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Solid Waste Management in Urban India: Imperatives for Improvement

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Abstract: Existing solid waste collection, transport and disposal systems are mired in turmoil across India. In cities where fast-growing populations produce more and more solid garbage than urban local bodies (ULBs) are unable to efficiently handle, the issue is more severe. Unfair solid waste management presents environmental and public health concerns. This study examines the status of solid waste management in India and recommends that many problems be solved.

Keywords: Solid Waste, Urban India, Imperatives, Improvement, SWM, ULBs

INTRODUCTION

One of the major obstacles to the growth of urban India has been solid waste management (SWM). Many studies have shown that hazardous waste disposal produces harmful gases and liquids owing to microbial decomposition, weather conditions, waste properties and sites of landfill. The 12th Annex of the 74th Constitution Amendment Act of 1992 requires urban municipal authorities (ULBs) to maintain cities and villages clean. Most ULBs nevertheless lack sufficient infrastructure and suffer several strategic and institutional shortcomings, including inadequate institutional capacity, budgetary limitations and a lack of political will. I Although many Indian ULBs are supported by government, nearly all remain financially unstable. All accessible landfill sites have already been depleted in India and ULBs involved do not have the means to purchase additional land. In addition, locating new trash locations is a tough job, because local authorities are not prepared to reserve land for waste from other regions within their authority.

Several legislation has been established on how to control waste disposal. The Environment, Forestry and Climate Change Ministry (MoEFCC) and the Ministry of Housing and Urban Affairs create a combined strategy and programmes (MoHUA). However, most of the parties lacking clarity and expertise and regulators failed to achieve their objectives. They are not achieving this objective.

2. REVIEW OF LITERATURE

The various elements of SWM in India are covered in a wide range of publications. For instance, Professor Sudha Goel's report entitled, "Municipal Solid Waste Management in India: A Critical Review," says that the development of an effective SWM system requires frequent monitoring and data gathering. Goel proposes that a centralised database of ULB experiences in SWM be created in order to enhance SWM practises across the nation and utilising current tools and technologies such as remote sensing, GIS and maths optimization.

In 2016 Rajkumar Joshi and Sirajuddin Ahmed claim that the failures of municipal sound waste management are due to a lack of awareness and technical expertise, a lack of financing and the inefficient execution of laws and regulations (MSWM). For his part, Som Dutta Banerjee underlines the infrastructural issue. Banerjee believes that SWM should promote private involvement to alleviate the public coffers burden.

The key shortcomings of SWM in India have also been identified in treatment procedures and practises in Chavan and Zambare. Annepu examines methods of reducing the volume of solid trash in his study Sustainable Solid Waste Management in India. Alone in Mumbai, the open flames of solid garbage and waste disposal fires release over 20,000 tonnes of air pollutants annually on land. Annepu also proposes the inclusion in the official system of informal recycling by training and using waste collectors for door-to- door trash collecting, and enabling them to sell their collected recyclables, inter alia to waste repurposing by producing fly-ash brics.

3. SOLID WASTE MANAGEMENT IN INDIAN CITIES

3.1 Solid Waste Generation and Composition

The cities of the globe produced 2,01 billion tonnes of MSW collectively in 2016 with a per capita amount of 0,74 kg daily. " The yearly production of trash should rise from 2016 levels by 70 per cent to 3.40 billion tonnes in 2050 with fast population expansion and urbanisation."

Table 1: Regional Waste Generation (annual)

Region	Waste Generation (Million Tonnes)
East Asia & The Pacific	468
Europe & Central Asia	392
South Asia	334
North America	289
Latin America & The Caribbean	231
Sub-Saharan Africa	174
Middle East & North Africa	129

This variance in the production of solid waste is dependent on many variables including population increase, higher incomes and changing patterns of consumption. In particular, the expansion of urban people leads directly to an increasing production of garbage.

In India, the amount of waste produced in recent years has risen considerably. From 84,475 wards per day, 147,613 metric metric tonnes of solid waste (MT) is generated, according to the "Swachhata Sandesh Newsletter" by the MoHUA. According to the 2014 study by the Planning Committee, 'Garbage for Energy Task Force' urban India would produce 2 76 342 tonnes of waste daily by 2021, 4 50, 132 TPD by 2031 and 11, 95 000 TPD by 2050. TPD by the year 2012. The production per capita of trash is 450 grammes per day and has risen by 1.3 percent annually. As of January 2020, the quantity of trash generated in 84,456 stores would vary from 32 to 22,080 MT each day. At 22.080 MT/day (out of 7.322 wards), the highest is Maharushtra, while the lowest is Sikkim at 89 MT/day (from 53 wards). Delhi produces 10,500 MT per day of the largest quantity of trash among the Union Territories (UTs). Daman & Diu is, in general, India's lowest garbage producer.

The division of solid waste into three categories may be: I biodegradable and organic wastes; (ii) inert and non-biodegradable trash; (ii) recyclable and demountable waste, (ii) recyclable waste, I food, cooking waste, plants, flower, leaved, fruits and paper; (plastic, paper, bottles, glasses, etc.). The Planning Commission Task Force report sets a level of 52 percent for biodegradable trash, followed by 32 percent for inert, non-biodegradable material. The proportion of recyclable trash has risen steadily over the years, by 17 percent. Data from a few municipalities indicate that biological degradable trash ranges from 55 to 60% each year.

The growing amount of plastic trash is a serious issue and contributes significantly to the damage to the environment. India produces plastic trash at a rate of 26,000 tonnes per day (TPD), or 9.4 million tonnes per year. To deal with this problem, a severe prohibition on the entry of plastic trash into India is ordered by the National Green Tribunum (NGT) since it is harmful to the environment. Furthermore a major collection of plastic was carried out and, with the assistance of approximately 6,41 crore people, a huge 4,024 MT of plastic was collected on 21 October 2019. A great deal is utilised in building of roads and furnace oil for this non-recyclable material. The NGT bench says: "Every manufacturer or brand owner is obliged to submit [an] application for registration or renewal and that the registration of plastic trash to be used for road construction or waste for energy purposes etc... and that is made in accordance with a checklist provided by a CPCB." The Ministry is engaged also in the promotion of plastic trash for the development of national roadways, especially in regions with a population of five lakhs or more, via reuse of the non-recyclable plastic garbage collected with NHAI, Transport and Traffic.

In order to remove both plastic bags and bottles, and other items like as plastic cutlery, straws, styrofoam containers and coffee scrapers, the Government of Indian announced on 5 June 2017 the National Strategy for World Environment Day to phase out all kinds of plastics of one-use by 2022. A FICCI research has estimated that 43 per cent of plastic from India is utilised for manufacturing packaging available single use, such as that used by Amazon and Flipkart eCommerce facilities. A total of 18 States, including Andhra Pradesch, Arunachal Pradesh, Assam, Chandigarh, Delhi, Gua, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnatak, Maharashtra, Odisha, Zikkim, Tamil Nadu, Utár Pradesh, Uttarakand and West Bengal, have imposed bans on plastic bags for manufacture, stockpillement, distribution or use. However, owing to weak state capability, the restrictions were not implemented successfully.

3.2 Waste Collection and Transport

The collection and transportation of waste is an important part of SWM. According to the MoEFCC, approximately 75%–80% of all municipal trash is collected and only 22%–28% is processed and processed. A significant part of the trash collected is frequently carelessly deposited and the drains and sewage systems are obstructed. They also produce rodents and insects that are carriers of fatal illnesses. Delhi has the lowest

collection of waste (39 per cent), while Ahmedabad has the greatest waste collection, according to a report published by ICRIER in January 2020 (95 percent).

In trash management the informal sector of the nation plays an important role. Informal employees, however, are not recognised legally and lack legal status and protection. They gather almost 10,000 tonnes of trash daily, without safety equipment like gloves and masks, and sometimes without the basic elements of clothes and shoes.

The SWM regulations now apply to trash-pickers no incentives nor do they acknowledge the economic significance of informal waste recycling activity. The new regulations are intended to involve municipalities in their waste management processes as informal trash pickers. The Government of India has released a handbook to help ULBs and States to integrate informal trash collectors as well as to promote solid waste repairs and re-use under the Mission-Urban (SBM). This paper provides an integration guide to the informal sector: a step-by-step approach for inclusive swach bharat.

"Waste segregation" is a key component of effective SWM. Trash producers are now required to store their waste in color-encoded waste containers – blue for dry waste and green for water – to enable optimal recovery, reuse and recycling. This substantially lowers SWM's impact on ULBs. Wet waste is utilised in a decentralised way for composting or biomethanation. In 20 of its 50 smaller communities, Tamil Nadu achieved 100% segregation and in the remainder 80–90% segregation. But in most countries mixing is still a significant issue with separated and unreplicated trash. The MoHUA announced, on World Environment Day 2017, a "Source Segregation Campaign" under the Swachh Bharat Mission to encourage people to separate their trash. All cities and cities were to use this campaign as a popular movement to embrace "source secrecy." According to the MoHUA's "Swachhata Sandesh Newsletter" for 2020, 63,204 wards (74.82%) achieved 100% home separation of trash by January 2020.

The revised 2016 SWM Regulations required the door-to-door trash collection, with waste producers obliging the waste picker to pay a "user charge." The Rules, however, do not specify the way in which the cost is determined – whether the quantity or kind of trash is paid. xxx 81.135 wards (96.05%) of 84,475 wards in India, including all wards at Andhras Pradesh, Arunachal Pradesh, Chhattisgarh, Goa, Guiharat, Karnataka, Madhya Pradesh, Mizoram, Rajasthan, Sikkim and Uttarakhand, were collected in all door-to-door waste collection by Januarian 2020 according to the "Swachhata Sandesh Newsletter."

Another issue is the delivery of solid waste since there is a lack of adequate transport infrastructures in many towns. The main cars used in the primary collection are hand-carts, or tricycles with containers, tricycles, small commercial vehicles (mini trucks), four-wheeled mini lorries with standard international trash bags. Selection of vehicles usually depends on the quantity of waste, distance, width and condition of roads and processing technologies. Many ULBs adopted the Global Positioning System (GPS), the GIS and the GIS in their trucks to collect secondary garbage disposal waste to save time, reduce human error and improve the monitoring system.

3.3 Processing, Treatment and Disposal of Solid Waste

In India, current processing technology covers composting, biomethanation, recycling, waste-to-energy, combustion, pyrolysis and trash. The kind and amount of waste accessible, its calorification value, the availability of funds, the availability of funds and resources, investments in capital investment, cost recovery, ULB capacity, land availability and local environmental sensitivity, relies on a range of variables.

Large amounts of trash generated by biogas, energy and compost are often treated using either bioethanation or composting technologies. Biogas has 55%–60% methane and is suitable for use as fuel for generating electricity. Aerobic composting and vermicomposting are the most popular techniques for the treatment of biodegradable waste. This compost is used for the cultivation of plants and vegetables in households.

The effective separation of trash in India, where mixed waste is frequently deposited in open places, is the essential component of composting. (This contributes greatly to global warming as well.) Separation may contribute to reducing waste transport burdens and reduced leachate and GHG emissions. Different components may be used to provide commercial use values when the trash is separated at source for various kinds of manufacturing operations.

Recycling is the process of converting separated solid wastes into a new product or a raw material for manufacturing a new product, according to the 2016 SWM Rules. The trash that is reusable and recycled is 18–20 percent of total waste and is energy- and time-intensive to separate from mixed waste. The recycling material is usually gathered by ragpickers, garbage recyclers, roaming trash purchasers (kabariwala), retailers and recycler unit, which decreases the amount of waste, saves the costs of waste collection, transport and disposal. Recycling also offers major economic advantages, such as decreasing the demand for imports of raw materials and fertilisers and providing recyclers with livelihoods.

From a financial viewpoint, recycling only pays if more resources are recycled from the recycled product for collecting, sorting and recycling. xxxvi According to ICRIER, few towns have biomethanated manure-generating plants, whereas many towns have composting facilities, however they are severely underused due to a lack of compost demand.

4. DISPOSAL OF SOLID WASTE

The main techniques of trash dumping and open burning in India remain. Most towns and villages dispose of their trash by dumping it outside the town in lowlands. More than 80 per cent of the trash collected in India has been indiscriminately disposed of in waste dumping plants, resulting in a deterioration of health and the environment, in the planning committee report of 2014. "It is certainly not unusual to have the smell and unsightly sight of waste thrown on the road side, occasionally spilling from water drains or floating on the surface of rivers. In addition, water logging and flooding of residential regions, highways and even railways during rainy season disrupts regular living with the obstruction of drainage with trash. They also trash excessively on the streets and public areas."

The garbage disposal technique in India is often utilised. The dumping sites as waste dumps are frequently unsustainable because they lack foundations, liner, levelling, soil cover, leachate control or treatment facilities. Research indicates that most sites have now been explored in the nation. Dr. Gopal Krishna points out that it will certainly have serious political consequences to seek additional locations for garbage and waste disposal facilities outside municipal borders. The regulations of the 2016 SWM do not set forth the criteria for the identification of these installations and the circumstances result in a land use dispute. In particular, the mindset of NIMBY makes it difficult to locate and buy new sundeck sites. In Delhi, for instance, sites such as Jaitpur in South East Delhi and Bawana in North West Delhi were selected, but the proposals were rejected by local citizens and villages who did not want to dump any garbage around them. A proposal to construct Phase I landfills was also criticised because the land and Sultanpur Dabas were owned by Indian Railways in Northwest Delhi and Tehkhand in South East Delhi. The project has not been successful. The inhabitants of Suchdev Vihar, Jasola, Sary Vihar, Haji Colony and Ishwar Nagar have protested in Okhla at the Waste-to-Energy (WtE) facility. Residents said that the major electoral problem was lack of clean, breathing air and a garbage incinerator of 2000 tonnes per day in Okhla. xl Cities have begun considering decentralised garbage collection and processing within geographical boundaries to tackle this problem. The installed "waste-to-compost" and biomethanation facility would assist decrease the cargo at trash sites via innovative methods such as 3Rs (remove, re-use, recycle).

WtE, which utilises combustion to provide heat and electricity, is an extensively utilised technique for recycling trash. Recycling can considerably decrease dumping in India by using this technique. RDF is not only a feasible economic alternative for solid waste recovery but also significantly lowers the waste space need. Increase usage of this technology will "diminish land disposal and provide clean, dependable renewable energy, decrease reliance on fossil fuels and minimise greenhouse gas (GHG) emissions." "Most facilities, however, could not function well because of many operational and design difficulties."

5. GOVERNMENT RULES AND POLICIES FOR SWM

5.1 Solid Waste Management Rules, 2016

In April 2016, the MoEFCC revised and announced SWM Rules replacing the Municipal Solid Waste (Management and Handling) Rules 2000. The new rules go beyond the jurisdiction of the city. It provides waste generators for waste separation and for dry waste recycling and recycle, for paper, plastic, glass and metal purposes, as well as for the use of wet waste for kitchen composting or biomethanation.. Local authorities shall establish 'the recycling equipment or secondary storage plants with sufficient room for sorting recyclable materials, so as to allow informal or authorised recyclers and waste pickers to separate recyclables from waste and to make waste pickers and recyclers readily available for collection of separated recyclable waste, such as paper; In addition the new regulations ban waste producers in open public places, outside businesses, or sewers and water systems from dumping, burning or burying solid trash. Garbage producers are now obliged to pay a user fee and a spot fine for littering and non-segregation to the waste collector. The regulations allow ULBs to regulate and impose spot penalty criteria. The 2016 SWM Rules also suggest that biodegradable waste, via composting or biomethanation, be processed, handled and disposed of within the premises. The engineering requirements and criteria for the establishment and operation of sites must be specified in Schedule 1 of the Rules.

The regulations for trash is currently poorly enforced and recycled and many cities are unable to combine door-to-door pickup in the informal sector. In addition, the regulations do not address NIMBY syndrome issues. According to MSWM Guidance Note, compliance with the SWM Rule demands that the scientific collection, management, processing and disposal of SWM be carried out via suitable systems and infrastructural facilities. The Rules of 2016 proposed the establishment, under the leadership of the Secretary of MoEFCC, of the Central Monitoring Committee. This Committee will monitor the general application of the SWM Regulations during 2016.

6. PLASTIC WASTE MANAGEMENT RULES, 2016

The MoEFCC reported the 2016 Rules of Management of Plastic Wastes in order to suppress the previous Rules of Management and Management for Plastic Waste 2011. This new regulation extends the competence to rural

regions from the municipal zone, with plastic now reaching villages. The waste producers are responsible for the separation and storage of plastic waste produced under the 2016 SWM rules prior to the transfer to an authorised waste collection service. These rules require a user charge to be paid by producers of trash as set forth in the ULBs' regulations for the management of plastic waste.

The MoEFCC revised the Rules on the Management of Plastic Waste of 2016, now known as Rules on Plastic Waste in 2018. The changes present the difficulties, possibilities and policy actions for collecting, sorting and recycling plastic trash. The amendment included three significant modifications. Firstly, "multi layered plastic that is not recyclable, or that is not recoverable, or that has no alternative use," as referred to in Rule 9, sub-Rule 3 was substituted for the phrase "non-recyclable multilayered plastic." Secondly, Rule 15, concerning the cost of transportation bags, was deleted. "The regulation formerly required the registration of suppliers with the local ULB who had plastic bags accessible. The new regulations are intended by requiring brand owners and manufacturers operating between two states to register with the CPCB to create a centralised registration system." xliv Thirdly, the idea of Extended Producer Responsibility has been established, which states that the collection of trash is the responsibility of both the manufacturers and the brand owners. Plastic carrying bags are the biggest component of waste litter and are recommended for an increase in minimum thickness from 40 mm to 50 mm and a minimum thickness of 50 microns for plastic sheets used for packaging goods and wrappings. It is enabled to collect plastic waste effectively and recycle it.

7. MUNICIPAL SOLID WASTE MANAGEMENT MANUAL, 2016

In cooperation with the German Society for International Cooperation (GIZ), the MoHUA has created the MSWM Manual, according to the 2016 SWM Rules. The Handbook offers ULBs with advice on MSWM systems strategy, design, implementation and monitoring. It proposes a seven-step strategy for correctly planning and management of MSW and suggests how to select suitable alternatives in a city based on quantity of trash produced, local waste characteristics, local geographic circumstances, land accessibility and other important variables. This strategy emphasises the participation of communities or stakeholders and interdepartmental cooperation at the level of local authorities to guarantee successful implementation.

The plan process proposes adoption of an ISWM hierarchy for the determination of processing or technological solutions for MSW. The planning method proposes The most popular waste reduction methods are waste minimization at source and product recycling followed by recycling to restore materials to new goods. Waste disposal in open dumpsites is the least recommended method. The ISWM's 3R method is closely connected. The paper is helpful for all ULBs in ensuring ecologically sound waste management and in promoting waste resource recovery.

In order to assist the cities speed up their implementation, the Directorate has taken several measures. The following are some of the major initiatives:

1. Conducting Swachh Survekshan

The MoHUA has undertaken several rounds of Swachh Surveyshan (SS) to foster the public involvement, guarantee the sustainability of efforts to cities without waste and open defecation, institutize existing systems through online procedures and sensitise all sectors of the community. In January 2016, 73 municipalities carried out their first round of the cleanliness survey; in January – February 2017 the second phase was carried out in 434 municipalities. The third round was performed in 4,203 urban centres in 66 days in 2018, which has affected approximately 40 crore people and became the biggest ever Pan-Indian health survey in the globe.

In urban regions of the nation, 4,242 urban centres and 62 cantonment boards were conducted in the Fifth Roundup of the annual Swachh Surveyshan, which was held between 4 January 2020 and 31 January 2020 (28 days). The aim of this study was to maintain the city's on-site performance and to check cleanliness continuously at service level. On 20 August 2020 the results were reported, with the top place maintained by Indore (Madhya Pradesh).

2. Star Rating of Garbage-Free Cities

MoHUA established the Garbage-Free Cities Star-Rating Protocol on 20 January 2018 in order to guarantee the ongoing scientific management of solid waste and encourage cities to attain greater sleekness. The rating procedure is a tool based on results, not a tool based on processes. Built on a culture of healthy rivalry in cities and the urbs ambitions to achieve better levels of "Swachhada" and sustainability, the single metric classification system, based on 12 parameters3. xlviii The main characteristic of the rating procedure is that stakeholders may measure the overall cleanliness of a city in a single metric. To obtain a particular star grade, cities are needed to do self-assessment and self-check. Citizens' organisations must be engaged in the mechanism of self-declaration, to guarantee that the star rating corresponds with their goal to make SBM a "Jan Andolan." A rigorous check system to guarantee transparency and standardisation supports the star rating.

A new multimedia campaign on compost waste, named "Compost Banao, Compost Apnao," under the SBM, was launched by the Minister for urban development (U). The goal is to encourage individuals to turn their

kitchen trash into fertiliser compost and decrease the quantity of waste going to landfills. This initiative is intended to inspire people to help clean up their city.

8. CONCLUSION

SWM is important in India, since ULBs have generally failed to effectively manage solid waste. These local authorities are largely reliant on State governments to finance the acquisition of additional land or the technology for SWM. In addition, waster collectors, who are important industry employees, have no legal standing and protection and are neither efficient or able to enforce waste collection and segregation procedures. In order to ameliorate the situation, emphasis must be given to institutional and budgetary problems. While the 2016 SWM rules deal with a significant number of issues, compliance is still low. A policy statement or action plan has to be created to promote the decentralisation of the waste management system.

Citizens' participation must be encouraged to improve SWM efficiency in India, in particular in the segregation of sources and the treatment processes. In order to reduce waste and scraping and promote reuse or recycling, the sustainable SWM policy agenda needs to encourage behaviour changes among people, elected representatives, and decision-makers. Community knowledge and a change of attitudes about and disposal of solid waste may help to improve the system of SWM in India.

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