

Current Trends and Challenges of Solid Waste Management in India

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Abstract:

Solid waste management in India has emerged as a critical environmental and public health concern due to rapid urbanization, population growth, and changing consumption patterns. In recent years, the country has witnessed significant developments in waste management practices, including the implementation of national initiatives such as the Swachh Bharat Mission, promotion of waste segregation at source, and increased adoption of recycling and composting techniques. Technological advancements, such as waste-to-energy plants and digital monitoring systems, are also shaping modern waste management frameworks.

Despite these positive trends, numerous challenges persist. Inefficient waste collection and segregation, inadequate infrastructure, lack of public awareness, and financial constraints hinder effective implementation. Additionally, the informal sector's integration into formal systems remains limited, and improper disposal practices continue to contribute to environmental pollution and health risks. Rural areas, in particular, face difficulties due to limited resources and institutional support.

This study highlights the current trends and identifies key challenges in India's solid waste management system, emphasizing the need for sustainable policies, community participation, and innovative solutions to achieve long-term environmental sustainability and improved quality of life

Keywords: Solid Waste Management, Municipal Solid Waste, Waste Segregation, Recycling and Resource Recovery, Sustainable Development, Swachh Bharat Mission.

Introduction:

Rapid urbanization in India has significantly contributed to the exponential increase in solid waste generation. As cities expand and rural populations migrate to urban areas in search of better employment and living standards, the demand for housing, infrastructure, and consumer goods rises sharply. This transition leads to higher consumption patterns, which in turn results in the generation of large quantities of municipal solid waste (Moh and Abd Manaf, 2014).

Indian metropolitan cities such as Delhi, Mumbai, Kolkata, and Bengaluru are among the largest waste generators in the country. The changing lifestyle of urban populations, characterized by increased use of packaged goods, plastics, and disposable materials, has further aggravated the problem. According to recent estimates, India generates millions of tonnes of solid waste annually, with urban areas contributing the majority share.

The rapid pace of urban growth often outstrips the capacity of municipal authorities to manage waste effectively. Inadequate infrastructure, inefficient waste collection systems, and lack of proper disposal facilities lead to the accumulation of waste in open spaces, streets, and landfills (Moghadam et al., 2009). This not only creates environmental pollution but also poses serious health risks to urban populations (Ramitha, 2023).

Moreover, unplanned urban expansion and the growth of informal settlements make waste management even more challenging. Limited access to proper waste services in these areas results in improper disposal practices, including open dumping and burning. Addressing the challenges of rapid urbanization requires integrated planning, investment in infrastructure, and active public participation for sustainable waste management (Pandey et al., 2025).

Composition and Types of Municipal Solid Waste in India:

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Municipal solid waste (MSW)(Jain et al., 2025) in India is highly heterogeneous in nature, reflecting the country's diverse socio-economic conditions, cultural practices, and consumption patterns(Madhavaraj and Karthikeyan, 2025). The composition of waste varies across urban and rural areas, as well as between different income groups, but it generally includes biodegradable, recyclable, and inert materials (Lal and Gupta, 2009).

A major portion of MSW(Sheikh, 2023a) in India consists of biodegradable or organic waste, such as food scraps, vegetable peels, garden waste, and agricultural residues. This fraction typically accounts for 40–60% of the total waste generated, making composting and bio-methanation viable treatment options. Recyclable materials, including paper, cardboard, plastics, metals, and glass, form another significant component. These materials have economic value and are often recovered by the informal sector, contributing to recycling and resource conservation(Mmerekı et al., 2016).

In addition, municipal waste includes inert materials such as dust, ash, and construction debris, which are non-biodegradable and difficult to process(Sheikh and Dinda, 2022). Hazardous household waste, such as batteries, paints, chemicals, and sanitary waste, is also present in smaller quantities but poses serious environmental and health risks if not handled properly. The growing use of electronic devices has further added e-waste to the municipal waste stream, complicating waste management systems(Idris et al., 2004).

The changing lifestyle and increasing consumerism in India have led to a rise in plastic and packaging waste, which is less biodegradable and more challenging to manage(Mmerekı, 2018). Understanding the composition and types of MSW is essential for designing effective waste management strategies, promoting segregation at source, and adopting appropriate recycling and disposal methods.

Waste Segregation at Source: Status and Issues:

Waste segregation at source is a fundamental step in effective solid waste management, as it facilitates recycling, composting, and safe disposal. In India, efforts have been made to promote segregation through policy measures such as the Solid Waste Management Rules, 2016, which mandate the separation of waste into biodegradable, recyclable, and hazardous categories at the household level(Sheikh, 2023b). Urban local bodies and government initiatives have increasingly emphasized door-to-door collection of segregated waste and public awareness campaigns(Minghua et al., 2009).

Despite these initiatives, the implementation of source segregation remains inconsistent across the country. While some metropolitan cities have achieved partial success, many smaller towns and rural areas still struggle with low levels of compliance. A major issue is the lack of awareness and behavioral change among citizens, leading to the mixing of waste at the point of generation. Even when segregation is practiced, it is often undermined by improper handling during collection and transportation, where different waste streams are mixed again.

Infrastructure limitations also pose significant challenges. Insufficient availability of separate bins, inadequate collection systems, and lack of processing facilities hinder effective segregation. Additionally, informal waste pickers, who play a crucial role in recycling, are not fully integrated into formal waste management systems(Sheikh, 2022).

To improve the status of waste segregation in India, there is a need for sustained public education, strict enforcement of regulations, better infrastructure, and stronger coordination between municipal authorities and communities(Karim et al., 2012).

Collection, Transportation, and Disposal Mechanisms:

Efficient collection, transportation, and disposal mechanisms form the backbone of solid waste management systems in India. Municipal authorities are primarily responsible for organizing door-to-door waste collection, street sweeping, and the transfer of waste to designated processing or disposal sites. In recent years, many urban local bodies have introduced improved collection systems, including the use of covered vehicles, GPS-enabled tracking, and scheduled collection services to enhance efficiency and accountability(Jenkins, 1993).

Despite these advancements, several challenges persist in the operational aspects of waste management. Collection coverage is often incomplete, particularly in peri-urban and informal settlements, where infrastructure and service delivery are inadequate. Irregular collection schedules and a shortage of manpower and equipment further exacerbate the problem, leading to the accumulation of waste in public spaces(Li et al., 2012).

Transportation of waste is another critical issue, as inefficient routing and outdated vehicles contribute to delays and environmental pollution. In many cases, segregated waste is mixed during transportation, undermining efforts at source segregation. Transfer stations and intermediate storage facilities are also insufficient or poorly managed in several cities. Disposal practices in India largely rely on open dumping and poorly managed landfills, which pose serious environmental and health risks. Leachate generation, groundwater contamination, and emission of greenhouse gases such as methane are common concerns associated with these disposal methods. Scientific landfill management and the adoption of waste processing technologies, such as composting, recycling, and waste-to-energy, remain limited in scope. Improving these mechanisms requires investment in modern infrastructure, better planning, and the adoption of sustainable and integrated waste management practices.

Role of Government Policies and Regulations:

Government policies and regulations play a crucial role in shaping the framework of solid waste management in India. Over the years, the Government of India has introduced several legislative measures to address the growing challenges of waste generation and disposal. Among these, the Solid Waste Management Rules, 2016 represent a comprehensive policy framework that mandates segregation of waste at source, promotes scientific processing, and assigns clear responsibilities to waste generators, local authorities, and other stakeholders.

In addition to regulatory frameworks, national initiatives such as the Swachh Bharat Mission have significantly influenced waste management practices across urban and rural areas. These initiatives aim to improve sanitation, enhance waste collection efficiency, and encourage behavioral change among citizens. Policies have also emphasized the principles of reduce, reuse, and recycle (3Rs), as well as extended producer responsibility (EPR), particularly in the management of plastic and electronic waste.

Despite the presence of well-defined policies, implementation remains a major challenge. Many urban local bodies face constraints in terms of financial resources, technical expertise, and institutional capacity, which hinder effective enforcement. Monitoring and compliance mechanisms are often weak, leading to gaps between policy objectives and actual practice on the ground.

Furthermore, coordination among multiple agencies involved in waste management is frequently inadequate. To strengthen the role of policies and regulations, there is a need for improved governance, capacity building, stricter enforcement, and active participation from all stakeholders, including citizens and private sectors.

Impact of Swachh Bharat Mission on Waste Management:

The **Swachh Bharat Mission (SBM)**, launched in 2014, has had a transformative impact on solid waste management practices across India. As one of the largest sanitation initiatives in the world, SBM aimed to promote cleanliness, eliminate open defecation, and improve municipal solid waste management systems. The mission significantly enhanced public awareness regarding hygiene, sanitation, and the importance of proper waste disposal.

One of the major achievements of SBM has been the expansion of door-to-door waste collection services in urban areas. Many cities have reported increased coverage and improved efficiency in waste collection mechanisms. The mission also emphasized waste segregation at source, encouraging households to separate biodegradable and non-biodegradable waste. As a result, several municipalities have initiated composting and recycling programs, leading to better resource recovery. SBM has also facilitated the development of waste processing infrastructure, including compost plants, material recovery facilities, and waste-to-energy projects. Financial support and performance-based incentives under the mission have motivated urban local bodies to adopt innovative and sustainable waste management practices. Additionally, the introduction of cleanliness rankings, such as the Swachh Survekshan, has fostered healthy competition among cities to improve their sanitation standards.

However, despite these positive outcomes, challenges remain. Sustaining behavioral change among citizens, ensuring consistent segregation practices, and maintaining infrastructure continue to be areas of concern. Moreover, disparities exist between urban and rural areas in terms of implementation effectiveness. Overall, SBM has played a pivotal role in reshaping waste management in India, but continuous efforts are needed for long-term sustainability.

Recycling Practices and Resource Recovery Potential:

Recycling and resource recovery are essential components of sustainable solid waste management in India, offering significant environmental and economic benefits. A considerable proportion of municipal solid waste generated in the country consists of recyclable materials such as paper, plastics, metals, and glass. These materials, when properly recovered and processed, can reduce the demand for raw resources, conserve energy, and minimize environmental degradation.

In India, recycling practices are largely driven by the informal sector, including waste pickers, scrap dealers, and small recycling units. This sector plays a vital role in collecting, sorting, and channeling recyclable materials back into the production cycle. It contributes significantly to resource recovery and provides livelihood opportunities to a large number of urban poor. However, the informal nature of these activities often results in inefficiencies, lack of safety measures, and limited access to modern technologies.

Formal recycling systems are gradually developing, with increased involvement of municipalities and private enterprises. Initiatives such as material recovery facilities (MRFs), extended producer responsibility (EPR), and public-private partnerships are helping to strengthen recycling infrastructure. Technological advancements are also improving the efficiency of waste sorting and processing.

Despite these positive developments, several challenges persist, including inadequate segregation at source, contamination of recyclable materials, and fluctuating market demand for recycled products. To enhance resource recovery potential, there is a need for better integration of the informal sector, improved infrastructure, public awareness, and supportive policy frameworks that promote a circular economy in India.

Technological Innovations (Waste-to-Energy, Smart Systems):

Technological innovations are playing an increasingly important role in improving the efficiency and sustainability of solid waste management in India. Among these, waste-to-energy (WtE) technologies have gained significant attention as a solution to both waste disposal and energy generation. WtE plants convert non-recyclable waste into electricity, heat, or fuel through processes such as incineration, gasification, and anaerobic digestion. These technologies help reduce the volume of waste sent to landfills while contributing to renewable energy production.

In addition to WtE, smart waste management systems are transforming traditional practices through the use of digital technologies. The adoption of Internet of Things (IoT)-based solutions, such as smart bins equipped with sensors, enables real-time monitoring of waste levels and optimizes collection routes. This not only improves operational efficiency but also reduces fuel consumption and operational costs. Geographic Information Systems (GIS) and data analytics are also being used by municipal authorities to plan and manage waste collection and disposal more effectively.

Automation and mechanization in waste sorting and processing facilities have further enhanced the recovery of recyclable materials. Technologies such as artificial intelligence and machine learning are being explored for advanced waste segregation and predictive maintenance of waste management systems.

However, the implementation of these innovations faces challenges, including high initial investment costs, technical complexity, and the need for skilled manpower. Ensuring proper segregation of waste is also critical for the success of many technologies. Despite these challenges, technological advancements offer promising opportunities for modernizing waste management in India.

Challenges in Infrastructure and Funding:

Infrastructure and funding constraints remain among the most critical challenges in the effective management of solid waste in India. Rapid urbanization and increasing waste generation have placed immense pressure on existing waste management systems, many of which are already inadequate or outdated. Urban local bodies often struggle with insufficient infrastructure for waste collection, segregation, transportation, processing, and scientific disposal.

One of the key issues is the lack of proper waste processing facilities such as composting units, material recovery facilities, and waste-to-energy plants. In many cities, landfill sites are either overburdened or poorly managed, leading to environmental hazards such as groundwater contamination, air pollution, and the emission of greenhouse gases. Additionally, there is a shortage of modern equipment, including covered vehicles, compactors, and smart waste management systems, which hampers operational efficiency.

Financial limitations further aggravate these infrastructure gaps. Many municipal authorities depend heavily on limited government funding and face difficulties in allocating adequate budgets for waste management. Revenue generation from user fees and waste processing activities remains low due to poor collection mechanisms and lack of public compliance. As a result, investments in advanced technologies and infrastructure development are often delayed or insufficient.

Moreover, private sector participation in waste management is still limited due to regulatory uncertainties, low profitability, and risks associated with long-term investments. Public-private partnerships (PPPs), although encouraged, have not been fully realized in many regions.

Addressing these challenges requires increased financial allocation, efficient resource utilization, innovative funding mechanisms, and stronger collaboration between government, private sector, and communities to build sustainable waste management infrastructure.

Role of Informal Sector (Waste Pickers and Ragpickers):

The informal sector, comprising waste pickers and ragpickers, plays a vital yet often under recognized role in solid waste management in India. These individuals are primarily involved in the collection, sorting, and recycling of waste materials such as plastics, paper, metals, and glass. By recovering recyclable materials from streets, bins, and landfill sites, they significantly reduce the volume of waste that reaches disposal facilities and contribute to resource conservation and environmental sustainability.

Waste pickers form the backbone of India's recycling ecosystem, handling a large share of recyclable waste at minimal cost to municipal authorities. Their activities not only support the recycling industry but also provide livelihood opportunities to economically marginalized populations. In many cities, they act as an informal extension of the formal waste management system, often achieving higher efficiency in material recovery than organized systems.

Despite their contributions, waste pickers face numerous challenges. They often work under hazardous conditions without protective equipment, exposing themselves to health risks such as infections, injuries, and toxic substances. Social stigma, lack of formal recognition, and absence of legal protection further marginalize them. Additionally, they are vulnerable to exploitation by middlemen and fluctuations in the market value of recyclable materials.

Efforts have been made in some regions to integrate waste pickers into formal waste management systems through cooperatives, identity cards, and social security benefits. Such initiatives help improve their working conditions and enhance overall efficiency in waste management (Sheikh and Iqbal, 2026).

Recognizing and supporting the informal sector is essential for creating an inclusive, efficient, and sustainable solid waste management system in India.

Public Awareness and Community Participation:

Public awareness and community participation are crucial elements in achieving effective and sustainable solid waste management in India. Waste management is not solely the responsibility of municipal authorities; it requires active involvement from citizens to ensure proper practices such as waste segregation, recycling, and responsible disposal. Increased awareness among the public about the environmental and health impacts of improper waste handling has led to gradual behavioral changes in some urban areas.

Government initiatives like the **Swachh Bharat Mission** have played a significant role in promoting cleanliness and encouraging citizen participation. Campaigns, workshops, and media outreach programs have helped educate people about the importance of reducing waste, segregating it at source, and minimizing the use of single-use plastics. Schools, colleges, and non-governmental organizations have also contributed by organizing awareness drives and community-based programs.

Despite these efforts, challenges remain in ensuring consistent public participation. A lack of sustained awareness, cultural habits, and inadequate motivation often lead to improper waste disposal and mixing of segregated waste. In many cases, citizens are not provided with adequate infrastructure, such as separate bins or reliable collection services, which discourages participation.

Community-based approaches, including resident welfare associations and local self-help groups, have shown promising results in improving waste management practices at the grassroots level. Encouraging citizen responsibility, providing

incentives for proper waste handling, and strengthening communication between authorities and communities are essential steps(Louati, 2016).

Enhancing public awareness and participation is key to building a more efficient, inclusive, and environmentally responsible waste management system in India.

Environmental and Public Health Implications:

Improper solid waste management in India has significant environmental and public health implications, posing serious challenges to sustainable development. Uncollected and poorly managed waste often accumulates in open spaces, streets, and water bodies, leading to land, air, and water pollution. The decomposition of organic waste in open dumps generates foul odors and releases harmful greenhouse gases such as methane, contributing to climate change.

One of the major environmental concerns is the contamination of soil and groundwater due to leachate from unmanaged landfill sites. This toxic liquid contains hazardous substances that can infiltrate water sources, affecting both ecosystems and human populations. Additionally, the burning of waste, a common practice in many areas, releases toxic pollutants, including particulate matter and dioxins, which degrade air quality.

From a public health perspective, improper waste disposal creates breeding grounds for disease vectors such as flies, mosquitoes, and rodents. These vectors are responsible for the spread of diseases like dengue, malaria, cholera, and gastrointestinal infections. Informal waste workers and nearby residents are particularly vulnerable due to direct exposure to hazardous waste and lack of protective measures.

Furthermore, the increasing presence of plastic and electronic waste introduces long-term environmental hazards, as these materials are non-biodegradable and release toxic chemicals over time. Addressing these issues requires improved waste management practices, strict enforcement of environmental regulations, and increased public awareness to safeguard both environmental quality and human health.

Trends and Comparative analysis of Solid Waste Management in India :

According to the data, trash creation in India increased steadily from 1,45,000 TPD in 2015 to 1,70,000 TPD in 2025, which is indicative of the country's growing urbanization, population growth, and rising consumption levels. Waste collection efficiency increased dramatically throughout that time, from 70% in 2015 to roughly 93–95% by 2021. This suggests greater policy execution, better logistics, and stronger municipal systems. Processing efficiency, on the other hand, has increased more slowly, rising from just 22% in 2015 to roughly 52% by 2023–2025. This underscores the ongoing disparity between garbage collection and scientific treatment or recycling capacity. The improvement in processing rates indicates advancements in public awareness and infrastructural development, but the standstill after 2023 points to structural limitations including a lack of treatment facilities, budgetary difficulties, and technology gaps.

Table 1: Year-wise Trends of Solid Waste Management in India (2015–2025)

Year	Waste Generated (TPD)	Collected (%)	Processed (%)	Remarks
2015	145,000	70	22	Low processing, landfill dependence
2017	150,000	75	30	SWM Rules 2016 implementation begins
2019	155,000	85	40	Improvement in collection systems
2021	160,000	95	50	Major boost under national missions
2023	165,000	93	52	Expansion of processing facilities
2025	170,000	93	52	Growth continues but stagnation in processing

Sources:

Central Pollution Control Board (CPCB) Annual Reports (2023–2025)

Government of India Open Data Platform (2025)

Ministry of Environment, Forest and Climate Change

MoSPI Statistical Reports (2025)

Research studies and national datasets.

In a larger perspective, India presently produces between 160,000 and 170,000 tonnes of waste every day. Despite excellent collection performance, processing efficiency is still relatively low at roughly 50–55%, which puts ongoing strain on landfills and increases environmental concerns. Significant inter-state differences exist in waste management performance as well: West Bengal, Bihar, and Assam lag behind due to lower processing capacity and institutional constraints, while Madhya Pradesh, Gujarat, and Chhattisgarh perform comparatively better due to stronger infrastructure and policy implementation. Recent legislative changes, such as revised waste management regulations in 2026, are concentrating on more stringent waste segregation at the source, enhanced compliance procedures, and treatment infrastructure expansion in order to address these issues.

Overall, the trend shows that waste management performance has improved, but it also highlights how urgently more funding for processing systems is needed to achieve sustainable waste handling and better circular economy results.

Table 2: State-wise Comparison of Solid Waste Management (Latest 2025 Trends)

State/UT	Waste Generated (TPD)	Collection Efficiency	Processing Efficiency	Performance Level
Maharashtra	22,000	High	Moderate–High	Advanced but landfill stress
Uttar Pradesh	15,000	Moderate	Moderate	High generation, uneven systems
Gujarat	10,000	High	High	Leading performer
Madhya Pradesh	8,000	High	Very High	Top-performing state
Tamil Nadu	14,000	High	Moderate	Strong urban systems
Karnataka	11,000	High	Moderate–High	Tech-driven initiatives
West Bengal	9,000	Moderate	Low–Moderate	Infrastructure gaps
Delhi (NCT)	11,000	Very High	Moderate	Landfill crisis persists
Chhattisgarh	2,500	High	Very High	Model state performance
Kerala	3,500	Moderate–High	High	Decentralized model

Above the table, Significant regional differences in India's municipal solid waste management performance are revealed by the state-by-state data. The huge amount of waste generated in high-generation regions like Maharashtra and Uttar Pradesh presents significant issues. While Maharashtra has reasonably robust collection systems, the state's continuous reliance on landfills puts the environment under stress. With superior infrastructure, governance, and policy implementation(Mandal, 2019), Gujarat and Madhya Pradesh stand out as top performers with high collection and extremely high processing efficiency(Mazzanti and Zoboli, 2008). Although processing capacity still has to be increased, southern states like Tamil Nadu and Karnataka exhibit robust urban waste management systems and technology-driven initiatives(Mian et al., 2017). West Bengal, on the other hand, exhibits moderate collection but comparatively low

processing efficiency, pointing to institutional and infrastructure deficiencies. Due to high garbage density and insufficient processing capacity, landfill pressures continue despite the Delhi region's extremely high collection rates. Smaller states like Kerala and Chhattisgarh do remarkably well; Kerala uses decentralized waste management techniques, while Chhattisgarh is frequently used as an example because of its extremely high processing efficiency. Overall, the pattern shows that important factors influencing waste management success across Indian states include infrastructure investment, policy support, technology adoption, and governance quality (Madhavaraj and Karthikeyan, 2025).

Conclusion:

Solid waste management in India represents a critical area requiring sustained attention and strategic intervention. The increasing volume and complexity of waste, driven by urbanization, industrialization, and changing lifestyles, have intensified the pressure on existing management systems. Although initiatives such as the **Swachh Bharat Mission** and regulatory frameworks like the Solid Waste Management Rules, 2016 have laid a strong foundation, effective implementation remains uneven across regions.

Key challenges—including inadequate infrastructure, poor segregation practices, limited financial resources, and weak coordination among stakeholders—continue to hinder progress. At the same time, emerging trends such as technological innovations, recycling initiatives, and growing public awareness offer promising opportunities for improvement.

An integrated approach that combines policy enforcement, technological advancement, and community participation is essential for building an efficient waste management system. Greater inclusion of the informal sector, investment in infrastructure, and promotion of circular economy principles can significantly enhance sustainability. Furthermore, consistent public engagement and behavioral change are vital for long-term success.

In conclusion, addressing the challenges of solid waste management in India requires collaborative efforts, innovative solutions, and a long-term commitment to environmental protection and public health for a cleaner and more sustainable future.

References:

- Idris, A., Inanc, B., Hassan, M.N., 2004. Overview of waste disposal and landfills/dumps in Asian countries. *Journal of material cycles and waste management* 6, 104–110.
- Jain, M.S., Singh, J., Kalamdhad, A., 2025. Introduction to Solid Waste Management, in: *Organic Solid Waste Management: Rotary Drum Composting*. Springer, pp. 1–16.
- Jenkins, R.R., 1993. *The economics of solid waste reduction*. Books.
- Karim, L.R., Nair, M., Williams, E., 2012. Municipal solid waste dumping on Ashtamudi Lake, Kollam, Kerala—an overview. *The Ecoscan* 1, 105–110.
- Lal, C., Gupta, V., 2009. Sustainable development of agriculture: Urban waste water a viable mean for Irrigation. Presented at the World Environmental and Water Resources Congress 2009: Great Rivers, pp. 1–28.
- Li, Y., Huang, G., Nie, S., 2012. A mathematical model for identifying an optimal waste management policy under uncertainty. *Applied Mathematical Modelling* 36, 2658–2673.
- Louati, A., 2016. Modeling municipal solid waste collection: A generalized vehicle routing model with multiple transfer stations, gather sites and inhomogeneous vehicles in time windows. *Waste Management* 52, 34–49.
- Madhavaraj, M., Karthikeyan, K., 2025. A review of municipal solid waste management and landfills in India: environmental impacts, sustainable strategies and policy insights. *Journal of Material Cycles and Waste Management* 27, 3076–3099.
- Mandal, K., 2019. Review on evolution of municipal solid waste management in India: practices, challenges and policy implications. *Journal of Material Cycles and Waste Management* 21, 1263–1279.
- Mazzanti, M., Zoboli, R., 2008. Waste generation, waste disposal and policy effectiveness: Evidence on decoupling from the European Union. *Resources, conservation and recycling* 52, 1221–1234.
- Mian, M.M., Zeng, X., Nasry, A. al N.B., Al-Hamadani, S.M., 2017. Municipal solid waste management in China: a comparative analysis. *Journal of material cycles and waste management* 19, 1127–1135.

- Minghua, Z., Xiumin, F., Rovetta, A., Qichang, H., Vicentini, F., Bingkai, L., Giusti, A., Yi, L., 2009. Municipal solid waste management in Pudong new area, China. *Waste management* 29, 1227–1233.
- Mmerekhi, D., 2018. Current status of waste management in Botswana: A mini-review. *Waste Management & Research* 36, 555–576.
- Mmerekhi, D., Baldwin, A., Li, B., 2016. A comparative analysis of solid waste management in developed, developing and lesser developed countries. *Environmental Technology Reviews* 5, 120–141. <https://doi.org/10.1080/21622515.2016.1259357>
- Moghadam, M.A., Mokhtarani, N., Mokhtarani, B., 2009. Municipal solid waste management in Rasht City, Iran. *Waste management* 29, 485–489.
- Moh, Y.C., Abd Manaf, L., 2014. Overview of household solid waste recycling policy status and challenges in Malaysia. *Resources, Conservation and Recycling* 82, 50–61.
- Pandey, A., Suthar, S.S., Amesho, K.T., 2025. *Solid waste management: A roadmap for sustainable environmental practices and circular economy*. Springer.
- Ramitha, K., 2023. Solid waste workers in India and the COVID-19 pandemic: A review of intersecting challenges. *Workplace Well-Being in Manufacturing Organizations in Nigeria: Do Employee Green 97-107 Behavior, Core Self-Evaluations and Empowering Leadership Matter?* 13, 126–139.
- Sheikh, D.S., Iqbal, R., 2026. Socio-Economic and Political Transformation of the Toto Tribe in West Bengal: Continuity, Change, and Emerging Challenges. *International Journal of Law Management & Humanities* 9, 2240–2262. <https://doi.org/10.1000/IJLMH.1111309>
- Sheikh, S., 2023a. Solid waste management practice in Burdwan Municipality, West Bengal: An overview. *Interdisciplinary Journal of Innovation in Nepalese Academia* 2, 102–112.
- Sheikh, S., 2023b. *Municipal Waste Management in West Bengal: A Comparative Study of East and West Burdwan Districts* (Thesis). The University of Burdwan, India.
- Sheikh, S., 2022. An Explorative Study on Solid Waste Management System in Burdwan Municipality. *International Journal of Economics and Management Studies* 9, 77–84. <https://doi.org/10.14445/23939125/ijems-v9i12p109>
- Sheikh, S., Dinda, S., 2022. Distributional Pattern of Solid Waste Generation in Burdwan Municipality. *Rabindra Bharati University Journal of Economics XVI*, 113–135.