATORY FRAMEWORK

The period from 2010 to 2022 witnessed several important developments in India's urban solid waste governance. The earlier Municipal Solid Waste (Management and Handling) Rules, 2000 established requirements concerning collection, storage, transportation, processing, and disposal. However, implementation remained uneven across cities.

The introduction of the Swachh Bharat Mission in 2014 placed sanitation and cleanliness prominently within the national development agenda and increased attention to municipal waste services. Subsequently, the Solid Waste Management Rules, 2016 replaced the 2000 rules and expanded the regulatory scope and responsibilities associated with solid waste management.

The 2016 Rules emphasized source segregation, door-to-door collection, processing and treatment, scientific disposal, and defined responsibilities for waste generators and local authorities. CPCB's review mechanism also requires State Pollution Control Boards and Pollution Control Committees to submit information concerning implementation, while CPCB consolidates these reports for the central government. Thus, governance during this period increasingly moved from a narrow municipal-cleaning model toward a multi-level regulatory framework. Nevertheless, the existence of legislation did not automatically ensure implementation, and research continued to identify weak enforcement and institutional capacity as important challenges. Kumar and Agrawal (2020), for example, identified poor policy implementation, inadequate infrastructure, weak financial planning, insufficient assessment, and limited integration of informal waste systems as continuing concerns.

### **URBAN LOCAL BODIES AND INSTITUTIONAL CAPACITY**

Urban Local Bodies constitute the principal operational institutions for municipal solid waste management. Their responsibilities generally include household and commercial waste collection, transportation, segregation, processing, treatment, and disposal. Effective governance therefore depends strongly on their technical, administrative, financial, and human-resource capacity. Studies during 2010–2022 indicated that many municipalities struggled to provide comprehensive waste services because of inadequate financial resources, insufficient equipment, shortage of trained personnel, weak planning mechanisms, and fragmented institutional responsibilities. Urbanization further increased the pressure on municipal systems, particularly in rapidly expanding cities and densely populated settlements. Governance problems can also arise when municipal responsibilities are distributed among multiple agencies without clear coordination and accountability. Consequently, strengthening ULBs requires not only additional infrastructure but also improved municipal planning, professional waste-management personnel, reliable data, transparent contracting, monitoring systems, and institutional accountability.

### **WASTE SEGREGATION AND COLLECTION GOVERNANCE**

Source segregation is a fundamental requirement for an efficient solid waste management system because mixed waste reduces the quality of recyclable materials, complicates composting and biological treatment, and increases the quantity requiring final disposal. The Solid Waste Management Rules, 2016 placed greater emphasis on segregation and collection responsibilities. However, evidence reviewed during the period showed that many urban areas continued to experience problems with mixed waste collection and insufficient segregation at household and commercial levels. Kumar and Agrawal (2020) identified unsorted waste at source as one of the important challenges facing Indian municipalities. Collection performance also needs to be distinguished from overall waste-management performance. According to the CPCB annual report for 2021–22, India generated 170,339 tonnes of solid waste per day and collected 156,449 tonnes per day, giving a reported collection efficiency of approximately 92%. However, effective governance requires subsequent segregation, processing, recovery, and environmentally safe disposal rather than collection alone.

### **PROCESSING, RECYCLING AND RESOURCE RECOVERY**

A major governance challenge in Indian cities is the transition from waste collection and disposal toward resource recovery. Municipal waste contains organic matter, recyclable materials, and other potentially recoverable resources. Composting, biomethanation, recycling, material recovery facilities, and waste-to-energy technologies have therefore been incorporated into different municipal strategies. Nevertheless, the effectiveness of these approaches depends on waste composition, segregation quality, technology selection, financial viability, and institutional management. Kumar and Agrawal (2020) emphasized that Indian municipalities need treatment and recycling strategies suited to local waste

characteristics and argued for greater use of both centralized and decentralized approaches. Governance should consequently avoid a technology-only approach and instead consider the entire waste chain, beginning with reduction and segregation and extending through recovery and final disposal.

#### **LANDFILLS AND ENVIRONMENTAL GOVERNANCE**

Landfilling and uncontrolled dumping remained important environmental concerns during 2010–2022. Improper disposal can contribute to soil, water, and air pollution and can create risks for nearby communities. Pal and Bhatia (2022) reported that improper collection and unscientific treatment of municipal waste contribute to environmental degradation and pollution. The management of legacy waste and uncontrolled dumpsites also became an increasingly important governance issue. Effective landfill governance requires scientific site selection, engineered landfill design, leachate management, landfill-gas management, monitoring, closure and remediation procedures, and strict enforcement of environmental standards. Therefore, municipal waste governance must address both newly generated waste and historical waste accumulated at existing dumpsites.

#### **INFORMAL WASTE SECTOR AND INCLUSIVE GOVERNANCE**

India's waste-management system has historically depended significantly on informal waste pickers, scrap dealers, itinerant buyers, and other informal-sector participants. These actors contribute to recycling and material recovery but have often operated outside formal municipal systems. The literature reviewed during 2010–2022 increasingly recognized the potential benefits of integrating informal workers into formal waste-management arrangements. Kumar and Agrawal (2020) noted that resource recovery could be improved through greater integration of the informal sector into municipal systems. Inclusive governance can involve registration, identification cards, access to protective equipment, social-security measures, training, formal contracts, participation in material recovery facilities, and recognition of their contribution to recycling. Such integration can simultaneously improve livelihoods and strengthen municipal resource-recovery systems.

#### **PUBLIC PARTICIPATION AND BEHAVIOURAL GOVERNANCE**

Waste governance is not exclusively an administrative responsibility. Household segregation, reduction of waste generation, recycling behaviour, community participation, and compliance with municipal collection systems directly influence the effectiveness of urban waste management. Studies have identified public apathy, inadequate awareness, and behavioural barriers as continuing challenges. The governance framework therefore needs mechanisms that encourage citizens to participate actively in waste management. Awareness campaigns, school and community programmes, user charges, incentives, penalties, feedback systems, and neighbourhood-level monitoring can support behavioural change. However, public participation is more likely to be sustained when municipal services are reliable and citizens can observe transparent and accountable waste-management practices.

#### **Financial And Administrative Challenges**

Financial sustainability is another central component of urban solid waste governance. Waste management requires continuous expenditure on vehicles, collection systems, labour, transfer stations, treatment facilities, landfill infrastructure, maintenance, monitoring, and environmental safeguards. Indian municipalities have frequently faced resource limitations and competing demands for urban services. Research has identified unplanned fiscal arrangements and inadequate municipal financial capacity as barriers to sustainable waste management. Sustainable governance therefore requires predictable funding, appropriate user charges, performance-based contracts where suitable, transparent expenditure systems, and long-term investment planning. Financing mechanisms should also recognize that waste management is an essential public service rather than an activity that can depend exclusively on short-term project funding.

### **TECHNOLOGY AND DATA-BASED GOVERNANCE**

Technology has increasingly become part of municipal solid waste governance through GPS-enabled collection vehicles, digital monitoring, weighing systems, geographic information systems, online complaint mechanisms, material recovery facilities, composting technologies, biomethanation, and waste-to-energy systems. Nevertheless, technology can be effective only when supported by appropriate waste segregation, skilled personnel, maintenance, financial resources, and institutional accountability. Pal and Bhatia (2022) noted that limited adoption of technology-based solutions remained among the challenges in Indian municipal waste management. Reliable data are equally important because municipalities need accurate information about waste generation, collection, processing, recycling, transportation, and disposal to plan services effectively. The CPCB annual reporting mechanism represents an important national monitoring mechanism, although differences in reporting practices and local data capacity can affect comparability and planning.

### **POLICY-IMPLEMENTATION GAP**

One of the most consistent findings in the literature between 2010 and 2022 is the gap between policy formulation and implementation. India developed an increasingly comprehensive regulatory framework, but many municipalities continued to experience problems in translating regulatory requirements into routine operational practices. Kumar and Agrawal (2020) specifically identified inadequate implementation of government policies as a major challenge and highlighted shortcomings in collection, transportation, treatment, recycling, and decentralized processing. This suggests that the central issue is not simply the absence of policies but the capacity to enforce, finance, monitor, and adapt them at the local level. Governance reforms must therefore emphasize implementation mechanisms, measurable service standards, institutional accountability, public reporting, and continuous evaluation.

### **DISCUSSION**

The literature from 2010–2022 demonstrates that urban solid waste governance in India underwent an important institutional transformation. The policy system increasingly recognized segregation, processing, recycling, public participation, and scientific disposal rather than focusing exclusively on collection and dumping. The 2016 Rules provided a stronger framework for allocating responsibilities among waste generators, municipalities, pollution-control agencies, and other stakeholders. Nevertheless, implementation remained uneven because municipal capacity, infrastructure, finance, public behaviour, technology, and institutional coordination varied considerably between cities. The available evidence also indicates that collection efficiency should not be treated as equivalent to sustainable waste management. The CPCB's 2021–22 data show relatively high reported collection efficiency, but effective governance additionally requires substantial segregation, processing, recovery, and scientific disposal. The review therefore indicates that India's urban waste governance challenge is multidimensional and requires integration of environmental regulation, municipal administration, public participation, economic incentives, technology, and social inclusion.

## **II. CONCLUSION**

Urban solid waste governance in India between 2010 and 2022 reflects a gradual transition from conventional waste collection and disposal toward an integrated management framework. Important developments included the strengthening of national programmes, implementation of the Solid Waste Management Rules, 2016, increased emphasis on source segregation and processing, and greater recognition of recycling and informal-sector participation. Nevertheless, persistent implementation gaps demonstrate that regulatory development alone is insufficient. Effective urban waste governance requires capable and financially sustainable ULBs, reliable waste data, source segregation, decentralized processing where appropriate, scientifically managed disposal facilities, integration of informal waste workers, public participation, transparent monitoring, and stronger coordination between government agencies. Future governance strategies should therefore focus on the complete waste-management chain and measure success not merely

through collection but through reduction, segregation, recovery, recycling, treatment, environmental protection, and social inclusion.

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