



Greener Waste Management in Indian Cities

The potential for behaviour change and waste segregation

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Executive summary

Waste segregation is a critical practice in global waste management, minimising the environmental impact of waste and maximising resource recovery. Globally, approximately 2.01 billion tonnes of municipal solid waste are generated annually, with India projecting 165 million tonnes by 2030. In India, a nation of over 1 billion people that is striving to achieve net-zero emissions by 2070, maintaining low per-capita emissions is crucial. Acknowledging this urgency, the launch of Mission LiFE by India in November 2022 (PIB, 2022) urges the transformation of consumption patterns and embrace of sustainable lifestyles to curb escalating emissions in the course of economic development. Waste segregation is intrinsic to sustainable behaviour and lifestyles.

This diagnostic brief delves into the behavioural aspects of the challenges and prospects of waste segregation in urban India. Based on fieldwork in Indore, Madhya Pradesh, and the southern part of Delhi National Capital Region (NCR), the study found that behavioural barriers like limited awareness, time constraints, a perceived high effort with unknown benefits, and entrenched status quo biases hinder effective segregation of waste at home. Conversely, supportive institutions and well-developed infrastructure, government mandates, recognition of environmental benefits, etc. promote waste segregation. The brief aims to uncover opportunities for behavioural interventions and policy enhancements, providing a comprehensive view of the landscape to reduce the carbon footprint associated with waste mismanagement in India.

Section 01: The Project

The global challenge of climate change demands transformative shifts in societal behaviour, particularly in waste management. By systematically separating different types of waste at source, countries can efficiently manage waste and maximise recycling and composting efforts. In India, where waste generation is projected to be 165 million tonnes by 2030 (MoHUA, 2021), addressing waste segregation is critical.

The benefits of waste segregation are far-reaching, reducing resource depletion through recycling, curbing methane emissions from organic waste, and fostering a circular economy. Separating recyclable materials like paper, plastics, glass, and metals facilitates their diversion for recycling, helping to preserve natural resources and to curb the energy-intensive manufacturing processes involved in producing new materials. Segregating organic waste enables its conversion through composting or anaerobic digestion, creating valuable resources for agriculture and reducing methane emissions from landfills. By embracing waste segregation practices, countries can move towards a sustainable and circular economy, where waste is viewed as a valuable resource. This practice not only helps reduce environmental pollution but also generates employment opportunities and fosters economic growth in the recycling and waste management sectors. Equitable and low carbon material use demands a comprehensive approach, encompassing structural and policy alterations by governments as well as behavioural and normative shifts at the individual and household levels.

The Low Carbon Lifestyles Project at CSBC seeks to initiate behaviour change towards sustainable lifestyle choices, including low carbon waste management, in Indian cities. It aims to design interventions to redirect individual and household choices towards sustainable behaviour and technologies. The primary goal is to ensure that policy incorporates an understanding of the context of consumer choices and of local barriers to the uptake of low carbon consumption, essential to devise levers for higher adoption.

This brief focuses on human choice and waste segregation, examining the barriers and facilitators in its adoption in Indian cities. The project uses Indore in Madhya Pradesh and the southern part of Delhi National Capital Region (NCR) as case studies to understand best practices, challenges, and opportunities, extracting valuable insights into how to implement sustainable waste management practices nationwide.

Project Objective:

A key objective of the Low Carbon Lifestyles Project is to advocate the adoption of waste segregation. It promotes waste segregation behaviour among Indian households located in urban areas and belonging to the middle- and high-income groups.

- Target Behaviour: Active engagement in waste segregation at the source, with proper separation of different types of waste for disposal or recycling
- Target Population: Indian households in urban areas belonging to the middle- and high-income groups

Waste Segregation – The Indian Context

Waste management has emerged as a critical issue in India, with significant environmental and health implications. In recent years, there has been a growing recognition of the urgency of putting in place effective waste segregation practices to control greenhouse gas (GHG) emissions and promote a sustainable future.

The waste sector in India accounted for approximately 4% of the country's total GHG emissions in 2018 (GHG Platform India, 2018). Methane (CH₄), a potent GHG, is released during the anaerobic decomposition of solid waste and the improper treatment of domestic and industrial wastewater. Waste contributed to 19% of total methane emissions in India in 2022 (IEA, 2023). By diverting organic waste from landfills and capturing methane emissions from both landfills and effluent treatment units, India has the potential to reduce emissions by approximately 78.75 million tonnes of carbon dioxide equivalent (CO₂eq) by 2031 (Manuja et al., 2018).

India faces a significant waste generation challenge, with 147,613 metric tonnes (MT) of solid waste generated per day from a sample of 84,475 wards, according to the *Swachhata Sandesh Newsletter* of the Ministry of Housing and Urban Affairs (Singh, 2020). Projections by the Task Force on Waste to Energy estimate that urban India will generate 4,50,132 tonnes per day (TPD) of waste by 2031 and a staggering 11,95,000 TPD by 2050 (Task Force on Waste to Energy, 2014). According to this report, per capita waste generation is currently at 450 grams per day, increasing at a rate of 1.3% per annum (Singh, 2020). The report also states that waste generation varies significantly across 84,456 wards, ranging from 32 MT to 22,080 MT per day.

Among the Government of India's initiatives to address the issue is its flagship Swachh Bharat Abhiyan (SBA), launched in October 2014, with the aim of achieving cleanliness and improved sanitation across the country (PIB, 2014). It accords the highest priority to waste management, including waste segregation (NITI Aayog, 2021). SBA emphasises the need for behavioural change among individuals and communities for the success of waste segregation initiatives.

The Solid Waste Management Rules of 2016 mandate the concerned agencies, including urban local bodies (ULBs), to support waste segregation through the establishment of Material Recovery Facilities, waste-to-energy plants, and waste-to-composting plants. The Municipal Solid Waste Management Manual, published in 2016, outlines a step-wise waste minimisation approach closely linked to the principles of Reduce, Reuse, and Recycle (3Rs) (MoUD, 2016). It assigns a pivotal role to ULBs in waste management: they are required to plan, implement, and monitor all systems of urban waste service delivery, especially municipal solid waste management. ULBs are also responsible for managing specific special waste streams, including plastic waste, biomedical waste, slaughterhouse waste, e-waste, waste tires, and lead battery waste (MoUD, 2016).

Through support from these policies, progress is being made in waste segregation practices. Since the inception of SBA-Urban in 2014, 83,487 wards – out of the total 92,634 wards covered – are practising 100% source segregation; 75% of waste in the coverage area is processed (MoHUA, 2023). However, waste management is a major problem for many ULBs in India, where urbanisation, industrialisation, and economic growth have led to an increase in waste generation with waste collection, transport, treatment, and disposal failing to catch up (Cheela et al., 2021; S. Kumar et al., 2017; MoUD, 2016). ULBs in India often struggle to provide effective services of waste collection, storage, and transport – fundamental to any waste management system – due to financial constraints; lack of infrastructure, technology, trained and qualified professionals, accountability, and a regulatory framework; and low environmental awareness and public attitudes towards waste (Cheela et al., 2021; S. Kumar et al., 2017).

The challenges posed by the growing population, urbanisation, and lack of awareness require concerted efforts from citizens, municipalities, and organisations. This is the right moment to unlock the full potential of waste management systems by improving source segregation rates at the household level, to keep the cities clean and address rising emissions.

Choice and Waste Segregation

Based on an extensive literature review, several barriers were identified that impede the widespread adoption of waste segregation practices globally. On the demand side, lack of awareness and of a sense of responsibility among waste generators were prominent issues (Fadhullah et al., 2022; Ghosh, 2016; Kumar & Agrawal, 2020; NITI Aayog, 2021; Sharma & Jain, 2019). Many individuals have a limited understanding of the importance of waste segregation and perceive waste management as the sole responsibility of authorities or others. Insufficient knowledge about waste sorting practices, reduction, reuse, and recycling further hinders effective waste segregation (Eshete et al., 2023). The inconvenience and perceived extra effort associated with waste segregation, including interim storage, pose additional barriers (NITI Aayog, 2021; Pedersen & Manhice, 2020). Cultural

perceptions and concerns about household order, such as visible waste and hygiene issues, also act as deterrents to waste separation (Kumar & Agrawal, 2020; Pedersen & Manhice, 2020).

On the supply side, infrastructure limitations, including inadequacies in collection systems, waste processing facilities, and suitable disposal sites, impede the implementation of waste segregation practices (Annepu, 2012; Eshete et al., 2023; NITI Aayog, 2021; Singh, 2020). The absence of separate bins or containers at home for various types of waste, further challenge effective waste segregation (NITI Aayog, 2021). The shortage of trained personnel, lack of qualified waste management professionals, and limited financial resources allocated to waste management by municipal authorities contribute to the challenge as it is perceived that even if waste is segregated at home, it is likely to be dumped together by external collectors (Singh, 2020).

The literature review also revealed key facilitators for the adoption of waste segregation behaviours. Education and awareness programmes, including effective communication campaigns, play a crucial role by informing individuals about the benefits of waste segregation and proper segregation methods (Fadhullah et al., 2022; Ghosh, 2016; Kumar & Agrawal, 2020). Economic incentives, such as financial rewards or discounts on waste disposal fees for proper segregation, can encourage households to participate actively. The income generated from selling valuable segregated waste, such as recyclables, also serves as an incentivising factor (NITI Aayog, 2021). The provision of physical items such as bins and bags specifically designed for waste segregation emerges as a significant facilitator as well (Kihila et al., 2021; NITI Aayog, 2021; Norkhadijah et al., 2014). Further, policies and mandates that promote waste segregation at the source provide a supportive framework and encourage waste generators to participate (Annepu, 2012; Singh, 2020).

Project Methodology

While there has been some behavioural research on segregation of waste at the household level in Indian cities, deeper investigation is required. This study comprehensively explores the behavioural and policy barriers that limit the adoption of waste segregation in urban India, and the facilitators that enable it. The project team designed a robust methodology to understand the barriers and facilitators related to waste segregation and thus design interventions to promote adoption.

- First, a detailed literature review was conducted to identify national- and state-level policies and incentives for building a sustainable waste management ecosystem in Indian cities.
- This was supplemented by a stakeholder mapping to understand the diverse actors involved in implementation.

- Next, the team carried out diagnostic fieldwork, designing and conducting interviews with 21 participants, including households and waste collectors.
 - The study spanned both high-income and middle-income categories of households, including standalone houses in affluent and middle-income neighbourhoods in Indore and the southern part of Delhi. Indore's high waste segregation and effective enforcement provide a model for successful waste management, while the challenges in the southern part of Delhi offer insights into scaling up source segregation interventions amidst supply-side barriers, contributing diverse perspectives to the study.
 - The team ensured gender and age diversity within the sample.

- We then consolidated and analysed the insights from fieldwork to identify behavioural and structural barriers to and facilitators for waste segregation in households.

- This was followed by ideation workshops to identify interventions to improve adoption.

Section 02: Insights from Fieldwork

Whether or not an individual consumer adopts a given sustainable behaviour depends on two sets of factors: (1) Demand side factors -- The preferences, needs, and beliefs of the individual can make her/him more likely to adopt that behaviour (such factors are demand-side facilitators of sustainable behaviour), or less likely to adopt the behaviour (demand-side barriers) and (2). Supply-side factors: The availability and accessibility of infrastructure and/or services at the systemic level make an individual more likely (supply-side facilitators) or less likely (supply-side barriers) to adopt the behaviour.

Our diagnostic fieldwork revealed 15 distinct barriers and facilitators that impede the uptake of the waste segregation among households in Indore and the southern part of Delhi NCR.

Demand-Side Barriers

1. *Lack of awareness and education:* The research showed that people are not aware of or do not understand proper waste segregation practices: how to segregate, what are dry and wet waste. There is both underestimation and a broader lack of understanding about the immediate and long-term harmful effects of improper waste disposal. Further, climate change and the need to reduce pollution – the mitigation of which relies heavily on waste management – are perceived as distant or irrelevant. The lack of awareness extends to the process of waste collection and segregation in the neighbourhood. Additionally, there is inconsistent behaviour within families, with some members segregating waste while others do not.
2. *High perceived effort vs unknown payoff:* We found that the resistance to waste segregation is fuelled by the perception that it is a high-effort activity with an unclear payoff, coupled with the belief that municipal workers, not households themselves, are responsible for it. This perspective, combined with busy schedules, challenges people to find time for segregation. The notion that segregation demands extra time and effort, possibly requiring higher salaries for household help, adds to the resistance. Smaller waste amounts or fewer family members can also lead to a dismissive attitude.
3. *Status quo bias:* Ingrained habits pose a strong barrier to waste segregation, as our research revealed. People find it challenging to break the habit of disposing of all waste together, even when presented with the environmental advantages of segregation.
4. *Time constraints:* Time constraints emerged in the research as a significant barrier, with busy schedules hindering waste segregation efforts. This is

exacerbated by the lack of convenient waste segregation facilities, such as easily accessible bins and absence of flexible waste collection schedules, making it difficult for individuals to integrate segregating waste into their daily routines.

Supply-Side Barriers

5. *Absence of clear communication and instructions from authorities:* Our fieldwork revealed the lack of clear communication and detailed guidelines from authorities regarding waste segregation practices. Absence of explicit instructions on the proper disposal of waste, the importance of segregation, and potential consequences of non-compliance creates confusion among residents and hinders effective waste management.
6. *Heavy workload of cleaning staff and financial concerns:* The heavy workload of cleaning staff, including waste collectors for standalone houses and housekeeping personnel for societies, poses a substantial barrier to waste segregation. Collecting segregated waste demands meticulous attention to separate categories like recyclables, organic waste, and non-recyclables, adding time and effort to the collection process. The larger workload often calls for higher salaries, and this demand becomes a problem for the waste management ecosystem.
7. *Limited knowledge and awareness among waste collectors:* Our research showed that waste collectors often lacked sufficient knowledge of waste segregation practices, including the benefits and reasons. While they may collect segregated waste following directions from higher authorities, because of their own lack of comprehensive understanding of the concept, they struggle to communicate the significance and ways of waste segregation to others. This acts a barrier to the motivation and ability of households to consistently adhere to segregation practices.
8. *Insufficient infrastructure and facilities:* A clear barrier to effective waste management indicated by our research is the inadequacy of waste segregation infrastructure, such as separate bins or recycling facilities. Limited availability of appropriate waste disposal options and recycling facilities discourages individuals from segregating waste.
9. *Lack of coordination and instructions from residents' associations:* Residents' welfare associations (RWAs) play a crucial role in cleanliness and waste segregation practices of the households living in the apartment complexes. The lack of specific instructions or information from RWAs regarding these aspects acts as a significant barrier.

Demand-Side Facilitators

1. *Value placed on proximate goals:* The research indicated that when people realised the immediate or tangible benefits of the practice, they were motivated to segregate waste. The emphasis on proximate goals in waste management initiatives like SBA drives a prioritised commitment among citizens. Respondents acknowledged waste segregation as a critical measure in preventing the spread of diseases, promoting hygiene, and mitigating mosquito breeding, indicating that the immediate advantages of the practice acted as more of an enabler than long-term climate considerations.
2. *Recognition of environmental benefits, particularly in recycling and plastic reduction:* A subset of participants demonstrated an awareness of the environmental benefits associated with waste segregation, primarily focused on recycling and pollution reduction. Their motivations were more closely linked to recycling and plastic use than climate change as they expressed a strong desire to reduce plastic consumption. They believed that waste segregation plays a crucial role in achieving this goal and promoting recycling practices.
3. *Education and media influence:* Our research indicated that people are influenced by education and media to adopt waste segregation practices. Many participants mentioned that they learned about waste segregation and its benefits from teachers in schools and colleges, indicating the importance of educational institutions in promoting waste segregation. Participants also highlighted the role of various media channels, including television, radio, and online videos, in increasing their knowledge and awareness about waste segregation practices.

Supply-Side Facilitators

4. *Government orders and initiatives mandating waste segregation:* Our research revealed that government orders and initiatives mandating waste segregation are very effective in enforcing waste segregation practices. Participants mentioned receiving specific orders and instructions from the government, municipal corporation, or Nagarpalika regarding waste segregation. Government initiatives, such as SBA and the installation of machines for waste segregation, were mentioned as positive steps in waste management. The study revealed that regular checks and penalties (challans) were enforced to ensure compliance with waste segregation practices. The fear of penalties serves as a facilitator, ensuring individuals adhere to waste segregation rules and guidelines.
5. *Infrastructure support:* Some participants mentioned the availability of separate bins for different types of waste in their areas as enabling them to

practise waste segregation. They also pointed to the presence of waste collection vans, which ensures efficient collection and disposal of segregated waste. The efficient functioning of supportive institutions (e.g. ULBs, RWAs) and well-developed infrastructure for waste segregation make it easier for individuals to implement waste segregation practices.

6. *Government initiatives and awareness campaigns:* Government initiatives and awareness campaigns raise public consciousness about the importance of waste segregation, resulting in greater participation and adoption among individuals. Interviewees acknowledged the efforts of the government, particularly the Swachh Bharat initiative, in promoting waste segregation. Awareness campaigns using posters, banners, and media channels have been effective facilitators.

Section 03: Recommendations and Interventions

This study has unveiled key behavioural and structural barriers that limit source segregation of waste in Indian cities. Utilising these insights is vital for policy, enabling governments to employ a powerful set of levers to facilitate the adoption of waste segregation practices.

To activate the behavioural bridge to policy, this study employs the 4Es Model of the UK government's Department for Environment, Food and Rural Affairs (DEFRA), which aspires to enable, encourage, exemplify, and engage in moving individuals towards sustainable practices (Institute for Government, 2015). This model offers an approach to addressing behavioural and structural gaps in policy:

1. Enable focuses on providing the necessary infrastructure to make sustainable choices accessible and attractive.
2. Encourage delves into the realm of information dissemination and public awareness to motivate individuals.
3. Exemplify emphasises the importance of leading by example.
4. Engage encourages active participation and collaboration amongst stakeholders to influence policy.

Through a series of ideation workshops, this project identified nine interventions that address the behavioural barriers to segregation of waste, organised below in the 4Es framework.

Enable

Addressing contextual and structural barriers is crucial for widespread adoption of waste segregation practices. To overcome such challenges, the project suggests the following interventions:

1. *Distribute dustbins*: The absence of dedicated bins discourages segregation efforts as users dispose of all waste together. Municipal bodies or RWAs must supply households with bins for distinct waste categories provides convenience, fostering consistent waste separation and addressing the challenge of mixed waste disposal.
2. *Provide user-friendly dustbins*: The dustbins provided to households must be user-friendly and clearly marked, enabling effortless waste segregation for individuals and households. These bins should incorporate visually distinguishing elements, including carefully selected colours for various waste types and intuitive logos (refer to intervention 3 for more details). This ensures that waste disposal becomes easily understandable, fostering widespread adoption of correct segregation practices.

Encourage

Infusing insights from behavioural research into conventional tools like information provision, regulations, incentives, and communication campaigns can enhance the effectiveness of these tools, addressing the specific concerns of those not currently practising waste segregation. The project recommends implementing targeted behaviour change campaigns:

1. *Use clear language for easy sorting:* Sometimes, terminology about waste make it hard to know where each type of waste goes. Certain items, such as used paper napkins, which may be 'wet' are more suitable for dry waste disposal, while items like seemingly dry eggshells are considered wet waste. Adopting clear and descriptive terms like 'organic waste' or 'kitchen and garden waste' or 'compostable' for wet waste and 'recyclables' for dry waste enhances communication, ensuring users understand and correctly sort their waste.
2. *Put visual reminders on everyday items:* People might forget to separate their waste because they don't see reminders. Putting simple pictures, like recycling symbols, on things that are used every day, like shopping bags, or food packaging, can nudge them to sort their waste.
3. *Highlight the immediate benefits of segregation:* Highlighting the immediate goals of waste separation helps overcome the idea that climate goals are far-off, shifting attention to more proximate advantages. Adoption of waste segregation can be encouraged by linking it to personal goals, like supporting cleanliness drives such as SBA, creating a sense of local pride in a clean locality, and underlining immediate benefits such as prevention of vector-borne diseases, improved health, elimination of foul odours, and enhanced aesthetics, which redirects focus to tangible benefits.
4. *Frame messaging on non-collection:* Disruption in waste collection due to non-segregation is a pressing issue. Introducing the slogan 'No segregation, no collection' establishes a new norm, making waste segregation a prerequisite for waste pickup. This message creates a sense of responsibility and consequences. Users understand that their failure to segregate will result in non-collection, impacting both their immediate surroundings and the broader waste management process.

Exemplify

Elevating the status perception of waste segregation requires influential figures in society, from celebrities to community leaders, to set an example. To enhance the status and societal acceptance of waste segregation, the project recommends that influential figures actively participate in and champion segregation practices:

1. *Initiate a norm shift campaign:* The status quo bias, rooted in the difficulty of breaking established waste disposal patterns, hampers the adoption of segregation norms. To counter this, a norm shift campaign can utilise influential figures, including celebrities or designated local 'waste segregation champions', to advocate for sustainable waste practices. This can be combined with showcasing success stories from cities with effective waste segregation, which targets civic pride, spurring the desire to be part of a clean city by adopting such practices. Leveraging norm-based messaging using aspirational figures and local community practices can be highly effective in fostering a collective shift towards responsible waste stewardship.

Engage

Improving waste segregation practices requires collective efforts from various stakeholders, extending beyond government initiatives and waste management authorities. The following intervention seeks to actively engage households, the community, and other actors to promote and incentivise waste segregation:

1. *Use local networks and segregation champions:* Limited localised awareness is a challenge. RWAs can network and organise residents into groups to foster community awareness and institute collective efforts towards effective waste management. Local champions, or community members who are segregating waste, could respond to questions on WhatsApp groups or carry out demos in communities/societies to address knowledge gaps.
2. *Establish waste segregation in schools:* Limited youth awareness poses a challenge in fostering sustainable waste habits, threatening the continuation of improper disposal. To counter this, waste segregation activities can be embedded into school curricula, actively engaging children. This makes them advocates for proper waste disposal, using interactive scripts and games for an engaging learning experience. Instilling these habits in children often creates a ripple effect, influencing families and communities to adopt sustainable waste practices.

The Path to Improved Waste Segregation

This diagnostic brief underscores the critical need for integrating behavioural insights into waste management policies to ensure adoption of sustainable waste segregation practices by Indian households. With waste generation projected to escalate significantly, it is imperative to address the barriers and leverage the facilitators for effective waste segregation. This brief consolidates essential insights into the behavioural challenges that hinder widespread waste segregation adoption and the enablers for this practice. While some factors may be context-specific, many are applicable across diverse urban landscapes in India. The research offers

innovative recommendations and interventions to enhance waste segregation practices, leading to a cleaner, greener, and more sustainable urban future.

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