

Evaluating the Functional and Institutional Dimensions of Waste Management in Jaipur City

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Abstract

Waste Management is a key component of the Swachh Bharat Mission and the Smart City Mission. Waste refers to discarded material and can be categorized into various types, including municipal solid waste, industrial waste, hazardous waste, electronic waste, and biomedical waste. Municipal waste originates primarily from households and residential areas and includes food waste, agricultural waste, and construction and demolition debris. In metropolitan cities like Jaipur, which have witnessed a rapid increase in population in recent years, the issue of waste management has become critical, as changing lifestyles and rising living standards have further intensified the rate of waste generation. This paper evaluates the current status of the solid waste management system in Jaipur, with particular emphasis on the role of the Jaipur Municipal Corporation (JMC). It provides a systematic analysis of JMC's waste handling practices and identifies key challenges, such as inefficient door-to-door collection, outdated handling techniques, inadequate transportation infrastructure, and unscientific waste disposal at open dumping sites. The study aims to offer insights for policymakers, private stakeholders, institutional bodies like CPCB, RPCB, and urban development authorities. It also emphasizes the potential of waste-to-energy technologies to mitigate environmental hazards and greenhouse gas emissions.. Furthermore paper concludes with recommendations to enhance the effectiveness of the waste management system in Jaipur.

Keywords: Metropolitan City, Door to Door Collection, Transportation, Industrialization, Public-Private Partnership and Disposal.

Introduction

The smartness of a city is often measured by its infrastructure, education, hygiene, and sanitation levels. With the growing emphasis on sustainable development, waste management has become a critical factor in measuring urban progress. Rapid urbanization, industrialization, and population growth have significantly increased waste generation. It has been observed that, there is a direct correlation between economic growth and waste production.

Usually, waste is regarded as discarded material; however, there is a change in attitude towards waste, viewing it as a useful product that can be further utilized to create valuable assets. With rising public

awareness, solid waste is now increasingly viewed not as a burden but as a resource that can be converted into energy, thereby reducing greenhouse gas emissions. Effective waste processing and recycling can help in reducing fossil fuel consumption. Effective solid waste management involves proper collection, efficient transportation, and scientific treatment methods. However, unscientific disposal practices adversely impact public health and the environment. Challenges such as lack of awareness, inadequate funding, corruption, and poor segregation practices hinder the execution of waste management rules. Though treatment methods like recycling, composting, incineration, and pyrolysis are available, open dumping remains the most commonly practiced method due to its low cost and convenience.

Study Area

Jaipur, the capital of Rajasthan, had a population of approximately 3 million according to the 2011 Census. The city is divided into zones and wards for administrative convenience. As a rapidly urbanizing metropolitan area, Jaipur faces escalating challenges in waste management. The growing waste generation rate necessitates proactive engagement from local bodies such as JMC and urban development authorities.

Although urban local bodies are responsible for waste management, they often lack the necessary power and resources. The JMC is the central agency handling waste management. The waste management workforce includes sweepers, door-to-door collectors, ragpickers, NGOs, private firms, and both permanent and temporary workers. JMC, in collaboration with private entities, conducts awareness initiatives like “Run for Clean City” and the “Swachhta Survekshan Singing Event.” Since 2010, a ban on plastic bags by the Rajasthan government has led to a reduction in plastic waste. However, data inconsistencies exist due to the lack of comprehensive studies.

According to data from the Jaipur Municipal Corporation (JMC), approximately 2,500 metric tons of waste is collected daily across the city. A large portion of this waste is gathered using vehicles such as trucks, tractors, and dumpers. However, the entire volume is transported directly to landfill sites, where it is disposed of through open dumping without any scientific processing or treatment. This practice poses serious risks to both environmental sustainability and public health. Notably, JMC allocates nearly 70% of its waste management budget to collection activities, while only 30% is directed toward waste transfer and final disposal. The effectiveness of the waste management system is further hampered by several persistent challenges, including a shortage of personnel, inadequate infrastructure, limited financial capacity, and low levels of technological adoption.

Functional Element of Waste Management in Jaipur

Waste management comprises a series of interrelated functional components, ranging from the initial collection of waste to its final disposal. In the context of Jaipur, the effectiveness of each of these components directly influences the overall success of municipal waste management efforts.

- **Collection**

The collection process in Jaipur primarily includes street sweeping and door-to-door waste collection services. Sweepers manually collect waste from public roads and streets, while door-to-door services target households and small commercial units. The collected waste is temporarily stored in either individual household bins or community bins. Despite being a fundamental aspect of waste management, the coverage of these services is inconsistent across different zones of the city. Several

areas continue to lack regular collection services, resulting in the illegal dumping of waste in open spaces.

According to the Jaipur Municipal Corporation (JMC), the city is divided into multiple zones, and door-to-door collection has been implemented in selected wards only. In zones without proper infrastructure, waste is deposited in temporary open depots or on vacant land, creating sanitation issues and breeding grounds for diseases. Furthermore, manual scavenging is still practiced in certain areas, which raises concerns regarding human dignity and occupational health.

- **Segregation**

Segregation of waste into biodegradable and non-biodegradable categories at the point of generation is a critical requirement for effective recycling and resource recovery. Despite awareness campaigns and Swachh Bharat Mission guidelines advocating for source-level segregation, its implementation remains limited in Jaipur. Although JMC has installed dual color coded bins at public places, green for wet (biodegradable) waste and blue for dry (non-biodegradable) waste, however households and businesses often fail to adhere to these standards.

The lack of proper segregation hampers the efficiency of downstream processes such as composting and recycling. In many cases, unsegregated waste is directly transported to landfills, leading to the loss of potentially recyclable materials and the overburdening of landfill capacities.

- **Transfer**

After collection, the waste is transferred to intermediate transfer stations before being transported to final disposal sites. In Jaipur, waste is typically moved using uncovered vehicles such as tractors, trucks, and dumper placers. This often results in spillage on roads, contributing to environmental pollution, traffic congestion, and health hazards for sanitation workers and the general public.

There are three major transfer stations in Jaipur located at Lal Dungri, Vidyadhar Nagar, and Mansarovar. These transfer stations act as hubs where waste is temporarily held and consolidated before being dispatched to landfill or processing sites using compactors and other heavy vehicles. However, the lack of covered and sealed transport vehicles continues to be a major issue, as it undermines cleanliness and safety standards outlined by national waste management policies.

- **Disposal**

Disposal represents the final and most critical stage of the waste management process. Jaipur currently has three designated dumping sites located at Mathuradaspora, Sewapura, and Langriyawas. These sites operate primarily through open dumping methods, as scientific landfill practices such as engineered lining, leachate treatment, and gas capture are not fully developed or implemented.

Waste Processing Facilities: at the Sewapura site, a composting plant with a treatment capacity of 250 metric tons per day (MTD) has been established to process organic waste. However, the volume of waste generated in Jaipur is approximately 2,500 MTD, far exceeds the city's composting capacity.

Additionally, a refuse-derived fuel (RDF) processing plant is operational at the Langariwas site. It is managed by Grasim Industries Ltd. This plant processes up to 500 tons per day (TPD) of waste and produces around 150 TPD of RDF. The RDF, derived from high-calorific-value non-biodegradable waste, is supplied to cement industries as a substitute for conventional fossil fuels.

Despite the existence of these facilities, the majority of waste in Jaipur still ends up in open dumping grounds, leading to leachate seepage, groundwater contamination, methane emissions, and degradation of air quality. The unscientific handling of waste at disposal sites highlights the urgent need for modernization and the adoption of integrated waste treatment technologies.

Role of Informal sector In Solid Waste Management System

It has also been observed that the informal sector plays a crucial role in the solid waste management ecosystem of Jaipur. This sector primarily consists of ragpickers who manually collect waste from community containers, roadside garbage bins, and dumping grounds. They separate recyclable or reusable materials—such as plastic, metal, glass, and paper—which are then sold to local scrap dealers. Estimates suggest that more than 15,000 ragpickers are engaged in informal waste management activities in Jaipur alone. These individuals typically belong to economically marginalized and socially excluded communities, and their involvement in this sector is largely driven by poverty and lack of alternative livelihood options.

Despite their contributions to reducing the volume of waste and promoting recycling, ragpickers often work without any protective equipment, under unsanitary and hazardous conditions. This exposes them to a range of health risks including respiratory infections, skin diseases, and injuries from sharp objects or toxic materials. Moreover, they lack access to social security, healthcare, or institutional recognition, making their role in the waste management system both invisible and vulnerable.

In terms of regulatory coverage, the Solid Waste Management Rules, 2000 (now revised in 2016), excluded military areas from the jurisdiction of municipal solid waste services. To address this institutional gap in Jaipur, the Jaipur Municipal Corporation (JMC) entered into a contractual agreement with a non-governmental organization named *Satya*. This organization is tasked with handling waste collection, segregation, and disposal in military cantonment zones. The initiative represents a collaborative approach involving public institutions and civil society actors to extend the reach of waste services in special administrative areas.

To improve the overall efficiency and inclusivity of waste management systems, it is imperative to formally integrate the informal sector through policy recognition, training, health benefits, and access to safety gear. Such measures would not only uplift the livelihoods of thousands of ragpickers but also contribute significantly to achieving sustainable and decentralized waste management in urban India.

Major Issues in the Existing Waste Management System

- **Incomplete Coverage of Door-to-Door Collection:** one of the primary challenges faced by the Jaipur Municipal Corporation (JMC) is the lack of universal door-to-door waste collection across all urban wards. many low-income and peri-urban zones remain underserved. This gap in service delivery forces residents to dispose of their waste in community bins or on open plots, contributing to unsanitary conditions and illegal dumping.
- **Low-Capacity Collection Vehicle:** the use of outdated and low-capacity vehicles for waste collection, such as small tippers, carts, and tractors, results in frequent overflows and the need for multiple trips to transfer stations. The mismatch between the volume of waste generated and the capacity of available vehicles limits the efficiency and coverage of daily operations.
- **Insufficient Processing Capacity at Waste Treatment Plants:** Jaipur generates approximately 2,500 metric tons of waste per day, yet the available waste processing infrastructure is inadequate to handle this volume. As a result, a large portion of unprocessed waste is diverted to open dumping sites, leading to environmental degradation.
- **Absence of Scientific Disposal Methods:** scientific methods such as sanitary landfilling, biomethanation, and waste-to-energy processing are either underutilized or absent in the current system. Open dumping remains the dominant mode of disposal at sites like Mathuradaspora,

Sewapura, and Langriyawas. These dumpsites lack leachate control systems, gas venting mechanisms, or proper covering, leading to groundwater contamination and greenhouse gas emissions.

- **Lack of Public Awareness on Source Segregation:** despite the provision of green and blue bins for wet and dry waste, respectively, there is a general lack of awareness and compliance among residents regarding source segregation. This results in mixed waste collection, reducing the effectiveness of recycling and composting efforts and increasing the burden on disposal infrastructure.
- **Use of Uncovered Vehicles Leading to Spillage:** the transportation of waste using uncovered trucks and tractors leads to spillage on roads, creating unhygienic conditions and public health risks.
- **Inconsistent Data Reporting:** accurate data on waste generation, segregation, collection efficiency, and treatment outcomes are often unavailable or inconsistently reported. (Ministry of Housing and Urban Affairs).
- **Lack of Staff Training:** municipal sanitation workers and supervisors often lack training in waste handling, use of personal protective equipment (PPE), and operating machinery at treatment facilities.
- **Shortage of Waste Management Professionals:** Urban Local Bodies (ULBs) face a shortage of qualified professionals such as environmental engineers, waste planners, and sustainability experts. This human resource gap limits the adoption of innovative waste management technologies and the execution of integrated waste strategies.

Suggestions

Based on the identification of existing problems, the study suggests the following:

- Strict adherence to proper waste segregation at the source.
- Increasing community participation through capacity building programs and awareness campaigns.
- Bridging the gap between policy benchmarks and their implementation.
- Encouraging private sector involvement through NGOs and public-private partnerships to enhance waste treatment efficiency.
- Upgrading disposal sites based on scientific principles.
- Implementing separate bins for biodegradable and non-biodegradable waste.
- Ensuring community garbage bins are fully covered and leak-free to prevent bacterial infections.
- Promoting door-to-door waste collection as the primary method citywide.
- Maintaining accurate records of waste data for effective treatment.
- Ensuring transportation vehicles are fully covered to prevent spills on roads and streets.
- Educating staff and personnel about waste composition to enable appropriate waste processing techniques.

Conclusion

An assessment of Jaipur's current waste management system reveals outdated and unscientific practices, particularly in disposal methods. These methods have severe environmental and health impacts. Literature reviews highlight persistent challenges such as inefficient collection, poor transportation, and

inadequate processing. This indicates a clear gap between expected service benchmarks and on-ground realities.

With rapid urban growth, effective solid waste management is essential for achieving Smart City objectives. Public awareness regarding sustainable development has increased, and there is significant potential for converting waste into energy. However, the city's current infrastructure and practices are insufficient to meet growing demands. Strengthening infrastructure, enhancing scientific processing, and promoting policy-driven action are necessary to ensure a clean and sustainable urban environment.

Bibliography

1. Central Pollution Control Board (CPCB). (2021). *Annual Report on Solid Waste Management*. Ministry of Environment, Forest and Climate Change, Government of India.
2. Chattopadhyay, S., Srivastava, V., & Ray, P. (2009). Municipal solid waste management in Kolkata, India. *Waste Management*, 29(2), 470–478.
3. Hosetti, B. B. (2016). *Prospects and perspectives of solid waste management*. Alpha Science International.
4. Jain, A., & Singhal, M. (2014). An analysis of treatment option for solid waste by characterisation and composition study: A case of Jaipur City. *International Journal of Scientific and Research Publications*, 4(10), 1–4.
5. Jain, S., & Singhal, S. (2014). Infrastructure challenges in municipal solid waste management in India. *International Journal of Environmental Engineering*, 6(1), 1–13.
6. Jain, S., & Singhal, S. (2014). Infrastructure and waste management systems in Jaipur: A critical review. *Journal of Urban Development Studies*, 12(3), 45–59.
7. Joshi, R., & Ahmed, S. (2016). Status and challenges of municipal solid waste management in India: A review. *Cogent Environmental Science*, 2(1), 1139434.
8. Kumar, K. R., & Satheesh, E. N. (2021). Efficient waste management models for smart cities: A case study. *Environment, Development and Sustainability*, 23(1), 327–345.
9. Kumar, S. (2009). *Solid waste management*. APH Publishing.
10. Kumar, S. (2009). Manual scavenging in India: A social injustice. *Indian Journal of Social Work*, 70(4), 619–632.
11. Ministry of Housing and Urban Affairs (MoHUA). (2020). *Swachh Bharat Mission (Urban): Guidelines and Assessment Protocol*. Government of India.
12. Rawat, M., Ramanathan, A. L., & Kuriakose, T. (2013). Characterisation of municipal solid waste compost (MSWC) from selected Indian cities: A case study for its sustainable utilization. *Journal of Environmental Protection*, 4(2), 163–171.
13. Rawat, M., Ramanathan, A., & Kuriakose, H. (2013). Characterization of municipal solid waste in Jaipur for energy recovery. *Journal of Environmental Research and Development*, 7(3A), 1300–1307.
14. Rawat, M., Sharma, A., & Joshi, Y. (2013). Assessment of solid waste management practices in Jaipur city. *International Journal of Environmental Research and Development*, 3(3), 55–63.
15. Sachdev, V., & Tillotson, G. (2002). *Building Jaipur: The making of an Indian city*. Reaktion Books.
16. Saini, A., & Kaur, N. (2018). Impact of municipal solid waste disposal on groundwater quality near Mathuradaspora, Langariwas dumping sites, Jaipur City, India. *International Journal of Advance Research, Ideas and Innovations in Technology*, 4(6), 132–136.

17. Saini, P., & Kaur, J. (2018). Municipal solid waste management in Jaipur: Challenges and way forward. *International Journal of Environmental Science and Development*, 9(5), 130–135.
18. Saini, S., & Kaur, P. (2018). An analysis of municipal solid waste management in India: Challenges and prospects. *International Journal of Management Studies*, 5(4), 93–102.
19. Saleh, H. M. (2021). Strategies of sustainable solid waste management. *Environmental Science and Pollution Research*, 28(13), 16336–16350.
20. Saleh, Z. (2021). Urban waste segregation and recycling behavior in Indian cities: A case for integrated policy intervention. *Waste Management Research Journal*, 39(2), 112–122.
21. Sharma, P., & Jain, S. (2020). Urban waste management challenges in India: A case study of Jaipur. *Journal of Urban Management*, 9(1), 35–47.
22. Singh, J., & Ramanathan, A. L. (2010). Solid waste management: Present and future challenges. In A. L. Ramanathan, C. Ramesh, & S. A. Khan (Eds.), *Urbanization and Global Environmental Change in South Asia* (pp. 159–169). Springer.
23. Singh, R., & Ramanathan, A. L. (2010). Environmental impact of unscientific municipal waste disposal: A study from Jaipur, India. *Environmental Monitoring and Assessment*, 160(1), 321–334.