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Sustainable Municipal Solid Waste Management in India: A Policy Agenda

Shyamala Mani a,*, Satpal Singh b

a Professor, National Institute of Urban Affairs, Core 4-B, India Habitat Centre, New Delhi, India
b Urban Sociologist and Research Analyst, National Institute of Urban Affairs, Core 4-B, India Habitat Centre, Lodhi

Abstract

Municipal solid waste management (MSWM) has emerged as a big challenge not only because of the health and environmental concerns but also due to huge quantities of waste generated. It is observed from many research documents that most urban local bodies (ULBs) in India are unable to handle such huge quantities of solid waste due to financial and institutional debilities. Furthermore, ULBs rarely have sufficient funds, resources, infrastructure and appropriate strategies for improved solid waste management. Segregation of waste, door to door waste collection, technologies for the treatment of waste, land resources and scientific disposal methods are some of the major challenges. Recognizing these challenges, the two ministries of Government of India namely Ministry of Environment, Forest and Climate Change and Ministry of Urban Development (MoUD) have initiated several policies and programmes to improve the current scenario of MSWM in India. Environment Ministry had promulgated the Municipal Solid Waste Management Rules in 2000 which is now being revamped as Solid Waste Management Rules 2015 while the MoUD has prepared a draft manual on MSWM to support cities and towns on planning and implementing a proper MSWM system in line with the SWM Rules being promulgated in 2015. It is observed that many policies and programmes fail to achieve their objectives due to lack of clarity and awareness among the stakeholders and poor enforcement by the regulators. The present paper provides a comprehensive view of SWM and most importantly highlights some major points of the policies/programmes initiated by the Government of India to overcome the challenges of solid waste management in our country.

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* Corresponding author.
E-mail address: smani@niua.org
Introduction

Rapid urbanization, urban growth and economic development have not only changed the physical size of the cities but is also exerting significant additional pressure on the infrastructural services across Indian cities. India is experiencing high urbanization, currently 31 percent as per Census 2011, contributing to 11 percent of the world population and having 53 metropolitan cities which may jump to 87 in 2031. Urban growth is phenomenal and important for the development of the country but unbridled growth may present a glimpse of chequered pockets of ghettos and high class areas (Gupta, 2015). These factors influence consumption rates that accelerate waste generation and change waste composition. The increasing trends in per capita waste generation puts immense pressure on urban local bodies (ULBs) who are mandated to provide this service in India. It is observed from the recent research that most ULBs are unable to handle such huge quantities of solid waste due to financial and institutional debilities. While, daily collection efficiency is around 50-60 percent and 90 percent in few ULBs, only 10 percent of the collected waste receives treatment and virtually nothing is scientifically disposed in engineered landfills (NIUA, 2013). Indian cities are facing the problem of limited availability of land for waste disposal especially in large cities. Furthermore, the ULBs rarely have sufficient funds, resources, infrastructure and appropriate strategies which have resulted in poor collection, transportation, treatment and safe disposal of solid waste.

Recognizing these challenges, the Indian government and key stakeholders have been deliberating upon mechanisms and arrangements to facilitate compliance of ULBs with requirements for treatment and safe disposal of solid waste (MoUD, n.a). The two ministries of Government of India namely, the Ministry of Environment, Forest and Climate Change (MEF&CC) and the Ministry of Urban Development (MoUD) have initiated several policies and programmes to improve the current scenario of solid waste management (SWM) system in India. The Environment Ministry had promulgated the Municipal Solid Waste Management Rules in 2000 which is now being revamped as Solid Waste Management Rules 2015 while the MoUD has prepared a draft manual on MSWM to support cities and towns on planning and implementing a proper MSWM system in line with the SWM Rules being promulgated in 2015. While the MSWM Rules 2000 prescribed the manner in which the authorities have to undertake solid waste management activities within their jurisdiction, it was observed that it failed to achieve its objectives due to lack of clarity, awareness among the stakeholders and poor enforcement by the regulators.

The present paper is an endeavour to provide a comprehensive review of the solid waste management system and most importantly highlight some major points of the government's policies and programmes required to overcome the challenges of municipal solid waste management in India. The paper has been divided into four sections. Section 1 provides the comprehensive review of the current municipal solid waste management in India including the issues and key challenges faced by the ULBs in making MSWM more sustainable. Section 2 discusses the technological options available for the treatment and disposal of solid waste. It also highlights the government's incentives and financial supports i.e. grants and subsidies to the ULBs for the improved SWM in the country. Section 3 of the paper provides the comprehensive review of the legal and policy framework for MSWM. The gaps in the SWM Rules 2015 and suggestions on it are discussed in the last section 4 of the paper before a brief conclusion.

Section 1: Current Scenario of Municipal Solid Waste Management

Solid waste management includes managing activities associated with collection, transportation, treatment and disposal of solid waste in an environmentally compatible manner with due consideration of the principles of economy, aesthetics, energy and conservation. These activities are briefly discussed in the following section:

1.1 Municipal solid waste generation

According to the Central Pollution Control Board (2015), India generated 1,43,449 tons per day (TPD) of municipal solid waste during 2014-15, with an average waste generation of 0.11 kg/capita/day (GIZ, 2015). It does not include waste picked up by Kabadiwalas from households and from the streets by rag pickers. Whereas
According to the report of the Task Force on Waste to Energy (WtE), (2014) of the Planning Commission, the 7935 urban centres of India generate 1,70,000 TPD i.e. 62 million tons of MSW annually. It is observed that there is conflicting data about the actual quantum of waste generation in urban India because there is no system of periodically collecting data on waste generation. In terms of per capita, the waste generation varies between 200-300 gms/capita for small towns, 300-400 gms/capita for medium cities and 400-600 gms/capita for larger cities as per the Planning Commission report. The increase in waste quantities has been estimated at 5 percent per annum. It is assumed that urban India will generate 2,76,342 TPD by 2021, 4,50,132 TPD by 2031 and 11,95,000 TPD of MSW by 2050. (Planning Commission, 2014). The physical and chemical characteristics of solid waste vary depending on population size and consumption pattern. As per the report, MSW constitutes 51 percent of organic waste, followed by the inert and non-organic waste at 32 percent. Plastics, paper, and glass constitute 17 percent of waste which are classified as recyclable wastes. The report of the Earth Engineering Centre (2012) stated that the calorific value of the waste taken largely from 7 large metropolises varied between 6.8-9.8 MJ/Kg (1620-2340 Kcal/kg). Waste from smaller cities have low calorific value mostly less than 800 Kcal/kg. It is known that a calorific value of over 2800 Kcal/kg is required for feasible incineration.

The report of planning commission highlights that the plastic waste including composites are high calorific value material and crucial ingredient for MSW based WtE plants. Chintan and many other reports show that plastics are the most preferred items for retrieving by waste pickers, from garbage, since they are light weight and plastics like HDPE, LDPE and PP fetch good prices. However, extremely light weight plastics like plastic carry bags or very highly soiled plastics may be left behind in the garbage because of their low price potential. For improving the recycling of plastic waste, the Ministry of Environment, Forest and Climate Change notified "The Plastic Waste (Management and Handling) Rules, 2011" in supersession of the "Recycled Plastic Manufacture and Usage rules, 1999" notified under the Environment (Protection) Act, 1986. This is again being revamped as Plastic Waste Management Rules 2015. "Rule 6 of the said rules mandates that a plastic waste management system be put in place and identifies municipal authority as the agency responsible for implementation of the said rules within their jurisdiction".

1.2 Solid waste collection

The latest report of the Planning Commission (2014) shows that as high as 68 percent of the waste generated is collected daily in India while according to the report of MoUD (2011), this percentage varies between the different sizes of cities, i.e. 70-90 percent in larger cities and less than 50 percent in smaller cities. It is observed that the collection efficiency of MSW in cities and towns is low due to non-uniformity in the collection system. Nearly 100 percent collection is observed in only those areas where the private contractors and NGOs are engaged in the waste collection activity. Uncollected waste often lies outside the designated bins in most of the urban areas due to inappropriate design, capacity, location and poor attitude of the community towards using bins. It is observed that the uncollected waste is generally burnt in open areas or on the streets. The report of the planning commission shows that over 81 percent of MSW annually is disposed at open dump sites without any treatment. Are port of Earth Engineering centre shows that "such open burning of MSW and landfill fires together releases 22,000 tons of pollutants into lower atmosphere of Mumbai city every year".

It is worthwhile to note that the segregation of waste at the door step is almost absent although door to door waste collection is improving in some cities of India. Recognizing the need to adopt innovative strategies for sustainable solid waste management, many ULBs have started door to door waste collection, zero waste management, and segregation of waste at source in their cities.

Success Stories

Research documents reveal that 100 percent door to door waste collection has been achieved in 329 cities of Goa, Gujarat, Karnataka, Madhya Pradesh, Mizoram, Nagaland, Odisha, Sikkim, Tamil Nadu and Telangana. It is further proposed in 1000 cities for the year 2015-16. In Goa, self-help groups are involved in the entire Margao Municipal Council. The Kochi Municipal Corporation has successfully implemented a bin-less system in a few wards of the city (Manual: MoUD, 2014).
Pune Municipal Corporation (PMC) has initiated door to door waste collection under SWaCH programme. In 2008, the PMC signed a five year Memorandum of Understanding to decentralize door to door collection services for households, shops, offices and small commercial establishments and to allow SWaCH members to carry out this work. As part of its support, the Corporation provides uniforms, aprons, raincoats and shoes for waste pickers involved in door to door waste collection as well as other equipment such as brooms and cycle rickshaws. At present, there are 2,300 waste pickers who collect garbage from 4 lakh properties with an average of 174 properties per waste picker. The Cooperative members collect user charges ranging between Rs.10/- to Rs.30/- per household per month from the service users. The advantage of SWaCH model is that it helps the PMC collect waste from door step, is cost effective, leads to high-resource recovery, is labour-friendly using existing workers and is a sustainable enterprise (NIUA, 2013).

In Surat, a door to door waste collection system by a private operator introduced in 2004 has been successful. The system is operated on a PPP model with a 10 year concession period. The operator uses closed body vehicles equipped with vehicle tracking system.

About 60 percent of total municipal solid waste is being collected and transported by the private operator by using 310 vehicles in the respective zones (Swachh Bharat Newsletter MoUD,2015). The Shimla Municipal Corporation formed a society known as 'Shimla Environment Heritage Conservation and Beautification' (SEHB) in 2009. The scheme was operationalized in April 2010. Personal protective equipment like rain coats, gum shoes and gloves have also been given to all sanitary staff (Bharti, 2013). The challenges of this system is mixing of wet and dry waste along with household e-waste and biomedical waste. Vehicle break-down, foul smell and spillage due to improper collection/transportation and inefficient monitoring of routes and operator are other issues that need to be addressed in Shimla.

Another initiative 'Zero Waste' system has been adopted by Pune, Ahmedabad, Namakkal, etc. In Pune, the Zero Waste project at Katraj ward No. 141 was undertaken in association with NGO, Janwani. The Corporation banned open dumping in June 2010 and all disposals are done using scientific processing only. There are five decentralized waste processing plants across the city. PMC has activated a new mobile SMS alert system for timely and effective complaint redressal regarding garbage containers. The sustainability of this system relied on household and commercial properties for the segregation of waste. This type of model is first in India that received ISO certification for solid waste collection and transportation. After successful implementation of this model, it was decided to replicate this model in 20 selected prabhags (electoral ward) in a phased manner. Work on the implementation of the first phase has already begun (Swachh Bharat Newsletter, MoUD, 2015). Ahmedabad has signed Memorandum of Understanding (MoU) with United Nations Centre for Regional Development, Japan towards making Ahmedabad a zero waste city. To achieve this objective, Ahmedabad Municipal Corporation is working closely with Urban Management Centre (UMC) for developing Master Plan, City Sanitation Plan, mainstreaming waste pickers and creating citizen awareness (NIUA, 2013).

1.3 Transfer station and transportation

Transfer stations are used where disposal sites are more than 10 km away from the city. To save transportation time and fuel such cities have a good performance record of vehicle maintenance and adequate facilities to maintain large size vehicles and containers. Ramp facility is provided to facilitate uploading of the dumper placer containers directly into a large container at the transfer stations. If there is an issue of suitable land for a permanent station then mobile compactor truck with primary collection vehicles can be used to improve the transportation efficiency of the system (MoUD, 2012). Such stations have been effectively used in Surat, and Coimbatore. There are six transfer stations in Surat and all are operational. Waste collected is transported to transfer stations through private vehicles and finally sent to the disposal site for waste disposal. Containers are fully closed with leak proof doors. The achievements of the transfer station model are (i) the municipal waste received through closed vehicles are dropped into closed containers without secondary handling; (ii) covered leak proof containers prevent spillage of waste on the road; (iii) no permanent or temporary storage at transfer stations, thus averting the nuisance of flies and animals at transfer stations; and (iv) separate leachate collecting system is provided. Coimbatore Municipal Corporation has four transfer stations namely Peelamedu (200 TPD), Sathy Road (125 TPD), Ukkadam (200 TPD) and Ondipudur
(125 TPD). All these transfer stations are operational. At present, although there are different types and sizes of vehicles used for transportation of waste such as dumper placers/schiff loaders, refuse collector without compactor, refuse collection mobile compactors, mini truck with tipping floor, hook loader/hook lifter, the selection of the type of vehicles depends on various factors such as the quantity of waste, distance, road widths and conditions and process technologies. To save travel time, minimize human errors and improve the monitoring system, many ULBs have installed Global Positioning System (GPS), Geographic Information System (GIS), and Global System for Mobile Communication (GSM) system in their trucks to collect waste from secondary sources for the disposal of waste. The Tool Kit for Solid Waste Management prepared by the MoUD reveals that municipalities like Pimpri-Chinchwad, Hyderabad and Delhi have benefitted from this system. Ensuring the efficiency of 100 percent waste collection is still a big challenge for the ULBs despite these technologies. Another significant challenge is to deal with corruption and lack of commitment in the solid waste transport sector.

Section 2: Technologies for treatment of solid waste

2.1 Technologies for MSWM

At present, there are a number of processing technologies such as composting, bio-methanation, recycling, refuse derived fuel (RDF), gasification, incineration, pyrolysis, engineered landfills etc., available for the treatment of municipal solid waste. However, each of the technologies may have positive as well negative implications. The selection of suitable technologies depends on the population of a city and quantity of waste. It is important to note that “the biggest constraints lie in separating, collecting and transporting this component to the location where decentralized or centralized large scale composting or biogas generation plus composting can be carried out” (Mani, 2015). Efficiency of recycling and composting is greatly reduced due to the absence of source separation.

Research documents show that over 50% of waste collected is biodegradable organic material which can be used for composting or used for generating biogas. This wet waste must be processed either through bio-methanation or composting technology for generating biogas, electricity and compost for use as nutrient and prevent such wastes from reaching the landfill. Reusable and recyclable waste that constitute 18-20 percent of the total waste are not separated because the process of separating them from mixed waste is highly energy and time intensive and is generally not carried out. However, the recycling industries face a number of problems such as (i) these industries being labour intensive, (ii) and the poor quality of recycled products are not compliant with regulatory requirements. Mixed waste can neither be recycled nor composted. The report of the Task Force on Waste to Energy (Vol.I), 2014 reveals that “only 22 states/UTs have set up processing and disposal facilities and the rest of the States/UTs had made no effort till 2013. Of the 279 conventional composting, 138 vermi composting facilities, 172 bio-methanation, 29 RDF and 8 Waste to Energy plants reported to have been established many are either closed or underperforming”.

2.2 Disposal of MSW

Waste dumps or open burning continue to be the principal method of waste disposal in India. These methods are continuous sources of harmful gases and highly toxic liquid leachate. Most of the cities and towns dispose of their waste by depositing it in low-lying areas outside the city without taking precautions. As per the estimates made by the Planning Commission (2014), more than 80 percent waste collected is disposed indiscriminately at dump yards in an unhygienic manner by the municipal authorities leading to health and environmental degradation. Limited availability of land for waste disposal is a major cause of the MSW mess especially in big cities. The position paper on the SWM in India of the Ministry of Finance, 2009 estimates a requirement of more than 1400 sq.km. of land for the solid waste disposal by the end of 2047 if MSW is not properly handled. The draft SWM Rules, 2015 provides criteria for the location of sanitary landfills. “Guidelines for the Selection of Site for Landfilling from the CPCB should also be consulted”. Finding new landfill sites is a major constraint including the 'not in my backyard' (NIMBY) phenomenon. People want a good facility for MSW but not in the vicinity of their households. The NIMBY attitude of the people has made the task difficult for the ULBs with respect to waste storage.
2.3 Financial Supports and Incentives

In order to give a push to MSWM in cities, the Central government has sanctioned the 12th and 13th Finance Commission Grants and Funds for the improvement of MSW under flagship projects like JnNURM, UIDSSMT from 2005 onwards and the recent Swachh Bharat Mission (SBM). The 12th Finance Commission had allocated Rs.25,000 crore (Rs.20,000 crore for Panchayat and Rs.5,000 crore for ULBs) for supplementing the resources of the ULBs during the period 2005-2010. Under the 12th Finance Commission (FC), an award of Rs.2,500 crore was made available to ULBs of all class I cities for SWM during the period 2005-10.

A substantial incentive grant of Rs. 5000 crore was recommended by the 13th FC for grid-connected renewable energy based MSWM on the states’ achievement in renewable energy capacity during April 2010 to March 2014.

According to the Tool Kit for SWM (2012), SWM should have been treated as a specific and exclusive project, which requires large capital investment as well as operation and maintenance cost. The estimates of the High Powered Expert Committee of MoUD, 2011 reveals that the per capita investment cost and per capita operations and maintenance cost for SWM both are highest in Class IA cities (Rs.900/- and Rs.269/- per year respectively) as compared to other classes (IB, IC and Class II and Class III) due to the assumption that large cities would adopt highly mechanized systems while smaller cities would adopt comparatively more labour intensive processes while Class III and IV cities would adopt lowest technologies.

The Ministry of Environment, Forest and Climate Change also provides financial support of upto 50 percent of the capital cost to set up pilot demonstration plants on MSW composting. The Ministry also extends limited financial assistance for waste characterization and feasibility studies. The Ministry of New and Renewable Energy (MNRE) has designed schemes to promote waste to energy projects. The Ministry also promotes all technological options for setting up projects for recovery of energy from urban, industrial and agricultural wastes. Currently only five pilot projects based on MSW to energy are being supported. Under this scheme, a minimum amount of Rs.2 crore and a maximum of Rs. 10 crore per project are available as capital subsidy. The entire capital subsidy amount is released to the beneficiary’s loan account. Some of State governments of Andhra Pradesh, Haryana, Gujarat, Karnataka, Maharashtra, Madhya Pradesh, Rajasthan, Tamil Nadu and Uttar Pradesh have announced policy measures pertaining to allotment of land, supply of garbage, and facilities for evacuation, sale and purchase of power to encourage the setting up of waste to energy projects. Land for the facilities is provided by the ULB at a nominal rent. Although recent announcement by the Power Ministry to purchase power generated from WTE plants at a higher rate than earlier, the cost of monitoring and mitigating emissions and pollutants from such incineration based WTE plants has made them unviable. Greater incentivization and operational support is required for promoting biomethanation based WTE. Swachh Bharat Mission is currently making available Viability Gap Funding (VGF) upto 20% to states and individual municipal corporations. However, ULBs are still not able to raise the rest of 80% investment required for SWM improvement in their cities and towns. Greater convergence of schemes and sustainable models need to be explored.

3. Legal and policy framework for MSWM

3.1 SWACHH Bharat Mission

One of the important declaration in the development agenda of NDA government is that of Open Defecation Free India by 2019. The "Swachh Bharat Mission" (SBM) is a major initiative of the Ministry of Urban Development (MoUD), Government of India. It is launched on the occasion of the birth anniversary of Mahatma Gandhi on 2nd October, 2014. The Mission is a national campaign covering 4041 statutory towns to clean the streets, roads and infrastructure of the country. Solid waste management is one of the important components of the Mission. The national government has allocated of Rs.14,623 crore for the SBM for urban areas, of which Rs.7,366 crore is given for the SWM for five years i.e. 2014-2019. While addressing the components of SBM for urban areas, state governments and ULBs are expected to focus on a set of social priorities and outcomes that define the scope and complexity of the Mission.
3.2 Municipal Solid Waste (Management and Handling) Rules-2000

According to the Indian Constitution, the SWM is a state subject and included in the 12th Schedule of the Constitution (74th Amendment) Act of 1992. ULBs are mandated to provide MSWM. State laws governing the ULBs also stipulate MSWM as an obligatory function of the municipal governments. Despite 15 years of implementation of these Rules, ULBs have not been able to put in place good systems. Wherever the people’s representatives along with the people have supported source segregation, door to door collection and eco-friendly treatment of the segregated components in waste, they have been able to solve the issue with regard to processing and disposal of solid waste. At present, the MSW Management and Handling Rules 2000 are under revision by MoEF&CC. The draft revised rules was circulated in 2013 and again in 2015 and will be finalized as Solid Waste Management Rules 2015. It lays down the mandatory functions to be performed by various stakeholders. Significantly, the new Rules not only emphasize source separation of wet, dry and hazardous waste and their separate treatment but specifically Construction and Demolition (C&D) waste for separation and treatment as a separate chapter. Similarly the new Plastic Waste, E-waste, Fly-Ash and Bio-medical waste Management Rules are under revision and will be promulgated in 2015.

3.3 Draft Manual on Municipal Solid Waste Management

The Central Public Health & Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, Government of India has prepared a draft manual on MSWM to support cities and towns on planning and implementing a proper MSWM system in line with the SWM Rules being amended in 2015. This manual addresses the all aspects of MSWM namely, planning, technical, institutional, financial and legal dimensions.

According to the manual, the MSWM plan should address the five year short term plan and long term periods from 20-25 years. "The five-year short term plan may be broken into specific action plans, covering various aspects such as institutional strengthening, community mobilization, waste minimization initiatives, waste collection and transportation, treatment and disposal and other policy changes as may be deemed necessary".

4. Gaps and Suggestions on the Draft SWM Rules 2015

The MoEFCC published the draft SWM Rules 2015 in their website in May 2015 and requested stakeholders throughout India to send their comments and suggestions. The authors examined the draft SWM Rules 2015 to identify gaps and make suggestions. These are discussed in the following paragraphs.

Gaps in the draft SWM Rules 2015

1. Although separate categories have been specified for wet, dry, hazardous and C & D wastes, a separate category for sanitary waste is missing.
2. GPS/GIS system for tracking trucks carrying separated waste needs to be emphasized.
3. Synchronization of secondary storage containers and vehicles with transportation is difficult because traffic congestion and pollution from waste collection vehicles plying during peak hours is an issue.
4. Use of user fee charges need to be spelt out especially for the first mile SWM – payment to waste collectors’ collectives for door to door collection, decentralized composting, recycling etc.
5. Horticultural waste needs separate processing. Similarly, prohibiting burning of leaves and garden waste needs emphasis.
6. Compliance criteria for Material Recovery Facilities (MRF) and use of Personal Protective Equipment (PPE) for door to door collection and secondary segregation need to be delineated.
7. Responsibility of processing domestic hazardous waste is left to SPCBs instead of making it mandatory to be transported to regional secured landfills and treatment like TSDFs worked out.
8. Knowhow and technologies are not available with ULBs for bio-mining and bio-remediation and action. This should be done through SPVs after proper EIAs etc.
Suggestions to improve proposed SWM Rules 2015

1. Greater emphasis on recycling is required. ULBs especially smaller ones can easily form cooperatives etc. with waste collectors initiatives and collectives for recycling rather than tie-ups with large companies for setting up incineration plants.

2. Recycling technologies for making structural from plastics or converting waste plastics and non-recyclables to Light Diesel Oil as mentioned in the Planning Commission report 2014 should be delineated and their standards prescribed. This is feasible in smaller ULBs also.

3. Waste to energy Plants based on incineration are still being tested. For smaller ULBs, the cost of incineration plus pollution control is prohibitive.

4. Much greater emphasis on ULBs working with waste pickers collectives and NGOs for setting up door to door collection of segregated waste, Material Recovery Facilities (MRFs) and secondary segregation while providing Personal Protective Equipment (PPE) to them is required.

5. Sanitary and household Biomedical waste management should have a separate section. Sanitary waste collection from doorstep every two days in red colour bags and transporting sanitary and biomedical waste generated in homes and non-medical institutions to Common Biomedical Waste Treatment Facilities (CBWTFs) should be made mandatory.

6. Flushing of gel based napkins should be banned and separate collection emphasized.

It can be said that Draft SWM Rules 2015 are a big step forward but they do not address all the concerns and need to be improved if they have to play an important role in improving waste management and sanitation conditions in our country.

Conclusion:

Overall, the policy agenda for Sustainable Solid Waste Management (SSWM) needs to drive behavioural change among citizens, elected representatives and decision makers to minimize wastage and littering and maximize reuse and recycling. SSWM is a people management issue and over-emphasis of technological solutions to solving the SWM problem will only delay in realizing good results.

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