

URBAN SOLID WASTE MANAGEMENT

UNDERSTANDING THE FAULT LINES AND ITS
BEST PRACTICES



MAARICO BARUAH



WORKING PAPER 01

SERIES EDITOR: ANJAL PRAKASH, ASHWINI CHHATRE AND AARUSHI JAIN

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Acknowledgements

The author would like to express heartiest gratitude to all the concerned individuals who have helped her understand the subject better. This includes experts in the field like Dr Sanjay Gupta (SWM expert), along with interview with NGO Midway Journey's founder Sheersendu Shekhar. To get the government perspective, the author was able to interview Simanta Baruah, Chief Engineer of Guwahati Municipal Corporation.

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Urban Solid Waste Management: Understanding the Fault Lines and its Best Practices

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Bharti Institute of Public Policy (BIPP) Research

May 2023

Published by

Bharti Institute of Public Policy, Indian School of Business

Mohali campus: Indian School of Business, Knowledge City, Sector 81, SAS Nagar, Mohali -140306

Hyderabad campus: Indian School of Business, Gachibowli, Hyderabad – 500111

Production team

Series Editor: Anjal Prakash, Ashwini Chhatre, Aarushi Jain

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Designer: Nimisha Jain

Citation: Baruah, M. (2023, May). *Urban Solid Waste Management: Understanding the Fault Lines and its Best Practices*. (BIPP Working Paper No. 01). Bharti Institute of Public Policy, Indian School of Business. DOI: <https://doi.org/10.5281/zenodo.7886209>

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Acronyms and Abbreviations

C&T	Collection and Transport
GDD	Guwahati Development Department
GMC	Guwahati Municipal Corporation
ISWM	Integrated solid waste management
JTO	Junior Technical Officer
MRF	Material Recover Facility
MMT	Million metric ton
MSW	Municipal Solid Waste
MSW	Municipal Solid Waste
PCBA	Pollution Control Board of Assam
STP	Sewage Treatment Plant
SWM	Solid Waste Management
SDG	Sustainable Development Goals
SBM	Swachh Bharat Mission
TPD	Tonnes per day

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Abstract

Located in the Northeast, Guwahati is the largest city and metropolis in the region. According to the 2011 Census, Guwahati (metro) has a population of 962,334, which is expected to grow as urbanisation continues. Urbanisation makes solid waste management more challenging and complicated unless appropriately planned. In the most recent Swachh Surveskshan Index 2021, Guwahati ranked 312, up from 356 in 2020 (GMC, 2022). Guwahati (through the Guwahati Municipal Corporation) must, however, overhaul its overall functions to reap benefits from its strategic location as the gateway to the Northeast and the rest of Southeast Asian neighbouring countries. It is clear from the literature review that Guwahati's solid waste management needs to be timelier and more unplanned. Several papers have examined its lacunas in certain aspects, but they have yet to discuss its fault lines while linking solid waste management to the Swachh Bharat Mission. The Assam State government has adopted a piecemeal approach to address the issue. There has yet to be much progress.

The paper seeks to answer two broader questions: (1) What are the current lacunas/gaps in the management of the waste management system in Guwahati? (a) How successful has Guwahati Municipal Corporation (GMC) been in trying to achieve the objective of Solid Waste Management Rules 2016? (b) How is the present solid waste management policy impacting the lives of the people living in Guwahati and adjoining areas? (2) What are the best practices that can be incorporated into the current system so that there can be a sustainable change in solid waste management practices and behaviour in Guwahati? Upon analysing these questions, it becomes apparent that structural issues in the GMC's functioning contribute to its consistently low ranking in the Swachh Survekhsan Index. Secondly, the comparison with other smaller cities (Titabor) or Indore (a larger metropolitan area) shows that public engagement is the key to transforming solid waste management. While the Swachh Bharat Mission (SBM) has raised awareness about cleanliness, the link between cleaning and dumping at a dump site on the one hand and managing solid waste sustainably and effectively on the other, needs to be understood.

Keywords: Solid Waste Management Rules, 2016; Draft Urban Solid Waste Management Policy, 2018, decentralised approach

1. Introduction

With the start of the COVID pandemic, the issue of solid waste management has been a subject of relevance. The wave of COVID has made humanity realise the need for not just human cleanliness and hygiene but also the cleanliness of its surrounding area. There has been significant impact of COVID-19 in the waste recycling, medical waste management, and the composition of littered waste (Yousefi, 2021). This makes the study of the handling of solid waste even more important than before. The term Solid waste management encompasses the process of collecting, transporting, treating, analysing, and finally disposing of solid waste. For the seamless flow of the entire process, there needs to be proper regulations and guidelines that must be followed.

Globally, waste generation rates are rising (Pavithra, K.M, 2021). According to World Bank estimates, the world generated 2.24 billion tonnes of solid waste in 2020 or 0.79 kilograms per person per day (World Bank, 2022). By 2050, waste generation is expected to increase by 73% from 2020 levels to 3.88 billion tonnes due to rapid population growth and urbanisation (World Bank, 2022). Developing countries suffer more from unsustainable waste management than developed nations, especially the urban poor, where more than 90% of waste is disposed of in unregulated dumps or burned openly. (UN-Habitat, 2010). In addition to causing serious health and safety issues, these practices also negatively affect the environment. By generating methane, poorly managed waste contributes to climate change, promotes urban violence, and breeds disease vectors (Tohit, N.F.M et al., 2019). Further, waste not collected in a city can have an adverse environmental impact in the long run. The presence of uncollected solid waste can result in drainage systems clogging, causing unsanitary conditions, and affecting residents' health (Ejaz, N et al., 2010). Locally and globally, uncollected waste is highly damaging when it is burned in the open

According to McKinsey Global Institute (MGI) report, by 2030, more than double the 290 million people who lived in cities in 2001 will live in cities. (Mckinsey, 2010). Rapid urbanisation will force Indian cities to restructure their public utility facilities in a way to accommodate the interest of the urban population. The solid waste generated by urban households and businesses must be regularly collected, recycled, or treated and disposed of properly to maintain healthy and sanitary living conditions. Cities are increasingly faced with solid waste management challenges due to rapid/ unplanned urbanisation, a lack of technical and financial capacity, or a low priority given to solid waste management (UN-Habitat, 2018). The generation of municipal solid waste is expected to double by 2025 as urbanization, and population growth continue (Berg, N. 2012).

All Urban Local Bodies are responsible for Solid Waste Management activities within their jurisdictions pursuant to the Solid Waste Management Rules, 2016. Guwahati Municipal Corporation (GMC) is responsible for Solid Waste Management in the Guwahati Municipal Area under the Guwahati Development Department (GDD). According to the GMC, Guwahati generates a total waste of 550 TPD (Tonnes per day) (GMC, 2022). To handle this total amount of waste, GMC employs its wide network of Primary and Secondary Collection systems to handle its municipal solid waste. Primary Collection involves the collection of solid waste from the house to house and from commercial establishments. In each of GMC's 31 wards

(Guwahati is divided into 31 wards), one NGO is assigned to perform Primary Collection and Street Sweeping (GMC, 2022). A secondary collection bin is located nearby where the NGOs deposit the waste they collect. The entire process of the Primary Collection is monitored by Junior Technical Officer's (JTO's) and Sanitary Supervisors of the ward.

According to the notification of user charges issued by the Corporation from time to time, the NGOs are also responsible for collecting monthly User Charges from households and commercial establishments. With a fleet of modern compactors, tippers, etc., GMC handles Secondary Collection and Transportation (C&T). In addition, Zonal engineers, JTOs and Supervisors are responsible for monitoring their activity. Various modern vehicles are used for C&T, including Compactor vehicles, Mobile Compactors, Transfer Stations, etc. In Guwahati, two transfer stations are currently operational. Finally, the waste is dumped in West Boragaon area, which is 12 km away from the city centre. The Assam Government has earmarked it for the purpose of Municipal Solid Waste Management site. According to GMC, Boragaon receives approximately 85-90 % of waste each day (GMC, 2022). From this data, it becomes evident that Guwahati has been dumping its waste in the outskirts of the city rather than processing/ recycling it. This becomes a major issue of concern as landfills or 'garbage dumpsites' (as they can be referred to in this instance) becomes unsustainable in the long run. It has major environmental-health-economic- ecological ramifications for the entire area.

This paper examines the fault-lines in the GMC's handling of solid waste. During this process, it highlights the deficiencies plaguing the system entirely. In interviews with experts in Municipal Solid Waste (MSW) and non-profits handling MSW, several lacunae and inefficiencies were uncovered. This paper aims to highlight several inefficiencies in the system so that loopholes can be plugged in, and municipal solid waste can be better managed. This paper aims to understand the root causes of the mismanagement of solid waste in Guwahati, and not just treat the symptoms. As an original piece of work, the purpose of this paper is to explore the system holistically rather than piecemeal.

The paper is organised into four sections and concludes with a conclusion. Section 1 compares and analyses Swachh Bharat Mission (SBM) and Solid Waste Management (SWM) practices. As a result, a framework for understanding the topic will be laid. The content of Sections 2 (a) and (b) discuss the GMC's own shortcomings as well as the current situation regarding waste management. Hence, it will be easier to comprehend how solid waste is handled. For this section, MSW experts and NGOs involved were interviewed, and their experiences were noted. To understand the topic, it is imperative to note their findings. Sections 3 (a) (b) and (c) discuss how GMC implemented and followed the Municipal Solid Waste Management Rules, 2016. This section compares Assam's draft Urban Solid Waste Management Policy, 2018, with the SWM, Rules 2016. The purpose of this study is to determine whether Guwahati has complied with the SWM Rules, 2016. In section 4, we discuss how Guwahati can become a smarter city by better managing municipal solid waste. As a conclusion, the paper recommends a deeper restructuring of the entire system (i.e., GMC) to address solid waste. If not, the measures taken so far will only be temporary and not sustainable.

2. Research Questions

Through this paper there has been an attempt to understand the following questions:

1. What are the current lacunas/gaps in the management of the waste management system in Guwahati?
 - a. How successful has Guwahati Municipal Corporation (GMC) been in trying to achieve the objective of Solid Waste Management Rules 2016?
 - b. How is the present solid waste management policy impacting the lives of the people living in Guwahati and adjoining areas?
 - c. What was the role of the Swachh Bharat Mission (SBM) in driving the Solid Waste Management practices in India?
2. What are the best practices that can be incorporated into the current system so that there can be a sustainable change in solid waste management practices and behaviour in Guwahati?

3. Literature Review

Several papers have been published on this subject. To gain a better understanding of solid waste management, several papers were studied. Both Pradhan, et al. (2012) and Ghatak, T.K. (2016) papers addressed the issue of solid waste management, the issue of turning waste into energy, and the importance of integrated solid waste management. To understand the impacts of dumpsite toxins on the food chain, health and environment, Karak, T et al (2013) was reviewed. Sarmah, et al. (2015) helped to understand Guwahati's waste generation and the need for proper disposal.

Taking a macro-level view, Neog, M (2020) explores the prevailing situation in Dibrugarh (Assam). Gogoi L et al (2013), a primary research paper gave intricate details about the waste management activities in Guwahati and the challenges facing the city. Through primary research, the paper was able to highlight the lacunas in the current operation of the solid waste management system in Guwahati.

To understand the interconnectedness of Swachh Bharat Mission (SBM) and Solid Waste Management (SWM) practices, the NITI Aayog (2021) paper '*Waste- Wise Cities: Best practices in municipal solid waste management*' highlighted the transformation from SBM 1.0 to SBM 2.0. Through various instances in the paper, it was able to demonstrate the best practices in various parts of the country including Mysuru, Indore etc. Further, it was able to highlight the importance of proper planning and stakeholder participation for handling solid waste effectively.

Meanwhile, Chakraborty, et al (2014) highlights various instances of waste being used productively. They examine the apparent demand and supply mismatch between the existing capacity to make compost and the inability to get enough waste to convert it into compost. They also make the case for the use of Geo-cells to construct roads. Despite the inability to handle waste efficiently and economically, this paper demonstrates the potential for solid waste if the resources are utilised effectively. To understand the right technology adoption,

the need to understand the composition of the waste becomes critical. Therefore, Singhal, A. et al. (2021) & Kashyap et al. (2010) demonstrated better adoption of waste-to-energy treatment.

To use waste to generate energy (such as biogas), Kaushik, K et al & Subramani, T et al (2014) focused on the sustainability of a decentralised approach to urban waste management in urban India. Furthermore, the paper by Sarma, P et al (2015) made appropriate policy recommendations for a holistic and sustainable solution to the SWM crisis. Singh, S (2020) paper "*Solid Waste Management in Urban India: Imperatives for Improvement*" dissects the challenges of improper solid waste management practices in urban India and offers recommendations to solve this myriad challenge. The paper suggests that citizen participation in source segregation is vital, as the author believes that community awareness will contribute a long way in creating sustainable practices.

Lastly, the CAG report (2016) was vital as it helped highlight the legal shortcomings and mismanagement in handling the GMC and Assam State Pollution Control Board. A lack of proper data on solid waste management and its handling in Guwahati, especially on its collection and categorization, makes determining the correct strategy difficult. Nonetheless, the papers cited above have contributed to understanding the inconsistencies in solid waste management.

4. Methodology

For the study of solid waste management, extensive data has been gathered through both primary and secondary sources. The primary data was gathered through interviews with NGOs like Midway Journey (an NGO in Guwahati working specifically on solid waste management) and several workers on the ground (namely- Ram Das, Chitu Nath).

Most of the government information was observed from the government website (www.gmc.assam.gov.in) And talk with the Guwahati Municipal Commissioner (GMC) Shri Devashish Sharma and the Chief GMC Engineer, Shri Simanta Barua.

The solid management crisis was better understood through other online sources such as Google Scholar, Economic and Political Weekly (EPW), Down to Earth articles, local newsprint and journals.

It was necessary to discuss the ground realities extensively with solid waste management experts like Dr Sanjay Gupta and solid waste management professionals (such as Shirshendu Shekhar Das) in order to understand the entire cycle of solid waste management, its fault lines, and its challenges, right from the beginning to the end. Sanjay Gupta's tireless work for over 20 years and his vast knowledge were valuable for this research project.

5. Analysis

5.1. Interconnectedness between the Swachh Bharat Mission (SBM) and the Solid Waste Management (SWM) Practices

As the discussion about solid waste management progresses, there is an ongoing discussion whether Swachh Bharat Mission acted as a boost to Solid Waste Management practices. On October 2, 2014, SBM (SBM) was flagged off, marking a paradigm shift in Indian SWM. As part of SBM, SWM is one of the six components that cost over 10,600 million USD over 5 years in 4,041 towns (Ministry of Jal Shakti, 2021). To ensure the proper disposal of municipal solid waste in all 83,000 wards in urban areas by 2019, SBM has stated one of its objectives as door-to-door garbage collection. To generate awareness and encourage citizen participation, Swachh Bharat citizen communities were formed. The various Swachh Bharat programs have reached over 335,000 citizens over the past 12 months (pib, 2021). This was one of the most important policies driving solid waste management practices in the country. The Government felt that a paradigm shift would be brought about by including solid waste management as one of its core components in SBM.

As a result of the flagship Swachh Bharat Mission, India's waste management sector has gained tremendous attention in recent years. In some way or another, the mission touched every citizen and became one of the most extensive cleanliness drives in history. Before the start of the SBM, there was a lack of awareness among citizens to keep their environment clean. It was SBM which created the much-needed awareness and gave SWM the much-required boost it needed to take the initiative forward. Our waste processing rate has increased from 18 percent in 2014 to 70 percent in 2021 (NITI Aayog, 2021). A coordinated government effort at all levels and massive citizen participation in the movement resulted in a new era of cleanliness in the country.

Sustainable waste management is being strengthened with the launch of Swachh Bharat Mission (Urban) 2.0, launched in 2021. The second phase aims to eliminate garbage from cities by improving waste source segregation, 100% door-to-door collection, and complete waste remediation. As urbanisation expands, the pressure to deliver quality urban service delivery on ULBs/authorities continues to rise.

With a budget outlay of Rs 1,41,600 cr, the SBM 2.0 aims to complete the task set forth by the launch of SBM 1.0. (MoHUA, 2021) With partnership among the three levels of the government, the aim is to ensure that all cities are 'Garbage Free' and 'Water Secure'. This will help the government achieve its SDG (Sustainable Development Goals) target of improving quality of life. Since, SBM U-2.0 deals with SWM, therefore it encompasses all the components including source segregation of solid waste, scientifically processing of all types of municipal solid waste, remediation of legacy dumpsites and adopting the principles of the 3R's (reduce, reuse, and recycle) to effectively handle solid waste management. There is a need to take forward the mission, as over 3,300 cities and over 950 cities are being certified ODF+ and ODF++ (pib, 2021). Along with the active participation of over 50% of India's urban population, this has generated the right mindset for the next phase. Citizens are practising

source segregation of garbage in 85 percent of wards, and 100% door-to-door rubbish collection in 97 per cent of wards has helped with this (CSE, 2021). More significantly, the Mission has significantly improved the lives of sanitation employees and undocumented garbage workers. With this, it becomes evident that SBM has been both complimentary and supplementary to the practice of SWM. To achieve the goal of zero waste management, we must capitalise on the momentum built up during the mission's initial phase.

For SWM, SBM provided the necessary paradigm shift required to kick-start the next phase of the SBM 2.0 initiatives. A more comprehensive network of stakeholders should be involved to make the processes more inclusive, which is necessary for sustainable Solid Waste Management (SWM). The disclosure of the second stage of the Mission will advance the mainstreaming of circular economy components in India's waste management industry.

Like any other city, Guwahati has made some progress, but not enough to encourage the required change in the behaviour of the individuals. According to the Sentinel Newspaper of Assam, the reporter narrates the abysmal condition of the roadsides strewn with garbage dumps even after several years of the SBM. The article claims of the Assam government on becoming ODF while on the ground noting the utter apathy of the government about SWM (The Sentinel, 2019).

5.2. Challenges and Loopholes in the management of the Guwahati Municipal Corporation (GMC)

As discussed, the handling of the solid waste management is dealt exclusively by the Urban Local Bodies (ULB's), as envisaged in the Municipal Solid waste Management Rules, 2016., to understand whether Solid waste Management has been successful, it is important to note the functioning of the GMC (in the case of Guwahati – Metro). This will help provide an insight into the handling / management of the municipal solid waste in Guwahati.

Approximately 44 lakh people live in Assam, 963429 of whom fall under the GMC (as per the 2011 census), and they generate around 550 MMT (Guwahati Municipal Corporation, 2022) per day. Rapid population growth in conjunction with the rise in waste generation has led to an increase in waste of 3% per year (Mubina, A, 2021). Although the Assam Government has tried to take some incremental steps on its part, the measures have not been adequate in trying to change the overall urban solid waste management landscape.

Solid waste management can only be successful when the municipal structure has a properly functioning Municipal Corporation. The inefficient way in which the GMC has handled municipal solid waste can be demonstrated by the growing piles of garbage on the roadside. This is blatantly in violation of the solid waste management rules, 2016.

During the study, it was found that the department has sufficient resources, but they are not being utilized effectively due to a lack of need assessments. According to Mr. Sanjay (SWM expert), the GMC brought in more than Rs.40 crore worth of equipment (compost machine) that will never be used. Equipment has been misallocated to municipalities due to a lack of coordination and foresight when planning. Instead of educating Safai Karamcharis, Rs 30 lakhs were spent on hoardings. According to experts, funds are only used to distribute to municipalities, not actually to make a difference. There are more than 70 tricycles that have

rusted since they were sent to Tinsukia a year ago. Because every municipality has different needs, a one-size-fits-all approach cannot be applied. While the municipality brought the equipment after studying its needs, it has yet to be fully utilized. By considering a local body's specific needs, it is imperative to customise planning. Time and again, top-down approaches have been observed rather than bottom-up approaches when framing policies. All three of Guwahati's compost plants (Bhangagarh, Chatribari, and waste to energy) were inactive. Additionally, more than 5 tons of wastes are generated in Beltola's vegetable market every day, which can be composted easily. However, due to a lack of proper planning, the compost continues to be sent to the dump site. In addition, segregation is not possible in most areas due to a lack of appropriate vehicles. A bifurcated body in the vehicle enables proper segregation, thereby making the collection of waste easier. But the purchase of such vehicles is not common in practice.

A lack of information regarding waste generation and its subcategories can cause problems. A poor data collection process renders the whole planning process meaningless. An accurate estimate of how much waste is generated and how it is categorised is lacking. In 2013, approximately 626.84 TPD of waste was generated, according to a study conducted by Dr Lakhimi Gogoi. This data, however, contradicts the GMC's official statement that waste generation will be 550 TPD (approximately) in 2022. It was previously required that trucks, dumpers, and trains be weighed before they could be dumped in Boragaon. Among its constituents are silted from drains, construction waste, industrial waste, and waste from commercial and residential areas. It is challenging to categorise solid waste properly when all solid waste is integrated during collection. It is tough for the city to plan how to handle waste when the data is inaccurate.

Any civic issue must be resolved with citizen participation. In the early 1970s, European municipal workers demonstrated appropriate waste behaviour in public. Only after successful pilot-program demonstrations were these cities able to dramatically improve their solid waste management. No public demonstrations about appropriate waste behavior have been organized in Guwahati. The government has taken steps to raise awareness, but they have yet to have much impact. Further, the flawed commission system, which provides incentives for waste generation instead of mitigating it, has generated more waste than before.

The system will continue to suffer from problems without strong accountability and enforcement mechanisms. Based on the above, it becomes clear that the Municipality has been highly ineffective in managing its internal working. Decisions taken by the GMC will have no value unless it transforms and revamps its functioning.

5.3. Solid waste management practices in Guwahati city

Among the most significant loopholes found is in the collection of 'accurate data'. A field study conducted by Dr Lakhimi Gogoi found that Guwahati generates 626.84 tons of waste per day (within its jurisdiction) (Gogoi, 2013). The data is way above the 550 tons/day predicted by the GMC. The average household produces 2.66 kg of waste every day, according to a 2013 study. The waste generated by markets, commercial establishments, hotels, restaurants, schools, and institutions each day is 129.59 tons. Despite the influx of construction and demolition activities in the city, waste generation is relatively low. This is because most of the debris is used for the filling of low areas. Despite the study being

conducted in 2013, Guwahati still lacks an efficient sewerage system. Throughout the city, there are open drains displaying a mixture of solid wastes and silts.

Table 1: Total Quantity of Solid Waste Generated in Guwahati

Sr. No.	Source	Unit Generate/Day	Total waste (TPD) Tonnes per day
1.	Domestic Sources	2.66 kg/household	490.64
2.	Markets	3.0 Kg/unit	4.72
3.	Commercial Establishments	1.62 Kg/ unit	62.97
4.	Hotels & Restaurants	83.89 kg/ unit	11.4
5.	Schools & Institutions	2.5 kg/Unit	2.5
6.	Streets Sweeping and Drain Cleanings	-	48.00
7.	Others	-	6.61
Total waste generated			626.84

Source: Data collected from the primary survey of Dr Lakhmi Gogoi and Meenu Tanwar, 2012

From Table 1, it becomes apparent that more than 90% is organic in nature, originating from the household sector. In the paper “Solid Waste Disposal and Guwahati City – An Analysis of Environmental Pollution and Health Risk”- the authors states that Guwahati continues to struggle in managing a proper disposal of the solid waste. According to the CAG, Guwahati has no sewage treatment plant (STP) (CAG, Report No. 3 of 2016, Government of Assam). Along with no STP, there are no sewerage connecting systems. The entire city relies, practically, on underground septic tanks to handle its sewage, which threatens the quality of the groundwater (Jamwal, 2020). Earlier population in Guwahati was sparse, so it could be adequately managed. But now with rapid rise in density of population, increased urbanization has resulted in generation of increased waste per unit area. At present, the current dumpsite is in Boragaon, which is next to the Deepor Beel (Ramsar Wetland). The CAG report of 2016 clearly noted that the location of the dumpsite near the Deepor beel ‘posed a severe threat to the fragile ecosystem of the lake’ (CAG report 2016, para 5.2). In its full report, the CAG

blames the mismanagement of the GMC and the inadequate functioning of the PCBA (Pollution Control Board of Assam) in effectively discharging its duties.

Local people are now at risk for health problems due to the pollution of air and water from municipal trucks carrying waste to the dumpsite without any processing. From the papers of Dr Lakhmi, it was an important observation that the Guwahati Municipal Corporation (GMC) is not directly involved in recycling municipal solid waste (Lakhmi, 2013). However, the municipality is responsible for coordinating the full range of waste collection and disposal services in Guwahati city. Although every effort is made, it is still impossible to provide adequate services in all areas except those with privilege. The final dumpsites do not always receive all this waste due to either resource constraints or inefficient infrastructure. As a result, the GMC continues to face serious waste governance challenges.

Guwahati has consistently generated more municipal solid waste over the years. Several factors have contributed to this, such as rapid population growth, mass migration from rural areas to urban areas, floating populations, and increased economic activity. In Guwahati, citizens dispose of municipal waste in a manner that leads to air, water, and land pollution (The Sentinel, 2019). Considering the severity of the issue, certain interventions are needed in Guwahati to improve living conditions.

Citizen groups and non-governmental organizations have played a critical role in awakening citizens and collaborating with government to address SWM challenges. Midway Journey was founded in Guwahati by young volunteers (Sheershendhu Shekhar) to empower citizens in the handling of SWM cycles. Recycling/segregation of dry and wet waste, and composting has been promoted through initiatives such as the Power of 300, clean-up drives, and online training. An SWM expert, Dr Sanjay Gupta, works at Skat Consulting and has started his own NGO to transform Assam's SWM practices. Having worked abroad, he returned to Assam, India, to bring about positive change. Since he arrived, he has been working relentlessly on this issue. In collaboration with the ULB of Titabor, he turned Titabor (a small town on Assam's outskirts) into Assam's first zero-waste town. It was possible to revolutionize solid waste management through micro-planning. The NGO conducted a complete value chain analysis with the local body. It was possible for Titabor to ensure source segregation through door-to-door collections. Besides composting organic waste, it also sent plastics and other non-recyclables to cement factories. By enforcing penalties for violations and providing strong leadership under the chairperson, the NGO collaborated effectively with the local body to create the first zero-waste town in Assam. To fully recover the legacy dumpsite, a bio-mining project has been established (Guwahati Times, 2020). Eventually, the town will be able to process all its waste this way.

5.4. GMC's commitment in achieving the Solid Waste Management Rules, 2016: How far is it?

Solid waste generation is further aggravated by rapid urbanization and a growing population (Mckinsey, 2016). In order to maintain residents' health and well-being, solid waste must be properly managed. In most developing cities, including Guwahati, garbage is left uncollected every day (Gogoi, 2013). This not only spreads disease, clogs drains, and damages infrastructure, but also serves as a breeding ground for pests. The most vulnerable

areas are informal settlements, where waste collection is scarce or nonexistent, and areas adjacent to open dumps (CSE, 2016). Having such a debilitating condition exposes one to disease and lowers one's quality of life. The management of waste is crucial to addressing such challenges.

Considering the dangers associated with improper solid waste management, proper management of these wastes becomes increasingly important. Approximately 90% of municipal solid wastes (MSW) are disposed of unscientifically in open dumps and landfills, harming the environment (Singh, 2020). In India, 65 million tonnes of waste are generated annually; of which 62 million tonnes are municipal solid waste (MSW), which includes organic waste, paper, plastic, wood, and glass (MoHUA, 2020). The average city collects 75-80% of its waste, and only 22-28% of it is treated. As for the remainder, it is discarded in landfills or dump yards (Kumar, 2020). By 2025, MSW generated will amount to 436 million tonnes, compared with 165 million tonnes by 2031. There is no doubt that the problem is grave, as evidenced by the astonishing figures. The situation in Guwahati remains grim as 85-90% of waste is disposed of in landfills (GMC, 2022). In Assam, there is currently no processing plant (CAG, 2016). The lack of these basic services indicates the abysmal state of the city.

Although it is apparent from the discussion above that Guwahati faces several difficulties. It's crucial to examine whether Guwahati has adhered properly to the SWM, Rules 2016. If not, how far along are we in our efforts to fulfil our commitments? Table 2 highlights the loopholes in the implementation of the SWM, Rules 2016.

Table 2: Provisions and Loopholes in the Implementation of the SWM, Rules 2016

Provisions of the SWM, Rules, 2016	Whether Guwahati is Compliant/or not??
<p>Segregation of waste at source</p> <p>Into three categories- Bio-degradable, non-bio-degradable and domestic hazardous waste</p> <p>Construction waste to be separately collected (as per Construction and Demolition Waste Management Rules, 2016).</p>	<p>The GMC does not have a strict directive regarding the separation of waste at the source. The GMC does not have a strict directive to separate waste at the source. When waste is collected by waste collectors, it is often mixed with other waste even though it should be sorted at the source.</p> <ul style="list-style-type: none"> • All waste is mixed, even if separately collected. • Lack of awareness among residents.
<p>Charging of user fee</p> <p>Per the rules, local authorities can decide how to collect user fees from waste generators. Both the 'user fee' (collection from waste generators) and the 'spot fine' (for littering and non-segregation of waste) will be decided by the authorities.</p>	<p>Despite the authorities charging the bare minimum fee in Guwahati (Rs.30 per month), neither the waste generators nor the waste collectors change their behaviour.</p> <ul style="list-style-type: none"> • According to GMC sources, reveal that NGOs involved in garbage collection were not able to collect 100% of the fees. Due to this and the low fees charged, waste collectors are not incentivized to do a better job. As a result, duties are not performed regularly. Guwahati residents have complained about the

	<p>irregularity with which these NGOs continue to perform their duties (Guwahatiplus.com). Because waste is not collected daily, residents dump waste along the roadside, causing unpleasant odours and sight. Guwahati is dotted with waste dumps all over the city.</p>
<p>Waste processing and treatment</p> <p>As per the guidelines, biodegradable waste should be processed, treated, and disposed of within the premises using bio-methanation or composting. Waste collectors will collect the remaining waste after the entire process has been completed.</p>	<p>As the waste in Guwahati is mixed and there is no mandate to separate it, there is little waste processing at the micro level. A granular level of processing is not possible with mixed waste due to its difficulty in processing. Thus, defeating the very purpose of setting up the compost plant.</p>
<p>Involvement of informal workers</p> <p>The rules mandate the involvement of informal workers (rag pickers/ <i>kabadiwalas</i>) into the formal sector by the State government into the solid waste management system.</p>	<p>For the fulfillment of this provision, no step as such has been taken by the GMC so far.</p> <ul style="list-style-type: none"> For the success of the solid waste management system, the involvement of the rag pickers becomes necessary. It is a known fact that in developing countries, such as India, informal waste management activities play a significant role in waste collection and recycling. According to the Centre for Science & Environment (CSE), as of 2008, the informal sector in India was reported to be recycling 30–60 per cent of the paper and cardboard, 50–80 per cent of the plastic and nearly 100 per cent of the glass bottles (CSE, 2021). Although unorganized, this industry contributes to the circular economy and helps achieve UN sustainable development goals
<p>Guidelines for establishing a landfill</p> <p>Non-recyclable waste with a calorific value of more than 1500 K/cal/kg shall not be disposed of in a landfill. Waste of such nature can be re-used either through recycling or by using in waste energy treatment plants (Refuse Derived Fuel). Further, the criteria to set up a landfill requires the site to be 200 meters away from a pond, 100 meters away from a river, 500 meters away from highways, public parks, and 20 km away from an airport.</p>	<p>Although DeeporBeel was declared a Ramsar site in 2002, dumping of waste started near the wetland in 2006. Along with the Wetland Rules, 2010, the SWM rules 2016, pollution norms have been blatantly violated by the GMC by setting up the Boragaon landfill (which shares a boundary with the Ramsar site, DeeporBeel) (CAG report, 2016). According to a study by Sonali Gohain & Sabitry Bordoloi on the impact of municipal solid waste disposal on the surface water and sediment of adjoining wetland Deepor Beel in Guwahati, it was found that MSW dump in the vicinity of the Deepor Beel has led to sediment indicating a Pollution load index (PLI) of ‘progressively deteriorating’ condition.</p>

<p>Promotion of Waste to Energy Plant</p> <p>Among the most controversial aspects of the Solid Waste Management Rules, 2016 is their push to promote waste to energy plants. As per the rules, non-recyclable waste with a calorific value of 1500 kcal/kg or more can be used to generate energy either through RDF that must not be disposed of in landfills or through giving away as feedstock for preparing refuse-derived fuel. High calorific waste shall be used for co-processing in cement or thermal power plants. (Down to Earth, 2016)</p>	<p>From the provision, it becomes clear, that the Waste to energy plant should be adopted after exhausting all the possible scientific methods of processing the waste.</p> <ul style="list-style-type: none"> • However, in the case of Guwahati, the GMC continues to operate with mixed waste, making it hard for it to be a raw material for the waste to energy plant. • Although the Commissioner of GMC has made it clear there is an intention to set up an incineration plant shortly. Currently, due to the low calorific value of waste in Guwahati along with the polluting nature of the WTE, setting up such plants becomes controversial.
<p>Authorisation letter required to operate dumpsite</p> <p>The Rule mandates that the municipal authorities, in this case, the GMC needs to obtain authorization letters from the State Pollution Control Board (SPCB) to operate the dumping site.</p>	<p>According to the GMC Commissioner, 10% of the current solid waste is being dumped at Chandrapur, without having the necessary authorisation from the SPCB to do so (Times of India, 2021). This is in gross violation of the Rules.</p>
<p>Waste sent to the landfills</p> <p>In 2016, the Rules advised waste generators to segregate their waste into three categories: degradable, non-biodegradable and household - to reduce landfill waste.</p>	<p>Despite this mandate, everything from construction waste to heavy metals is being piled up at Boragaon, and they are continuing to pile up in Chandrapur as well, without any pre-treatment.</p>

Source: Based on Solid Waste Management Rules, 2016, order of the National Green Tribunal (NGT) regarding Deepor Beel protection, 2020 and expert reviews.

All these violations indicate that although the rules have been in force since 2016, there continues to be blatant disregard by the GMC on all fronts. Based on the above, source segregation cannot be guaranteed by the GMC. If segregation doesn't happen, then all other provisions, including waste to energy, composting, etc., cannot be adhered to. And thus, gets defeated.

5.5. Draft Assam Solid Waste Management Policy, 2018

Following the Solid Waste Management Policy, 2016, the MoUD will assist States in formulating state policies based on the national solid waste management policy strategies. Accordingly, the Assam government released the Draft Urban Solid Waste Management Policy in 2018. Using this framework, local governments will be able to manage solid waste in the state scientifically and economically. Rather than creating landfills, the task force involved in the formulation of the policy tried to utilize waste to create wealth.

The Draft contains the following provisions: (a) Emphasis on waste reduction, reuse, recycling, and recovery. To minimize the likelihood of waste being sent to landfills, waste resources have been utilized to the maximum extent possible (b) the relationship between haphazard solid waste management and health and environmental issues is understood (c) guidelines regarding the integration of informal waste collectors into waste management systems are established (d) ensure capacity building of local bodies so that they can efficiently segregate, process and transport waste at source. This will help them manage waste better. (e) The importance of segregated solid waste is stressed. (f) Collection of segregated solid waste from all households, including slums. By removing waste from slum areas, diseases will be prevented from spreading. As a result, the living standards of the people in such areas will be further improved (g) to ensure that there is a daily collection of waste in market areas, which is then processed either in a decentralized compost plant or a bio methanation plant (h) the framework was designed to be decentralized. On-site processing has been the focus. Waste will not be transported to a distant site for processing (i) community participation is crucial to decentralize waste management. By promoting home composting, kitchen waste can be processed at home (j) promoting composting in all areas maintained by the local authority (k) encouraging recycling in the informal waste sector (l) recognizing the importance of Urban Local Bodies (ULB's) and empowering/supporting them to act as focal points for the successful management of solid waste in the State (m) The principle of "Polluter pays" shall be adopted to ensure that those responsible for damage to the environment shall pay for the consequences that ensue.

As a result of door-to-door collection throughout the city as well as engagement with stakeholders, the 2018 Draft Policy on Urban Solid Waste Management has all the ingredients to revolutionize the way solid waste is managed in Guwahati. Although it has been drafted for three years, it has yet to be finalised.

5.6. Comparison between the Draft Assam Solid Waste Management Policy, 2018 and the SWM Rules, 2016

As the Draft Assam Urban Solid Waste Management Policy 2018 derives from the Solid Waste Management Rules, 2016, its structure and content are similar. Keeping in mind the context, the SWM Rules, 2016 are supplemented by the Draft Urban Solid Waste Management Policy, 2018. From policy formulation to policy implementation, Guwahati needs to engage stakeholders at every stage. A successful policy requires mass citizen participation because, without the cooperation of citizens, it cannot succeed. As part of the draft ASWM policy, the draft touches on concepts such as "Polluter's pay", highlighting the framework that should guide the policy. By doing so, a national set of objectives gets a regional touch.

5.7. Waste Management Challenges in Guwahati, India

Based on the above analysis, it becomes evident that for Guwahati to successfully handle solid waste management effectively, it needs to adopt certain best practices while better understanding its local context.

To create a sustainable solid waste management system, there is need to firstly overhaul the internal workings of Guwahati Municipal Corporation (GMC). GMC's leadership, including the Commissioner and Chairman, must have a vision for the city. It is essential to have a roadmap for what needs to be accomplished and how to accomplish it. Like Indore, where the focus is on doing better than the last time (even after being ranked 1, GMC leadership should have the same mindset. It is impossible to achieve anything without a vision. Additionally, the prevalent incentive structure should be changed. Instead of making waste generating activity a 'commission-based system', such activity should be changed to incentivise reduce, reuse, and recycle. Secondly, GMC needs to collect accurate data about waste generation and its sub categorization. A proper plan cannot be implemented without the required data. The collection of data should be based on city-wide comprehensive primary research that includes both the total amount of waste generated and the composition of the waste generated.

Thirdly, public participation is crucial to the success of this initiative. A variety of initiatives should be used to generate mass awareness, such as radio jingles, mandatory inclusion of civic studies in school curriculums, regular TV advertisements on regional news channels, FM radio, and popular songs. To educate the public about the importance of segregating waste, the local government should work closely with them. The public will be more aware of their behaviour if they are aware of the entire value chain from 'waste' to 'wealth'. All subsequent parts are worthless without segregation. Fourthly, the GMC should establish a strong enforcement mechanism to ensure that those who violate the SWM Rules, of 2016 are severely punished. GPS-enabled tracking systems should be installed on all vehicles used in the collection and transportation of segregated waste to implement a carrot-and-stick approach. Fifthly, The GMC should ensure that informal workers are formally included into the solid waste management activities. Formalizing informal sector will go a long way in giving dignity, livelihood and ensuring better SWM activities. Sixthly, Like Mysuru, the GMC should implement a decentralized approach through on-site home composting, community composting, a bio-gas plant for organic waste, and a Material Recover Facility (MRF) centre in Fancy bazaar where there is an abundance of plastic, cardboard, and recyclable material generation. In addition, since majority of the waste in Guwahati is organic (60-70%), decentralised composting can be done as practiced in Mysuru. By reducing the organic waste load, and recycling the plastics, there can be significant reduction in the waste ultimately landing in the landfill. Seventhly, GMC requires a strong sewage treatment plant and a proper connection between the main sewage plant and all households. If this does not happen, all sewage will continue to be dumped into the Brahmaputra River (CAG report, 2015). Eighthly, there needs to be a pilot project demonstration of SWM practice with a decentralised approach, so that the efficacy of the project can be proved before scaling it up city wide. For instance, by taking 2-3 wards and adopting the best practices, from which lessons can be learnt and scaled all over the city. Lastly, Guwahati should move to a completely integrated solid waste management (ISWM) system. This will help bring in better coordination regarding waste reduction, reuse and recycle.

Most importantly, GMC needs to fully implement all the provisions of the SWM Rules 2016. These steps will drastically change waste management practices in Guwahati, thereby ensuring an integrated solid waste management system. As a result of adding citizen

participation to the GMC's decision-making process, the GMC's decision-making process will be improved. With this, enlightened decisions will be made. Besides 100% segregation, 100% processing will boost the circular economy. As a result of adopting all the above-mentioned best practices, Guwahati will not only improve its Swachh Survekshan Index ranking, but will also improve its habitability and liveability.

6. The Way Forward

Public utilities have been under tremendous pressure due to rapid urbanization and population growth. It is no different in Guwahati. In almost every city in urban India, solid waste management is the most pressing issue. According to a McKinsey report (2010), by 2030, the population of cities is expected to double. To cope with their limited capacity, cities need to step up their efforts. The Government of India sequentially planned SBM 1 and SBM 2, starting with the construction of toilets in Gramin areas. Then, a plan was drafted sequentially for SBM 2.0, which is solely focused on SWM practices. As a result of SBM 1.0, mass awareness was raised among the public. Since then, it has been called a '*Jan andolan*'. Waste treatment capacity in India was only 18% in 2014, which posed a serious threat to the environment. Compared to 2014, our waste processing rate has increased to 70% by 2021. Slowly but surely, SBM has helped boost SWM practices. As a result of the SBM, the city's cleanliness improved significantly. Although mixed waste (around 85% of total waste) was collected and dumped far off, it was not able to manage it sustainably. In Guwahati, mixed waste continued to be dumped in the West Boragaon region, instead of being processed and recycled. This dumpsite (and not landfill) is located near Deepor beel, a Ramsar site known for its pristine beauty and ecological diversity. GMC's callousness has been strongly criticized by the CAG and NGT. Along with this, GMC continues to violate almost all the Solid Waste Management Rules 2016. Unless segregation is achieved, all other provisions will be meaningless. As put forth by Dr Sanjay Gupta (SWM expert), Guwahati continues to suffer from a serious *waste governance deficit*.

While Guwahati has been dubbed a 'smart city', it struggles with basic waste management practices. The core of SWM Rules, 2016, which is 'segregation' continues to be the biggest challenge for the city. There are a variety of reasons for the lackadaisical attitude, including the slow bureaucratic structure, red-tapism, and corruption. For transformational change in the practice of waste management in Guwahati- there needs to be a fundamental re-structuring of the way the GMC functions. Unless changes are made within the functioning of the GMC, there will be little or no progress in the way solid waste management is handled in the city. Guwahati had earlier set up bio-methanation plant (which is non-functional now), without ensuring the necessary input required for processing. Such kind of flawed planning can be avoided if need assessment is done in the first place.

Instead of having a top-down approach, there needs to be a decentralised approach and a pilot project to prove its validity. Unless this is done, it will be very difficult to scale the practice all over the city. As is observed in most successful cities, like Indore, a pilot was done to prove the project's efficacy before scaling it up. Following this the structure was put in place before citizens were asked to comply. So, the right structuring of the SWM plan is vital. The Assam government released the Draft Assam Urban Solid Waste Management Policy,

2018, which is in sync with the provisions of the SWM Rules, 2016, with a contextual framework. This needs to be quickly finalised. For the successful change in SWM practice in Guwahati, strict implementation of the provisions of the SWM Rules, 2016, is crucial. Source segregation will be the key.

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