GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

No. 2022/EnHM/11/01/WS **New Delhi, dt. 24.01.2022**

The General Managers,
All Zonal Railways/PUs,
DGs of RDSO and NAIR.

Sub: "Promoting Behaviour change for strengthening Waste Segregation at Source" - Policy Guidelines developed by NITI Aayog.

Please find enclosed herewith a copy of DO letter dated 06.12.2021 from CEO/NITI Aayog on the subject matter.

The enclosed guidelines provide recommendations for policy interventions that support behavioural change in individuals, households and institutions to strengthen waste segregation at source to facilitate, strengthen, widen and deepen the adoption of necessary practices among different stakeholders for a sustainable and lasting impact. The recommendations have relevance for policies in the broad areas of waste management, circularity, sanitation, urban planning and product packaging amongst others.

These Guidelines should invariably be incorporated in all ongoing initiatives on waste segregation and management including contracts for OBHS, rag picking and station cleaning.

Encl: As above (24 pages)

24/1/22

(Ravi Jain)
Executive Director/ME(EnHM & Proj.)
Railway Board

Copy to: MD/KRCL & CRIS and CMDs of all PSUs under M/o Railways.

E.O. 1041119

अमिताभ कांत
Amitabh Kant
मुख्य कार्यकारी अधिकारी
Chief Executive Officer

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Chairman, Railway Board
E-Office No 104 0872
Date : 10.12.2021

December 6, 2021

Dear Secretary,

It gives me great pleasure to share the document titled "Promoting Behaviour Change for Strengthening Waste Segregation at Source- Policy Guidelines" developed by NITI Aayog.

Evidence abounds that viability of the circular economy approach to waste management and natural resource recovery, including recycling, composting and waste-to-energy projects, hinges crucially on segregation of waste at source. India has created a sound regulatory framework for supporting it, and now requires effective implementation on the ground.

The Guidelines provide recommendations for policy interventions that support behavioural change in individuals, households and institutions to strengthen waste segregation at source. The objective is to facilitate, strengthen, widen, and deepen the adoption of necessary practices among different stakeholders for a sustainable and lasting impact. The recommendations have relevance for policies in the broad areas of waste management, circularity, sanitation, urban planning, and product packaging, amongst others.

You are requested to incorporate these Guidelines in your ongoing initiatives on waste segregation and management. You are also requested to share it with concerned agencies in your respective sectors.

With regards,

Yours sincerely,

(Amitabh Kant)

To:

The Secretaries/Additional Chief Secretaries/Pr. Secretaries/ Member Secretary as per the list enclosed.

स्वच्छ भारत
एक कदम स्वच्छता की ओर

List

1. Secretary, Ministry of Agriculture
2. Secretary, Ministry of Chemicals and Fertilizers
3. Secretary, Ministry of Civil Aviation
4. Secretary, Ministry of Coal
5. Secretary, Ministry of Commerce and Industry
6. Secretary, Ministry of Consumer Affairs, Food and Public Distribution
7. Secretary, Ministry of Defence
8. Secretary, Ministry of Development of North Eastern Region
9. Secretary, Ministry of Drinking Water and Sanitation
10. Secretary, Ministry of Environment and Forests
11. Secretary, Ministry of Food Processing Industries
12. Secretary, Ministry of Heavy Industries and Public Enterprises
13. Secretary, Ministry of Housing and Urban Poverty Alleviation
14. Secretary, Ministry of Information and Broadcasting
15. Secretary, Ministry of Micro ,Small and Medium Enterprises
16. Secretary, Ministry of Mines
17. Secretary, Ministry of New and Renewable Energy
18. Secretary, Ministry of Panchayati Raj
19. Secretary, Ministry of Petroleum and Natural Gas
20. Secretary, Ministry of Planning
21. Secretary, Ministry of Railways
22. Secretary, Ministry of Road Transport and Highways
23. Secretary, Ministry of Rural Development
24. Secretary, Department of Space
25. Secretary, Ministry of Statistics and Programme Implementation
26. Secretary, Ministry of Steel
27. Secretary, Ministry of Textiles
28. Secretary, Ministry of Tourism
29. Secretary, Ministry of Tribal Affairs
30. Secretary, Ministry of Urban Development
31. Secretary, Ministry of Water Resources
32. Secretary, Ministry of Women and Child Development
33. Secretary, Ministry of Youth Affairs and Sports
34. Additional Chief Secretary/Principal Secretary, Department of Environment of all States and Union Territories
35. Additional Chief Secretary/Principal Secretary, Department of Urban Development of all States and Union Territories
36. Member Secretary, State Pollution Control Board of all States and Union Territories

सत्यमेव जयते
NITI Aayog



Policy Guidelines

Promoting Behaviour Change for Strengthening Waste Segregation at Source







सत्यमेव जयते
NITI Aayog



Policy Guidelines

Promoting Behaviour Change for Strengthening Waste Segregation at Source





November 2021

अमिताभ कांत
Amitabh Kant
मुख्य कार्यकारी अधिकारी
Chief Executive Officer

सत्यमेव जयते

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MESSAGE

It gives me great pleasure to share the document titled "Promoting Behaviour Change for Strengthening Waste Segregation at Source- Policy Guidelines" developed by NITI Aayog.

Evidence abounds that viability of circular economy approach to waste management and natural resource recovery, including recycling, composting and waste-to-energy projects, hinges crucially on segregation of waste at source. While India has created a sound regulatory framework for this, it now requires effective implementation on the ground.

Segregation at source requires multiple stakeholders to collaborate and align their initiatives. Regulatory agencies, businesses, innovators and financiers need to strengthen the institutional mechanisms to engender the enabling ecosystems. At the same time, civil society organisations, communities and individuals need to assiduously work to embed segregation at source it in attitudes, behaviour and choices.

India is committed to strengthening Circularity Economy, both as an end and as a means for achieving its Sustainable Development Goals and Climate Action "*Panchamrit*" ambition. Solid waste is a significant contributor to green-house-gases, especially methane emissions, and therefore circularity is crucial for our mitigation action. At the same time it also contributes to adaptation action as it offers opportunities for green jobs creation.

I congratulate the team for having developed these Policy Guidelines which have immense relevance for policy formulation, creation of viable circular business models, and field implementation.

(Amitabh Kant)

स्वच्छ भारत

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सत्यमेव जयते

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FOREWORD

India generates a large quantity of waste annually. Rising prosperity, urbanization and consumption portend a rapidly growing trend in quantum of waste generation that threatens sustainability of cities and ecosystems.

A circular economy approach needs to be adopted for efficient and comprehensive waste management. However, the viability of recycling, composting, waste-to-energy, and other resource recovery projects, crucially depend on ensuring segregation of waste at source. Many policies and regulatory initiatives have been notified by the government to support this. These include, inter alia, the six Solid Waste Management Rules. They need to be complemented with on-ground practices, including behaviour change for adoption for waste segregation at source.

India is also a global leader on implementation of Sustainable Development Goals (SDGs). Comprehensive waste management lies at the intersection of SDG 6 (Clean Water and Sanitation), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 14 (Life Below Water).

These policy guidelines have been developed under the guidance of Dr. Rajiv Kumar, Hon'ble Vice Chairman, and Mr. Amitabh Kant, CEO, NITI Aayog. The document has been prepared by the Natural Resource and Environment (NRE) vertical by the expert contribution of Ms. Saloni Goel. The document has also received valuable contributions from Dr. Ritu Tripathi, Assistant Professor, Organizational Behaviour at Indian Institute of Management Bangalore, and Mr. Amit Jain, Managing Director, IRG Systems South Asia Pvt. Ltd.

The policy guidelines promise to be a valuable resource for policy planners and field implementers alike, for supporting behaviour change in individuals, households and institutions to facilitate, strengthen, widen, and deepen the adoption of waste segregation at source practices for a sustainable and lasting impact.

(Avinash Mishra)

स्वच्छ भारत

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List of Abbreviations

ULB	Urban Local Bodies
MSW	Municipal Solid Waste
MoHUA	Ministry of Housing and Urban Affairs
PCB	Pollution Control Board
C&D	Construction & Demolition
CPCB	Central Pollution Control Board
SPCB	State Pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organisation
CERC	Central Electricity Regulatory Commission
RDF	Refuse Derived Fuel
MSWM	Municipal Solid Waste Management
GRIHA	Green Rating for Integrated Habitat Assessment
IGBC	Indian Green Building Council
LEED	Leadership in Energy and Environmental Design
SBM	Swachh Bharat Mission
NREP	National Resource Efficiency Policy
UNEP	United Nation Environment Programme
IEC	Information, Education and Communication
MW	Mega Watt
TPA	Tonnes Per Annum
SUP	Single Use Plastic
SLB	Service Level Benchmarks
DPR	Detailed Project Report
MT	Metric Tonnes
NSO	National Statistical Office
EPR	Extended Producer Responsibility
BIS	Bureau of Indian Standards
MRF	Material Recovery Facilities

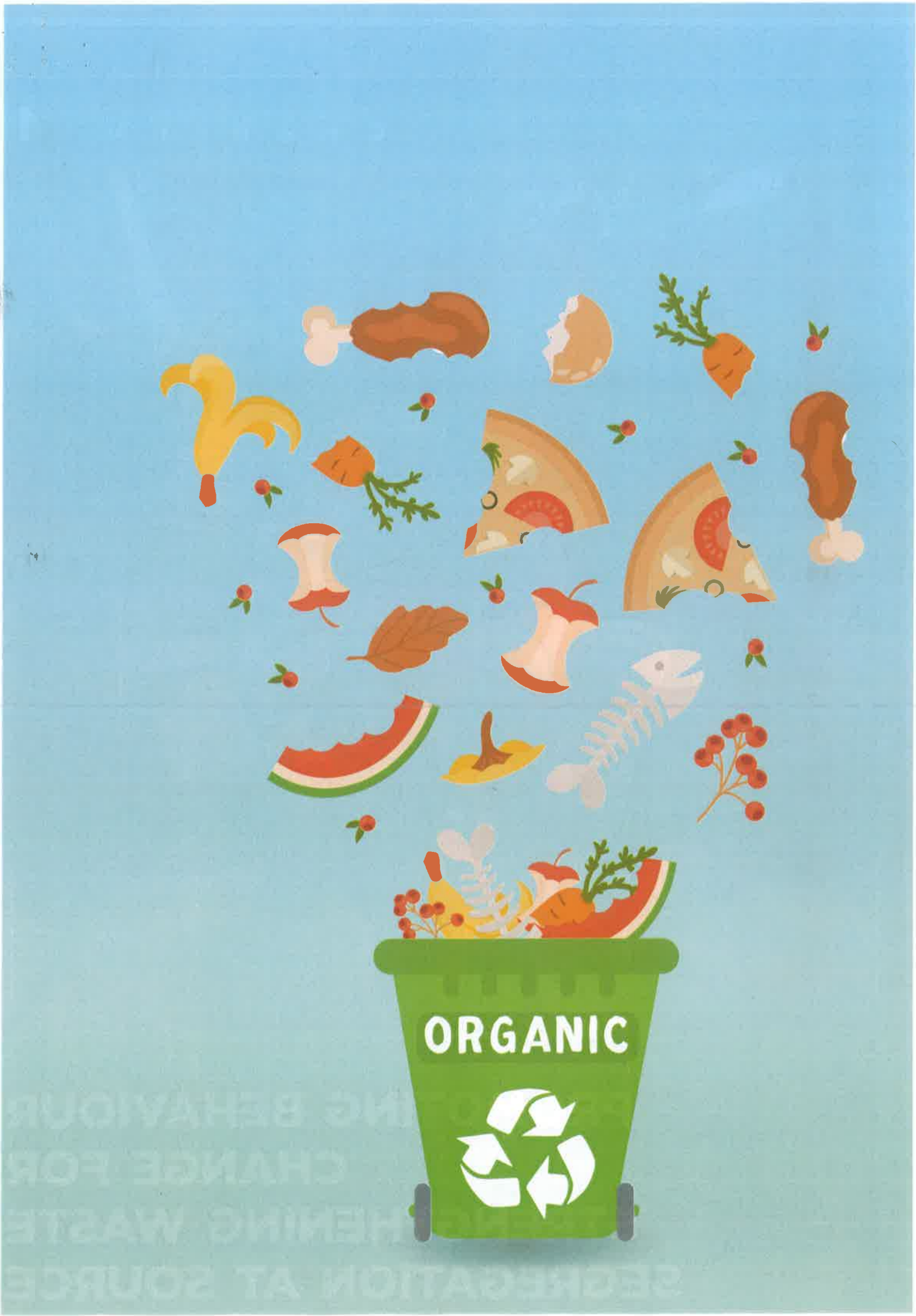
Prologue

PROMOTING BEHAVIOUR CHANGE FOR STRENGTHENING WASTE SEGREGATION AT SOURCE

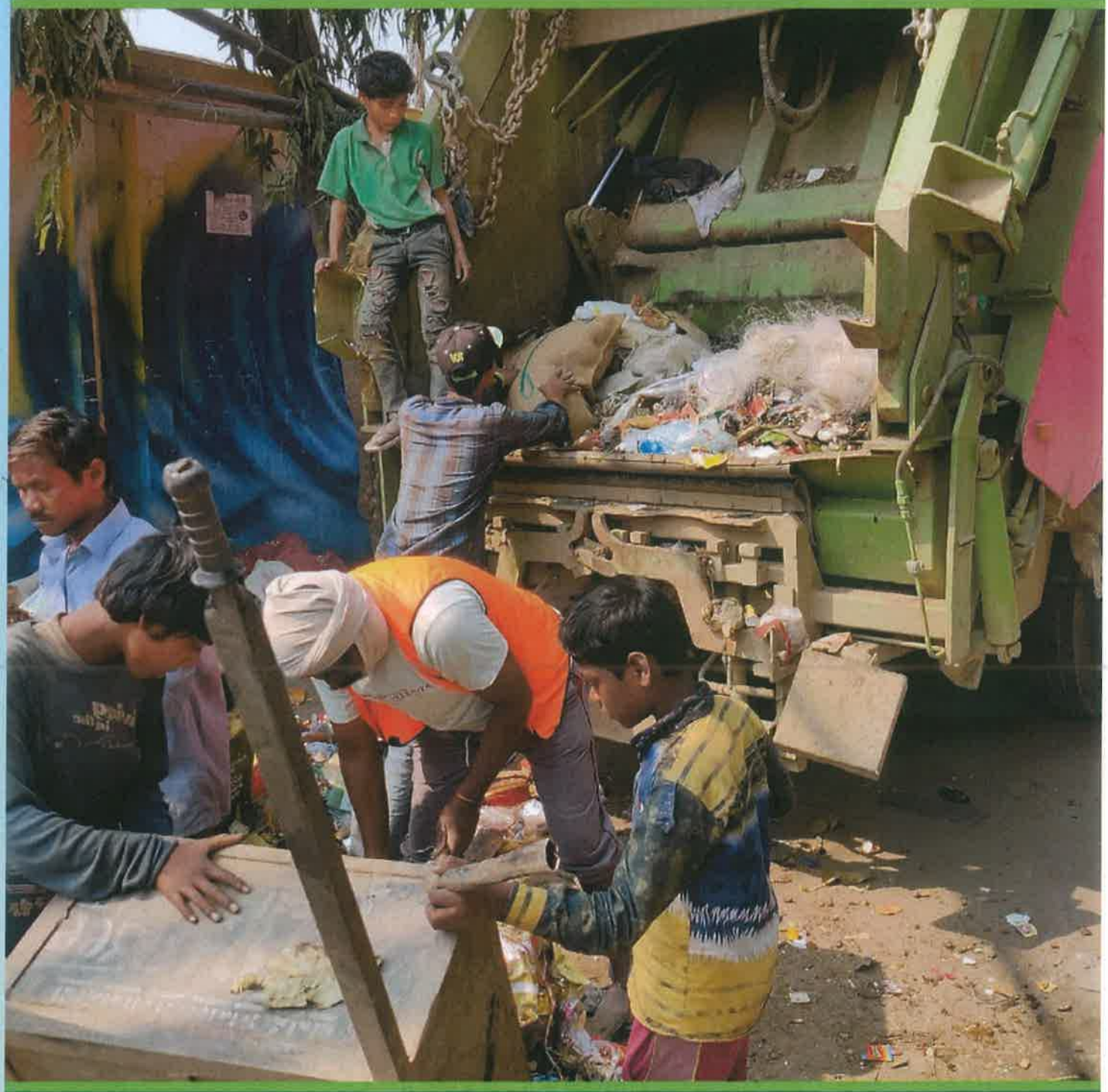
The policy guidelines have been developed to support behavioural change in individuals, households and institutions to strengthen waste segregation at source (WSS). The objective is to facilitate, strengthen, widen and deepen, the adoption of WSS practices among different stakeholders for a sustainable and lasting impact. The recommendations are anchored in a holistic perspective on human behaviour that contextualize WSS as being a behavioural practice and act that is enmeshed with the psycho-structural features of the environment. **The recommendations have relevance for policies in the broad areas of waste management, circularity, sanitation, urban planning, and product (including food) packaging, amongst others.**

There is ample evidence from operations of recycling, composting and waste-to-energy projects that their viability critically hinges on availability of segregated waste. Waste can alternatively be segregated at the point of generation (source segregation), or at the point of treatment (secondary segregation). The former offers distinct advantages over the latter. **However, source segregation requires sustained sensitisation and participation of individuals and institutions generating the waste.** This entails behavioural change interventions that transcend socio-economic strata and literacy levels.

The recommendations in this note are based on the study and analysis of the extant regulatory landscape, national and international best practices, and are underpinned by mapping waste segregation behaviour in Indian socio-cultural context.


ORGANIC

CHAPTER 1



PROMOTING BEHAVIOUR CHANGE FOR STRENGTHENING WASTE SEGREGATION AT SOURCE

Promoting Behaviour Change for Strengthening Waste Segregation at Source

India generates about 49.8 million tonnes of solid waste annually[1]. World over annual waste generation estimates are pegged at almost 2 billion tonnes, and are expected to grow to 3.4 billion tonnes, an increasé of 70% by 2050. **Countries like India that fall in the world's fastest growing regions of South-Asia and Sub-Saharan Africa, are projected to witness a much higher, three-fold rise in waste generation by 2050[2].**

Studies suggest that despite waste management increasingly occupying a position of priority, globally about one-third waste is still not being managed in an environmentally sound manner. Countries like India face the additional challenge of legacy waste, i.e. waste that has been left unattended and untreated in dumps for years. Municipal waste management is expensive and can comprise the single largest budget head of Urban Local Bodies (ULBs). Most Indian cities are struggling with inadequate finances and infrastructure to effectively collect, treat and dispose-off waste. It is estimated that while 70-95% waste is collected in the major metropolitan cities, collection can be as low as 50% in small cities[3]. The indiscriminate dumping of solid waste in landfills has dire consequences not only for residential dwellings but also for the civilization as a whole because of its contribution to global warming. Biodegradable waste in landfills releases methane, which has a 34 times higher global warming potential over 100 years as compared to carbon dioxide[4].

In this backdrop, a pivotal shift in approach is needed that reflects the fast catching global trend of looking at **waste as a resource**. Recycling, composting and waste-to-energy are increasingly being adopted as alternative waste management strategies. Advantages include reduced pollution and improved environmental performance, beneficial health and social impacts, and enhanced employment and economic opportunities. Lesser waste reaching landfills can result in extended landfill life spans, reduced pollution and green-house gas emissions from landfills/ waste dumps, and reduced landfill fires. Waste handlers (formal and informal) stand to benefit as the approach focuses attention on reducing occupational risks and enabling mainstreaming of the informal sector. Recycled materials are often cheaper raw materials compared to virgin materials, and offer advantages of natural resource efficiencies.

However, material recovery from waste necessitates separation of different

waste streams. Historically this has been approached in two significantly different ways: (1) Source/Primary Segregation- separation at source by individuals, households, and institutions, and separate collection systems; and (2) Secondary Segregation- recovery by mechanical processing and sorting of mixed waste at central facilities receiving large quantities of waste. The first approach of primary segregation or waste segregation at source, has distinct advantages, which are elaborated in the next section. Secondary segregation of waste has inherent limitation. In Europe, secondary segregation to recover valuable resources from mixed municipal waste has resulted in generation of output with product quality unsuitable for existing recycling applications[5]. It has also resulted in contamination of wet waste, and resultant compost, with hazardous heavy metals, leading to contamination of soil and environment. **The first approach of source segregation and separate collection, which is now the basis of the European waste legislation, requires deeper and wider adoption in India as well.**


GLASS

CHAPTER 2



ADVANTAGES OFFERED BY WASTE SEGREGATION AT SOURCE

Advantages Offered by Waste Segregation at Source

Waste Segregation at Source offer far-reaching benefits- optimal utilization of municipal machinery and workforce, efficient infrastructure operations, and enhanced environmental outcomes.

- Source segregation reduces the need for secondary segregation, which is capital, energy and land intensive.
- Waste segregated at source is least likely to be contaminated with other waste types, and therefore more likely to be recycled. As it is also more likely to be clean, the cost of pre-treatment before recycling or re-purposed is also reduced. For the above reasons, waste segregated at source is more attractive to recyclers.
- The treatment or recycling options for different waste types depends on the nature of waste. More often than not, the processes are cumbersome and expensive. Waste segregation contributes towards reducing the quantum of waste to be treated or recycled, thereby reducing cost.
- Waste treatment often involves transportation to the treatment facility, which has both cost and carbon footprint. Where waste has been segregated at source, the volume of different waste types reduces, leading to a concomitant reduction in transportation footprint.
- It also supports decentralized treatment options like community composting units and dry waste collection centres that are more efficient in waste management. Current estimates suggest that in countries like India, wet waste comprises more than half of municipal solid waste. Hence the burden of transportation and landfill loading with waste from residential areas doing on-site composting, reduces by the same proportion.
- Source segregation and recycling results in waste minimization, or lesser waste reaching landfills. This directly translates into longer life spans of landfills, and reduced demand for land for new landfills. This is a significant benefit, especially in areas that have history of land conflicts and NIMBY attitudes.
- Waste minimization resulting from primary and secondary segregation also translates into reduced green-house-gas emissions from waste dumps and landfills.

Source segregation reduces the attractiveness of the existing in-human, unhealthy and hazardous practice of rag pickers rummaging through waste piles to salvage saleable waste items.


E-WASTE

CHAPTER 3



EXISTING POLICY MANDATES IN INDIA

Existing Policy Mandates in India

A number of market transforming policies & initiatives have been formulated and notified by the government. Some of the significant policy initiatives are described below.

- The six Solid Waste Management Rules[6], and guidelines by CPCB, CPHEEO, and other related agencies, prescribe utilization of waste materials in some select sectors. The MSW Rules mandate that concerned agencies (urban local bodies, MoHUA, SPCBs, Ministry of Fertilisers, Agriculture) support waste segregation by collection, setting up of MRFs, waste to energy and waste to composting plants. The Plastic Waste Management Rules 2016 suggest utilization of plastic waste in road construction. Construction and Demolition Waste Management Rules 2016 require local authorities to incentivize re-utilisation of C&D Waste. CPCB has also issued guidelines for utilization of hazardous waste in cement co-processing, steel and power units. Biomedical Waste Management Rules require recycling of plastic and metal content of waste after appropriate disinfection.
- Section 2.1 of the Municipal Solid Waste Management Manual, 2016 by CPHEEO, Ministry of Urban Development, prescribes a step-wise waste minimisation approach that is closely linked to the 3Rs (Reduce, Reuse, and Recycle). The Manual mentions the need for policy interventions at the national, state and local levels, and envisages a pivotal role for ULBs for effective management.
- In order to incentivise waste composting, Ministry of Chemicals & Fertilizers has notified the policy on promotion of City Compost providing Market Development Assistance of Rs. 1,500 per tonne to fertilizer companies, ULBs, and compost manufacturers. Ministry of Power has revised the Tariff Policy 2006 under the Indian Electricity Act, 2003, making it mandatory for State DISCOMS to purchase power from Waste-to-Energy plants. In addition, Central Electricity Regulatory Commission (CERC) has notified generic tariff for Waste-to-Energy at Rs. 7.04 per unit and for RDF (Refuse Derived Fuel) at Rs. 7.90 per unit.

- For providing impetus to the use of waste in roads and construction activities, the Ministry of Road Transport and Highways has notified use of plastic waste in bituminous mixes in construction of National highways.
- The Central Public Works Dept. has mandated use of recycled portions of C&D Waste in construction activities, if the same is available within 100 kms of the construction site.
- The Swachh Bharat Mission Urban was launched in October 2014. It envisages strengthening solid waste management capacity of Urban Local Bodies (ULBs). Several implementation guidelines have been developed and disseminated. Notably, solid waste managemen has been accorded the highest priority in Swachh Sarvekshan, with the largest weightage of 55%. The Mission provides funding support to ULBs based on approved DPRs. Funding includes a mix of Central, State and other funds, with Centre's contribution to the tune of 35%. ULBs are required to prepare Detailed Project Reports in order to apply for funding.
- The various green building norms provide for re-utilisation of C&D waste. MoHUA has issued a notification to local authorities to incentivize and provide 1% to 5% extra ground coverage and FAR for projects of more than 3000 sqm plot size on basis of GRIHA evaluation. Similarly, MoEFCC has provided for out of turn appraisal for environmental clearance of building and construction projects on the basis of GRIHA/IGBC/LEED evaluation.
- In Tamil Nadu, industrial projects undertaking GRIHA rating are eligible for 25% subsidy on the cost of establishing environmental infrastructure. Similarly, other states like Haryana, Andhra Pradesh, Maharashtra, Gujarat, Punjab, West Bengal and Jharkhand have announced incentives for projects adopting GRIHA ratings.[7]
- The existing BIS383:2016 has been revised to include use of aggregates from C&D waste in different types of concrete (plain, lean and reinforced).
- MSWM Manual, 2000 published by CPHEEO, Ministry of Urban Development, stipulates that data on waste generation, weight and volume should be collected by each authority in its respective area of operation. Data on municipal solid waste is collected by ULBs. It is compiled at the state level, and further aggregated at the national level by SBM Urban. Data on special waste categories is compiled by SPCBs and aggregated by CPCB. Updated data on various process and outcome indicators can be seen on the SBM Urban dashboard [8]. In addition, 8 indicators for SWM have been identified in the Handbook for Service Level Benchmarks by MoHUA.
  - Household level coverage of SWM services
  - Efficiency of collection of municipal solid waste
  - Extent of segregation of municipal solid waste
  - Extent of municipal solid waste recovered
  - Extent of scientific disposal of municipal solid waste

- Extent of cost recovery in SWM services
- Efficiency in redressal of customer complaints
- Efficiency in collection of SWM-related user charges

The new draft National Resource Efficiency Policy (NREP), 2019 is guided by the principles of reduction in primary resource consumption to 'sustainable' levels, Sustainable Development Goals, and staying within the planetary boundaries. It uses the approaches of Circular Economy (CE) and resource efficiency (RE) for creation of higher value with less material, waste minimization, material security, and creation of employment opportunities and business models beneficial to the cause of environment protection and restoration.

The Ministry of Mines has issued a National Non-Ferrous Metal Scrap Recycling Framework, 2020 to promote life cycle management approach for better efficiency in the mineral value chain process. It aims to promote a formal and well-organized recycling ecosystem by adopting energy efficient processes. The framework envisages setting up of a Central Metal Recycling Authority to facilitate recycling of metals. It aims to establish a mechanism for registration of segregators, dismantlers, recyclers, collection centers etc. to bring recycling within the ambit of organized sector.

The Ministry of Road Transport and Highways has come out with National Auto Scrappage Policy in March 2021. It aims to achieve multiple goals like reduction in air pollution, the fulfilment of India's climate commitments, improving road and vehicle safety, better fuel efficiency, and boosting the availability of low-cost raw materials for auto, steel and electronics industry. The government expects recycling of metals like steel, copper and aluminium from the scrapped vehicles to help reduce their imports.

The Ministry of Environment Forest & Climate Change unveiled the Plastic Waste Management (Amendment) Rules, 2021 that propose to ban select categories of single-use plastic items. The proposed prohibition on their manufacture, use, sale, import, and handling is in keeping with the objective of phasing out single-use plastic by 2022. It is proposed to be implemented in three stages starting 2021 and culminating in mid-2022. Further, a guideline document for "Uniform Framework For Extended Producers Responsibility (Under Plastic Waste Management Rules, 2016)" was also formulated by the ministry.

CHAPTER 4



USING BEHAVIOURAL INSIGHTS

Using Behavioural Insights

In the last decade or so, behavioural economics has provided rich theoretical insights into human behaviour particularly those involving judgment and decision-making. In this stream of literature, nudges "an intervention, from either private or public institutions, that affects people's behaviour while fully maintaining their freedom of choice"[9] (p.4) is particularly relevant to waste segregation. A nudge instrument attempts to influence behavior in the desired direction without altering the available options or the economic pay-offs. The structured environment designed to elicit the desired behaviour is called the choice architecture, which influences judgment and decision-making in a subtle and automatic manner. For example, provision of organ donation as the default option in the driving and motor vehicles form shows a significant increase in organ donation, just as small-sized plates in buffets has been found to result in less food wastage.

The benefits of including nudges for behaviour change are that they automatically guide behavior, with possibilities of spill-over. People that have acted in environmentally friendly ways triggered by behavioral interventions, are more likely to perform other pro-environmental behaviors. Nudges are cost-effective because that they do not require constant surveillance resources, fines or levies. Also, nudges tend to operate within the action domain eliciting desired actions and behaviours and not merely positive attitudes or intentions.

Nudges in the domain of environment-friendly practices have been called 'green nudges'. Policy makers around the world are utilizing the green nudges insights for sustainable practices. The UN Environment Programme (UNEP) in an effort to mobilize the Sustainable Development Goals (SDGs) and to protect the global environment, came up with 'Green Nudges' strategies for university campuses with the support from their Behavioural Insights Team.[10] For example, University College Cork, Ireland, reduced the use of disposable cups and facilitated the use of reusable cups by installing cup washers on campus.

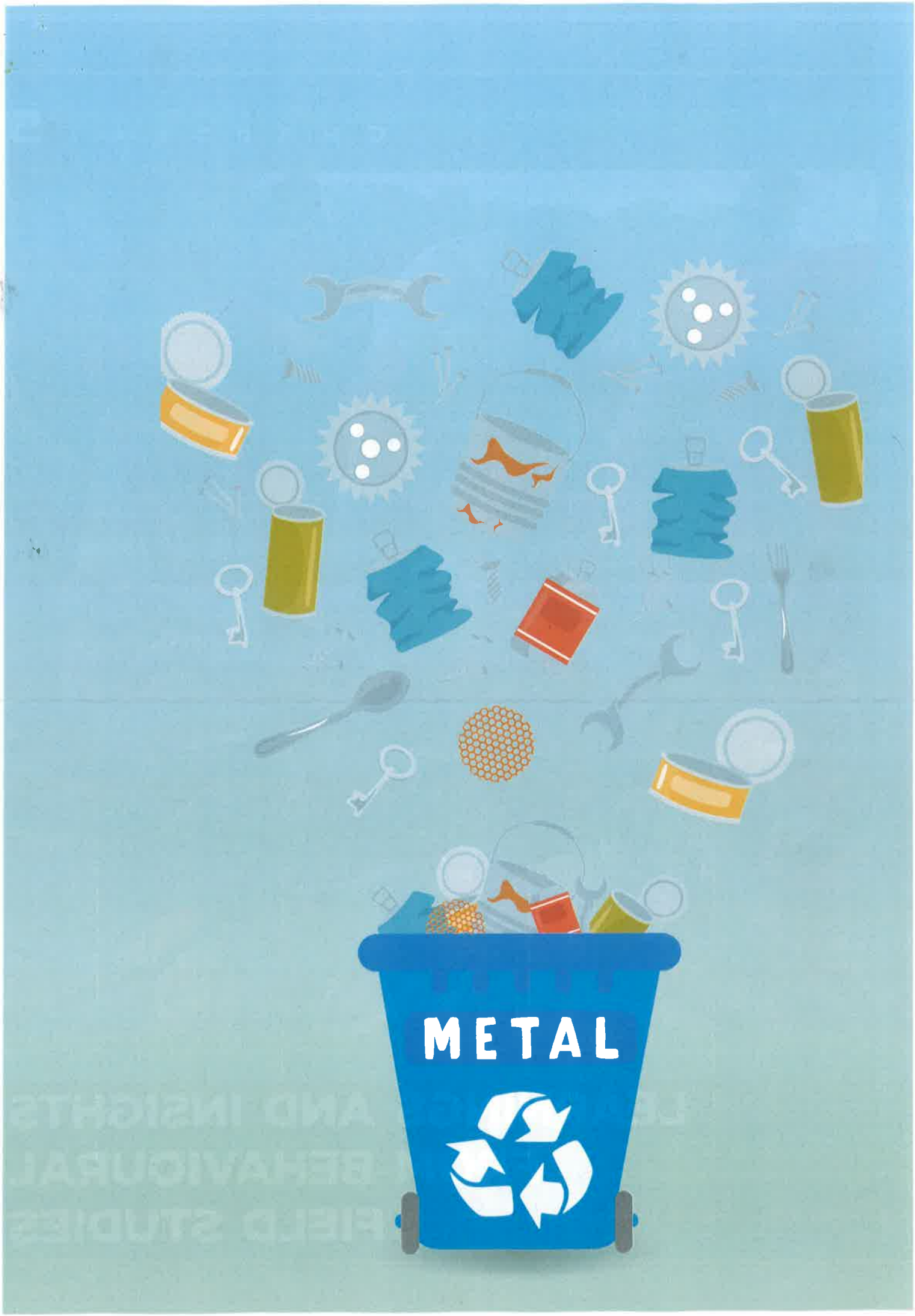
As outlined in handbooks utilizing nudge strategies, the effectiveness of nudges lies in the following approach: 1) Choosing the target behaviour, 2) Understanding the context, 3) Designing the nudge, 4) Testing the effectiveness of the nudge, 5) Reflecting and redesigning.

A related line of literature on effective and successful influencing or crafting

persuasive messages has identified six principles of influence that operate as heuristics or shortcuts[11]. Two of these are particularly important to the domain of WSS:

1. **Authority**: Individuals are persuaded by messages that are endorsed by trusted authority figures. For example, when people are shown the opinion of a distinguished economist on an economic problem, participants followed that opinion, even without evaluating other relevant evidence[12].
2. **Social Proof**: People are influenced by similar others in taking a course of action. For example, British tax officials were able to get much more in tax revenues by including a message on tax recovery letters stating that most people do pay their taxes on time[13]. Home energy report on average reduces 2% energy consumption by providing households with information on their past energy consumption and those of their neighbors[14].

We draw upon the nudges-oriented literature to suggest interventions such as intuitive Product, Packaging and Dustbin Design, and upon persuasion techniques to suggest text-based nudges in recommending effective IEC messaging. While these are detailed in the concluding section on Policy Recommendations, we also wish to highlight how the behavioural insights have been used in different pro-environmental initiatives across the world. These serve as exemplars of best practices that can inform policy recommendations.


METAL

CHAPTER 5



LEARNINGS AND INSIGHTS FROM BEHAVIOURAL FIELD STUDIES

Learnings and Insights from Behavioural Field Studies

Interventions drawing upon behavioural insights have been empirically investigated for their impact and effectiveness. A lot of research evidence has accumulated that ascertains the efficacy of such interventions. A few representative examples are provided below:

5.1 Water-Saving Campaign Using Social Norms and Information Diffusion in Colombia[15]

The Environment for Development (EfD) initiative reported a randomized field experiment that took place in the town of Jericó, a small town situated in the southwestern region of Antioquia in Colombia. Water was subsidized for households. However, both the local water utility EPJ (Empresas Públicas de Jericó) and the municipality of Jericówere were concerned about encouraging households to save water.

The researchers designed an information diffusion campaign in which they provided feedback to household not only for their water consumption, but also provided information on how the household compared with neighbours. **Results indicate that social information and appeals to norm-based behaviour reduced water use by up to 6.8 percent in households directly targeted by the campaign.** This experiment indicates that such information campaigns provide normative guidelines, thereby creating implicit peer pressure to engage in socially desirable behaviours.

5.2 Pilot Program of Waste Segregation in China[16]

The Ministry of Housing and Urban-Rural Development of China launched a waste segregation program in June 2000 in eight pilot cities (Beijing, Nanjing, Shanghai, Hangzhou, Xiamen, Guilin, Guangzhou and Shenzhen). In this programme, people could sort their waste at home voluntarily and then send the sorted waste to separate containers in the community. Before the pilot program, waste separation was not practiced in households. In 2015 the Notice on the Announcement of the First Batch of Waste Source Separation Demonstration Cities (Districts) was enacted, which extended the 8 pilot cities to 26 cities (districts) as waste separation at source was a successful initiative.

Researchers studying this trend, using a unique nationally representative sample of households, estimated the impacts of nudge interventions on the participation in household waste source separation.

Researchers obtained 11,193 households in 28 provinces, municipalities, and autonomous regions in China. The researchers asked the respondents: "In the last 12 months, how often did your household engage in waste sorting?" The possible three responses were: (i) never, (ii) sometimes, and (iii) regularly, with higher scores indicating a higher frequency of participation in waste sorting activities.

Results showed that people in cities that launched waste sorting scheme exhibited a 0.243 points increase in the frequency of waste sorting. The effect continued to persist even thirteen years after the program was introduced. The research highlighted two key variables that explained this effect- social interaction and waste-related knowledge.

5.3 Choice Architecture Used for Garbage Bins during Kumbh 2019[17]

In keeping with the goal of Swachh Kumbh in 2019, the Prayagraj Mela Authority deployed 20,000 dustbins along roadsides, inside camps, and in vending areas. The dustbin deployment pattern was a deliberate choice architecture ensuring visible, easy to access, regular and predictable availability of dustbins. In addition, the waste management services was operated around the clock ensuring that there were no overflowing dustbins and general cleanliness was maintained. **A well operating system was instrumental in garnering responsible waste disposal behaviour by pilgrims at the event.** Cooperation was witnessed across socio-cultural backgrounds. Littering was observed to be considerably reduced as compared to similar events in the past as well as littering in urban areas.

5.4 Leveraging social norms, salience and commitment devices to decrease littering [18]

In 2010, eight municipalities in the Netherlands participated in a project aimed at reducing littering in the immediate surroundings of waste containers. Six behavioural interventions, which were tested on target group included:

1. Self-correction by self-reflection: placing a mirror next to the waste container, so that people see themselves when bringing their waste to the container.
2. Injunctive social norm: placing a picture of a person littering next to waste containers alongside the request to behave in the right way by throwing trash bags in the appropriate containers.
3. Descriptive social norm: placing alongside the waste containers a sign with the text: "Help to keep it clean here: most people in this neighborhood do not litter around the containers".
4. Monitoring and penalties: monitoring waste container sites and placing a warning that littering can result in a fine.
5. Commitment and consistency: the "foot-in-the-door" approach consists in first prompting people to a generic commitment (e.g. commit to keeping the neighborhood clean) and then giving them a concrete hint of how to honour that commitment (e.g. placing a sign next to the container inviting them to keep the neighborhood clean by not littering).
6. Setting the right norm: emptying the containers more frequently and keeping their location clean.

The results of the experiment showed that three of the interventions had statistically significant effects. **The descriptive social norm intervention led to a reduction in littering frequency from 50% to 30%; mechanisms based on monitoring and penalties resulted in a reduction from 51% to 29%, and commitment devices led to a reduction from 45% to 28%.** For the remaining interventions, no significant effect was observed.

5.5 Developing interventions to change recycling behaviours[19]

There are different models for predicting the understanding of behavior. The COM-B model is one such model which provides a simple framework for understanding behavior in which 'capability' (physical and psychological), 'opportunity' (physical and social) and 'motivation' (automatic and reflective) are conceptualised as three essential conditions for behavior. There are nine interventions functions surrounding the COM-B model that can be used to address deficits in one or more of capability, opportunity or motivation. These intervention functions can be further linked to the behavior change techniques that are applicable.

Psychological capability may include the interventions like education, training, and enablement. These intervention functions could be increasing knowledge or understanding, imparting skills, increasing means/reducing barriers to increase capability and opportunity. Physical opportunity include training, restriction & environmental restructuring. The intervention functions could be changing the physical or social context and enablement, using rules to increase the target behavior by reducing the opportunity to engage in competing behaviors. One such example is use of signage (communication/marketing) or through establishing voluntary agreements that outline rules for recycling in the workplace (regulation). An intervention aiming to restructure the environment by providing bins may achieve this by creating mandatory workplace guidelines.

Under the motivational approach, persuasion, incentivisation and coercion have been recommended by researchers, intervention developers and policy makers. However, it has been found that interventions aimed at capability and opportunity rather than motivation are likely to be the most effective. These intervention include changes in bin positioning, the addition of informational signage, and incentives to give up individual under-desk waste bins.

CHAPTER 6



CHALLENGES AND BARRIERS

Challenges and Barriers

As outlined earlier, Waste Segregation at Source has distinct advantages, and there are several policy mandates to support it. However, simple as it sounds, there remain several impediments that prevent WSS from becoming the norm. Primary waste generators, be it households, street vendors and consumers, or commercial establishments such as restaurants and shopkeepers, may not have enough sensitivity towards waste management. They may not have the required infrastructure in place, they may not prioritize it, or they may be too preoccupied to engage in source segregation. This understanding needs to be nuanced with the Indian socio-cultural context, within which the psychological tendencies unfold because, more often than not the socio-cultural context provides affordances (or barriers) to socially desirable action. Any policy that requires public engagement and civic action would fail to materialize at the ground level if it is not congruent with how the social actors think and behave.

6.1 Weak markets for segregated waste

India has a healthy tradition of segregating waste at homes, which is often witnessed in the form of careful segregation and collection of newspaper, plastic and glass bottles, pieces of metal etc. This waste is periodically sold to the *kabadiwala* (ragpicker). Even the meagre income generated by this practice has worked as sufficient incentive for its adoption over generations, and its popularization across socio-economic profiles. This practice has created a systematic, though un-organised, value chain which is providing employment and livelihood to many- ragpickers, aggregators and recyclers.

Notably however, only wastes that have some market value are segregated and enter the value chain. This can be observed at the household levels where only wastes that the *raddiwala* is willing to purchase are segregated and collected, in the selective mining of saleable waste from landfills/garbage dumps by ragpickers, or at the material recovery facilities.

Facilities that can process segregated waste have not kept pace with the current levels of generation. It is estimated that the waste to compost potential in the country stands at 54 lakh TPA. 145 plants are currently operational with capacity for producing 13.11 lakh TPA. The waste to energy capacity is estimated at 541 MW. At present 7 plants produce 88.4 MW.

Thus policies that widen and deepen the market for segregated waste can create incentives for waste segregation all along the waste value chain, right up to the level of the waste generation.

6.2 Gaps in waste and segregated waste management capacity of ULBs

Inadequate infrastructure, operational inefficiencies, and poor services for collection and transportation of segregated waste can have a direct bearing on waste segregation behaviour. Individuals, whether as part of households or as members of communities or institutions, are the key to source segregation of waste. However, it is observed that citizen willingness to segregate waste at source is often not backed up by the required institutional mechanism for its collection, transportation, treatment, recycling or disposal. This task falls within the purview of Urban Local Bodies (ULBs). Without the necessary mechanisms, often source segregation either does not take off or loses momentum soon after.

In reverse, Kuching South City, Sarawak, Malaysia witnessed dramatic improvement in community participation after availability of infrastructure (bins and collection centres) and regular collections were ensured.[20] Location and convenience of access of recycling bins, and regularity in street sweeping and waste collection are important determinants for adoption or rejection of SWM services.[21] The cleanliness and absence of litter at the site of Prayagraj Kumbh 2019 can be attributed to availability of properly designed and adequate solid waste collection and transportation infrastructure. The organizing authorities deployed 20,000 specially designed dustbins, 120 tipper vehicles and 40 compactors to evacuate 10,000 tonnes of solid waste from the site over 50 days.

CAG's Report also indicated that despite clear enunciation of roles and responsibilities for agencies at all levels under SBM, there exists a lack of accountability at the district level. ULBs lacked exclusive SWM cells, coupled with shortage of manpower, including appointment against sanctioned positions. While many trainings on SWM have been conducted for ULB staff, deficiencies in trainings were observed including poor attendance, participation by staff that do not have the responsibility of SWM, use of non-standardised training modules, and use of uninteresting and conventional training methods, all leading to poor training outcomes.

Poor maintenance and non-replacement of worn-out collection vehicles also has been observed to dis-incentivise responsible waste disposal behaviour by citizens as these are interpreted as indicators of a fractured SWM system.[22]

CAG's Performance Audit Report 2018 for the State of Goa[23] highlights the gaps in SWM infrastructure like environmentally unsound transportation, manual handling of waste without protective gear, unscientific leachate management and absence of fencing and fire-fighting equipment at waste processing and disposal sites. Only nine out of 14 ULBs were observed to have waste processing facilities, almost all of which are under-utilised to the extent of 103.40 TPD, clearly indicating poor collection and segregation outcomes.

There were no waste management plans in place as yet for bio-medical, hazardous and electronic wastes. The report also highlights week monitoring by State Pollution Control Board.

6.3 Unintuitive product, packaging, and dustbin design

Waste segregation is often perceived as a physical and cognitive burden, which disincetivises source segregation. Most persons encounter the challenge of identifying waste type (whether the waste is plastic, fabric or wood), and which waste is to be disposed-off in which dustbin. Literature suggests that often waste bin design is unintuitive and a by-product of complex waste sorting regulations. Correct waste sorting requires conscious effort instead of being an automatic, effortless act.

Furthermore, segregating different types of wastes before disposal into appropriate dustbins is oftentimes difficult for physical reasons as well. Packaging often comprises plastic lined paper. If source segregation is to be done, it will require a tedious exercise of pulling apart the two layers and disposing them off separately. Most consumers would be disinclined to do it. The same can be said for products as well. The common electric wire comprises a metal wire housed in a plastic tubing. Separating metal from plastic is again cumbersome.

6.4 Fractured IEC messaging

Waste segregation at source implicitly implies that its onus rests with every citizen. In the Indian context however, domestic staff and commercially engaged sanitation workers also have a significant role. Since stakeholders come from a very wide range of socio-economic, language, literacy, and lifestyle backgrounds, uniform and effective messaging remains a challenge. Messaging on various categories of waste varies from state to state, and even from one city to another within a state. Different organisations, be it urban local bodies or civil society organisations, develop their own, and often unique messages, which can even be contradictory and confusing.

Furthermore, people's perceptions may not be based on scientific facts at all, resulting in wrong choices. The non-woven bags, which are 80% polypropylene (PP) and remaining 20% polyester [24] are often mistaken as cloth bags. They are thus proliferating in retail outlets as alternatives to Single-Use Plastic (SUP) carry bags. In reality, their constituent polymers, much like plastics, have indefinite life in the environment.

Effective messaging, which is informed by *attitude-behaviour gaps* (whereby individuals do not reckon correct waste disposal as necessary civic duty), by miscalculation of the consequences of littering (both personal, e.g. being fined, and public, e.g. generating an environmental externality in the form of unregulated dumpsites) and by negative *social norms* (whereby individuals can be "incentivised" to litter if they see everyone else doing so) can reduce littering. COVID has amply demonstrated that people are more likely to adopt responsible behaviour through effective messaging, provided they are able to establish a connection between lifestyle choices and its negative impact on their health.

There is a need for an extensive survey for gathering information on available facilities, existing knowledge and practices in order to prepare a uniform and effective messaging strategy.

6.5 Gaps in category-wise data on solid waste

Data on municipal solid waste as on date is sketchy. Most estimates on quantity of MSW are based on per capita estimates, which according to the Handbook on Service Level Benchmarks (SLBs) [25] is unreliable. There are capacity gaps amongst key stakeholders for data collection, compilation and reporting. Furthermore, data can be patchy, with long temporal and spatial gaps. The Performance Audit of Solid Waste Management in ULBs in Karnataka by CAG in 2018 observed that in some ULBs, assessment of waste generation was conducted in the year 2005 for a period of five years and later in 2016 under Swachh Bharat Mission (SBM) scheme for similar period, leaving a large data gap for the period 2010 to 2016. MSW data is not available for all ULBs, and even where it is available, there are gaps in reported values under various data heads. Data's unreliability and partial availability prevents its utilisation for the purpose of review, planning, and evidence based policy formulation.

The Performance Audit of Solid Waste Management in ULBs in Karnataka by CAG in 2018 yielded that out of 281 DPRs, only 218 had received approval of the High Powered Committee, and 58 ULBs had not even commenced preparation. DPRs were found to be based on unscientific and inadequate assessment of MSW generation, and had made incorrect assessment of design capacity. Out of the 30 DPRs studied, none had mentioned measures to manage e-waste, hazardous waste, hospital waste and industrial waste. Just as importantly, involvement of key stakeholders in planning process was often found to be absent, leading to poor support and ineffective implementation.

The situation is still worse with respect to data on CND waste, plastics, e-waste, biomedical waste etc. The CPCB Annual Report on Implementation of Plastic Waste 2018-19[26] is the most authoritative compilation of state-wise plastic waste generation data. The report acknowledges that many ULBs have not submitted their plastic waste generation figures. Furthermore, the annual plastic waste generation assessed as 3,360,043 MT, is considerably lower than the estimates in CPCB's 2015 report on Assessment and Quantification of Plastic Waste Generation in Major Cities[26]. The latter estimated plastic waste at 5.5 million MT based on extrapolation of data from 60 cities.

6.6 Socio-Cultural Characteristics Relevant to the Domain of Waste Segregation

Some of the above-mentioned barriers get accentuated in the Indian society because of unique socio-cultural characteristics. Some of these are described below:

6.6.1 Waste Segregation in Indian Households: Whose Responsibility?

One of the unique surveys conducted among nationally representative sample of Indian households can provide informative insights to this question. The Ministry of Statistics and Programme Implementation and the Indian National Statistical Office (NSO) launched a landmark 'Time Use Survey: How Indians Spend Their Time' during the period from January 2019 to December 2019 to measure the time spent by urban and rural household members in doing various activities [27]. More importantly, the primary objective of the survey was "to measure participation of men, women,

and other groups of persons in paid and unpaid activities." Paid activities included activities that lead to certain monetary compensation, and unpaid activities are compensation-free. The latter are mostly obligatory and more often than not, acts of responsibility for the well-being and care of household members. Cleaning and maintenance of the household premises falls within the latter category. The survey covered 1, 38, 799 households with members ranging from 6 to 60 years of age. It was observed that the division of labour differs markedly among males and females. In rural areas, while males on average spent 98 minutes per day in household activities, females spent 301 minutes. The observations were similar for urban households. Male spent 94 minutes, while females spent 293 minutes.

What do these numbers tell us in terms of the demographic context of WSS? It is striking that across rural and urban areas, the responsibility of cleaning or waste-related activities are undertaken by female members. Not only is this divide prevalent at an early age, but it continues till the later years, and is hardly any different in urban and rural populace.

Thus gender-agnostic public policy interventions may, therefore, fall short of the achieved targets because many guidelines may potentially have the male subject in mind, whereas the work is actually carried out by the women.

6.6.2 Domestic Workers in Households and Employed Manual Labour in Commercial Establishments

Another unique feature of Indian society is that most households and commercial establishments have 'paid labour' who carry out manual work. Domestic work such as sweeping, cleaning utensils, washing clothes, cooking, caring of children and such other work is carried out for an employer for remuneration by domestic help. Those employed in domestic work have little or no education. "Official statistics place the numbers employed in India as 4.75 million (of which 3 million are women), but this is considered as severe underestimation and the true number has been estimated to be more between 20 million to 80 million workers".[28]

In such arrangements of delegation of work, cleaning activities are downplayed in the value chain and are not integrated in the overall ecosystem of households or the commercial establishments. This conception of work in the Indian society is often ignored and the guidelines on waste segregation are targeted keeping the literate and educated population in mind. Although the Municipal Solid Waste Management Guidelines 2016 put the onus of waste segregation on waste generators, assuming that these identities overlap. In reality, waste generators and potential waste segregators are not one and same entity even in the same household and commercial establishments because of delegation of the waste management chore.

6.7 Other Socio-Cultural Considerations

Drawing upon research in cross-cultural management, three cultural dimensions are proposed that may be useful in understanding attitudes and behaviours relevant to waste segregation- *collectivism, power distance,* and *uncertainty avoidance.* On a scale from 0-100, India has an intermediate score of 48 in collectivism, a high score of 77 in power distance, and a medium low score of 40 on uncertainty avoidance.[28] The implications and manifestations of

the theoretical dimensions are elaborated below.

Collectivism: With a score of 48, India is somewhere in the middle of individual and collectivism dimension. Scholars theorize that there is a 'coexistence of opposites' in Indian society. People may have a high degree of individual aspirations and goals, but those must conform with the in-group's preference and values.[29]Moreover the collectivism in the Indian context is characterized by a rigid in-group and out-group distinction wherein in-group harmony and well-being is valued at the expense, neglect, or indifference to out-group. In the realm of maintaining cleanliness and managing waste, it means that groups such as apartment, residential complexes, and gated communities would define the psychological boundaries, or the physical radius of the focal area of concern in a very limited manner. Beyond the in-group boundaries, the out-group be it other people or physical space is looked at with indifference. Hence, high degree of cleanliness and hygiene are practiced in households or in one's own residential complexes. The standards literally go down the drain in public spaces and civic spaces.

Power Distance: India is mostly associated with hierarchical, top-down, and controlling social structures. It is common for people to be more receptive to external demands, commands, expectations, and obligations, rather than being autonomous and self-guided. Hence, there is a proclivity to maintain civic sense when it is enforced by the authority of law or rules or regulations. In the domain of waste segregation, there is much greater likelihood for desirable behaviours to occur when there is a perceived sense of 'expected' or 'prescribed' behaviour by an external authority or agency.

Uncertainty Avoidance: This dimension is correlated with the society's level of comfort with ambiguities and unknowns. India has a score of 40, which implies that members display a fairly high propensity to tolerate the imperfections or unexpected instead of feeling nervous or anxious about it. This may be counterproductive for triggering certain environmental crisis-related fears and anxiety, as the overall attitude is one of relaxed indifference and apathy, or a 'chalta hai' attitude.

Considering that the socio-cultural characteristics such as household structures, division of labour, and the country-level dimensions are unique to the country, any intervention designed to alter a public behaviour would not be effective, if it is not congruent with the contextual realities. Hence, behavioural interventions, as discussed in the following section, are potentially powerful ways to achieve the desired targets in WSS vis-à-vis the socio-cultural context considerations.


PLASTIC

CHAPTER 7



POLICY RECOMMENDATIONS

Policy Recommendations

This policy guidelines highlights the behavioural interventions that have been found effective in driving socially-desirable behaviour among individuals in different parts of the world. In light of the existing policy mandates and the barriers that prevent them from being optimally realized on the ground in India, the following policy recommendations are proposed.

7.1 Strengthening the market for segregated waste

It is observed that source segregation of waste occurs mostly for wastes that have a market value. In order to incentivize individuals, households and institutions to segregate different waste streams in order to strengthen their market proposition, the following measures are suggested:

- **Greening Public Procurement**: A green public procurement policy can be a powerful catalyst for promotion of recyclables as government is one of the largest procurers of products. Mandatory or preferential procurement of products that have recycled waste content above a prescribed threshold may be considered for adoption.
- **Mandatory Recycling Content in Products:** Policy initiatives like the National Policy on Biofuels prescribes a 20% blending mandate for biofuels with fossil-based fuels by 2025. A similar end-of-pipeline target, in the form of a minimum percentage of recycled material content in identified products, has potential for strengthening the market case for utilisation of segregated waste, thereby incentivising source segregation. The recycled content targets shall also strengthen implementation of the EPR mandate under the larger circular economy umbrella. Additionally it may also help reduce input cost of products that substitute expensive virgin materials with cheaper recyclables as raw material.
- **Incentivising and facilitating use of waste**: Use of waste can be incentivized by developing innovative waste-based technologies and products, and linking waste utilisation to fiscal or other benefit. Benefits may be in the form of relief in house tax, water tax or property registration tax, or fast tracking of mandatory permissions, similar to

GRIHA incentives. This approach can be further strengthened by developing BIS codes (like BIS 383:2016) for adoption of different recycled materials to promote their acceptability e.g., waste plastics etc.

- **Strengthen waste utilization facilities:** Mechanisms for support existing waste utilization facilities in the form of linkages with suppliers of segregated waste, notably ULBs and waste aggregators, viability gap funding and innovative business models may be considered.

7.2 Strengthening capacities of ULBs and institutional mechanisms for management of segregated waste

Policy support that strengthens capacity of ULBs for management of segregated waste shall be crucial for achieving source segregation. Suggested areas of intervention are:

- **Strengthening financial capacity of ULBs**-This may be achieved by augmenting funding to ULBs for SWM. A key intervention shall be ensuring timely finalization and approval of SWM DPRs of all ULBs under Swachh Bharat Mission Urban, so that project financing activities can commence at the earliest. Alternatively ULBs may be supported and incentivized to raise matching financial resources through local taxes, user charges, land leveraging, innovative revenue streams, and other mechanisms prescribed in Swachh Bharat Mission Urban Guidelines 2017.[30]
- **Adequacy of physical infrastructure and services**- ULBs should procure adequate and suitably designed infrastructure required for collection (individual and community bins), transportation (compartmentalized collection vehicles), and treatment of segregated waste (secondary sorting or material recovery facilities etc.). Indore converted vehicles of 1 m^3 capacity into 3.2 m^3 capacity, keeping the same payload of 1 ton as per the RTO norms. This resulted in decreased vehicle and staff requirement, and saved capital and operational costs for the ULB. Planning of SWM services could include bin free services, strategic sighting of bins and establishment of recycling facilities with maximum visibility. These can be backed up by efficient, predictable, timely and consistent service delivery. For example bin free city initiative may be planned where waste generators have to empty their dustbins directly into ULB's waste collection vehicles at specified time. Further, the procurement of equipment can be facilitated by ensuring availability of appropriate technologies and equipment on GeM portal.
- **Effective leadership and governance framework**- This requires prioritization of waste management by the topmost political and administrative levels within ULBs. Simultaneously, subordinate bureaucracy and staff should be strengthened by decentralization of responsibilities, capacity building, and accountability mechanisms. For e.g., sanitary inspectors, who are directly involved with day-to-day operations should undergo regular monitoring, reporting and review based on key process indicators (KPIs). They may even be empowered to levy fines. Corporations need to notify bye-laws for fines, and fine structure needs to be

clearly defined for every type of violation.

7.3 Product, Packaging and Dustbin Design

Nudge interventions can be designed to target psychological barriers to adoption of responsible waste segregation and civic behaviour. Choice architecture that minimizes need for conscious thinking can drive segregation decisions to the sub-conscious, resulting in intuitive desirable actions. The following measures are suggested for adoption:

- Waste segregation should be predicated on three simple co-mingled waste streams- wet, dry and inert. This principle should be adopted uniformly across the nation, and all waste collection infrastructure, including bins, should be planned accordingly. All biodegradable waste should be disposed in wet, all recyclable waste in dry, and remaining in inert. Household, communities and institutions may be encouraged to compost wet waste in-situ. Dry waste may be collected and transported to Material Recovery Facilities (MRFs) or Dry Waste Collection (DWC) Centres, where it can be sorted manually or mechanically by trained persons with the help of necessary equipment. The remaining inert waste may be disposed-off in landfills.
- A uniform colour code may be adopted across the nation for the three co-mingled waste streams. Suggested code is green for wet waste, blue for dry waste, and black for inerts.
- Products and packaging should carry suitable colour labels to guide disposal behaviour choices of consumers, much like the green and red dots used to indicate vegetarian and non-vegetarian foods. For example, recycleable products or packaging should carry a blue symbol to guide consumers to do the end-of-life disposal in the blue dustbin.
- Product and packaging should be designed innovatively to make dismantling and disposal simple and intuitive, thus making source segregation automatic. Policies that incentivizes innovations in product and packaging design should be encouraged.

7.4 Strengthening IEC Messaging

The role of IEC messaging is well documented for the purpose of sensitizing and informing waste generators to nudge them towards adoption of socially responsible civic behaviour, including waste segregation. However, for it to result in optimal outcomes, it is suggested that IEC messaging for source segregation should be based on the following principles:

- Messaging should be designed to ensure that every member of the household/community/institution is able to identify and possess the knowledge of different kinds of waste- wet, dry and inert.
- Messages should be pictorial and multi-lingual to widen effective outreach amongst the diverse population of the country.
- Messages should be uniform, simple and unambiguous, linked to health impacts of poor waste management, and informed by science.
- Messages need to reflect the waste segregation and management infrastructure including conformity

with the principle of three co-mingled waste streams.

- Messages should convey details like responsible cutting and disposal of items like milk packets/cartons, chips packets etc. Separation of tiny cut pieces of the packets make the fragmented pieces extremely difficult to collect and recycle, hence more awareness regarding these details will be helpful in the long run.
- Messaging needs to specifically address domestic hazardous waste like batteries, pesticides, lubricants, broken glass, paints etc., and household medical waste. Unequivocal messaging on their harmful impacts on society, health and environment as a whole, are to be very clearly indicated through all possible mediums.
- The context of the target audience is equally important in crafting the messages so the messaging resonates with the users. Hence messages as wells as the channels of communications should be uniquely tailored to the target group. In case of bulk generators, guidelines can be provided on code of conduct, planned group activities, organizing workshops etc.
- Persuasion techniques such as peer pressure, social proof or authority-endorsed messages can be effective in bringing about behaviour change.
- Urban local authorities can sensitize citizens not only through public messaging but also through one-on-one interactions and education by leveraging collaborations and partnerships with NGOs and CSOs. This can include innovative approaches like attaching NGO/CSO personnel with waste collection vehicles who would educate citizens at household level and ensure waste segregation.
- Furthermore, strategic locations should be identified to consistently communicate messages on source segregation. Shopping malls, supermarkets and retail stores have been found to be effective for such communications, especially at billing queues as customers wait their turn to pay for purchases.

7.5 Use of fiscal incentives and disincentives to encourage source segregation:

The following fiscal measures may be considered towards engendering positive social action in the short term, and ensuring attitudinal and behavioural change in the long-term. However, their success will depend on the ability of ULBs to build commensurate capacity amongst its staff, and ability to plug waste leakages in the form of unaccounted waste dumping along roadsides, on vacant plots of land, and into khuds and drains, to avoid the waste collection fee.

- **Pay As You Throw (PAYT):** This intervention entails a waste collection fee from the waste generator in proportion to the total quantity of waste being disposed. Waste generators will be incentivized to segregate, treat and dispose-off waste at source, leaving a smaller amount to be handed over to the municipal system. Wet waste can be disposed of by in-situ composting, and dry waste through sale to the local *raddiwala*.
- **Duration of Landfill Permits:** Private operators of landfills can be incen-

tivized to minimize landfill dumping if the duration of their landfill operation permit is determined by airspace available in the landfill, and not on number of years of operation. This will, on the one hand encourage waste recovery, and on the other it will incentivise waste minimization and segregation in the upstream of solid waste collection system.

7.6 Strengthening Database in Waste

Data on waste generation (different waste categories and aggregated) is crucial for monitoring, identifying priority areas of intervention, designing context-specific local waste management solutions, and planning ground-level operational details like number of vehicles, route management, waste collection tracking etc. Data will also help identify waste segregation hotspots for targeted messaging and IEC activities. Data when shared with public can be a tool of sensitization and awareness. Information highlighting positive instances of desired behaviour can be a powerful tool to nudge people into adopting socially desirable behaviours.

Hence it is recommended that:

- ICT tools should be adopted for data reporting, including red flagging unreliable data sets.
- Capacity of ULBs for data collection should be augmented with the help of focused trainings modules for concerned staff. Data collection shall improve if subordinate staff perceives data as a tool that eases operations, and not just as a tool for chastisement.
- Available data should be used for periodic review by senior officials, and as a decision support tool. This shall help prioritise quality data collection amongst subordinate staff.
- Independent agencies should be engaged for data validation in order to improve data reliability.

References

1. Swachh Bharat Mission [Internet]. [cited 2021 Nov 11]. Available from: http://swachhbharaturban.gov.in/dashboard/
2. Kaza S, Yao LC, Bhada-Tata P, Van Woerden F. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050 [Internet]. Washington, DC: World Bank; 2018 [cited 2021 Nov 11]. Available from: https://openknowledge.worldbank.org/handle/10986/30317
3. Sharma KD, Jain S. Overview of Municipal Solid Waste Generation, Composition, and Management in India. Journal of Environmental Engineering. 2019 45(3):04018143.
4. Working Group 1 contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis — IPCC [Internet]. [cited 2021 Nov 11]. Available from: https://www.ipcc.ch/report/ar5/wg1/
5. Pretz T. Processing of municipal household waste material. In: Mineral Processing on the Verge of the 21st Century(pp. 627-636). Routledge; 2000.
6. Solid Waste Management Rules, 2016; Plastic Waste Management Rules, 2016; Bio-Medical Waste Management Rules, 2016; E-Waste Management Rules, 2016; Hazardous and other Waste (Management and Transboundary Movement) Rules 2016; Construction and Demolition Waste Management Rules, 2016 .
7. Green Rating for Integrated Habitat Assesment [Internet]. [cited 2021 Nov 11]. Available from: https://www.grihaindia.org/griha-incentive
8. *http://swachhbharaturban.gov.in/RPT_DashBoard.aspx?id=c00b-0004d25a9f22ba135c5c0bdcfb19*
9. Sunstein CR. Behavioral Science and Public Policy. Elements in Public Economics [Internet]. 2020 Oct [cited 2021 Nov 11]; Available from: https://www.cambridge.org/core/elements/behavioral-science-and-public-policy/13D1F3EDA08E6446EADBFAF838606F91
10. UN Environment Programme. The Little Book of Green Nudges [Internet]. 2020 [cited 2021 Nov 11]. Available from: *http://www.unep.org/resources/publication/little-book-green-nudges*
11. Cialdini, RB. Influence: Science and Practice, 5th Edition. Boston: Pearson Education, 2009.
12. Engelmann JB, Capra CM, Noussair C, Berns GS. Expert Financial Advice Neurobiologically "Offloads" Financial Decision-Making under Risk. PLOS ONE. 2009 Mar 24;4(3):e4957.
13. Martin S. 98% of HBR Readers Love This Article. Harvard Business Review [Internet]. 2012 Oct 1 [cited 2021 Nov 11]; Available from: *https://hbr.org/2012/10/98-of-hbr-readers-love-this-article*

14. Allcott H. Social norms and energy conservation. Journal of Public Economics. 2011;95(9-10):1082-95.

15. Torres, M., & Carlsson, F. (2016); (Rep.). Environment for Development Initiative. Retrieved February 4, 2021, from https://www.jstor.org/stable/resrep15042?seq=1#metadata_info_tab_contents

16. Zhijian Z, Xueyuan W. Nudging to promote household waste source separation: Mechanisms and spillover effects. Resources, conservation, and recycling. 2020 Nov;162:105054.

17. Ramesh G., Tripathi R., Raj P. Kumbh 2019 An Integrative Assessment, 2021; Report submitted to Prayagraj Mela Pradhikaran

18. Tackling Environmental Problems with the Help of Behavioural Insights [Internet]. oecd-ilibrary.org. [cited 2021 Nov 11]. Available from: https://read.oecd-ilibrary.org/environment/tackling-environmental-problems-with-the-help-of-behavioural-insights_9789264273887-en

19. Gainforth HL, Sheals K, Atkins L, Jackson R, Michie S. Developing interventions to change recycling behaviors: A case study of applying behavioral science. Applied Environmental Education & Communication. 2016 Oct 1;15(4):325-39.

20. Otitoju TA, Seng L. Municipal Solid Waste Management: Household Waste Segregation in Kuching South City, Sarawak, Malaysia. American Journal of Engineering Research. 2014;10.

21. Venkateswaran S. Managing Waste: Ecological, Economic and Social Dimensions. Economic and Political Weekly. 1994;29(45/46):2907-11.

22. Hazra T., Goel, S. Solid waste management in Kolkata, India: Practices and challenges. Waste management, 2009; 29: 470-478.

23. Audit Reports Accountant General, GOA [Internet]. [cited 2021 Nov 11]. Available from: https://cag.gov.in/ag/goa/en/audit-report

24. Toxics Link for a toxics-free world [Internet]. [cited 2021 Nov 11]. Available from: https://www.toxicslink.org/?q=content/%20environmental-illusion-non-wo-%20ven-bags

25. Service Level Benchmarks : Ministry of Housing and Urban Affairs, Goverment of India [Internet]. [cited 2021 Nov 11]. Available from: https://mohua.gov.in/cms/Service-Level-Benchmarks.php

26. Central Pollution Control Board Annual Report 2018-19 [Internet]. [cited 2021 Nov 11]. Available from: *https://cpcb.nic.in/annual-report.php*

27. Time Use in India-2019 Ministry of Statistics and Program Implementation |Government Of India [Internet]. [cited 2021 Nov 11]. Available from: http://mospi.nic.in/publication/time-use-in-dia-2019

28. About domestic work [Internet]. 2010 [cited 2021 Nov 11]. Available from: http://www.ilo.org/newdelhi/info/WCMS_141187/lang--en/index.htm

29. Hofstede G, Hofstede GJ, Minkov M. Cultures and organizations: Software of the mind. New York: Mcgraw-hill; 2005.

30. Sinha D, Tripathi RC. Individualism in a collectivist culture: A case of coexistence of opposites. In: Individualism and collectivism: Theory, method, and applications. Thousand Oaks, CA, US: Sage Publications, Inc; 1994. p. 123-36. (Cross-cultural research and methodology series, Vol. 18).

31. Assessment and quantification of plastics waste generation in major cities - India Environment [Internet]. [cited 2021 Nov 11]. Available from: http://www.indiaenvironmentportal.org.in/content/422053/assessment-and-quantification-of-plastics-waste-generation-in-major-cities/