

Municipal Solid Waste Management in Dehradun and Indore: A Comparative Analysis with Legal Aspects

Jaya Agarwal^{*1} and Girijesh Kumar Singh²

ICFAI Law School, The ICFAI University, Dehradun, India

(Received 5 December, 2022; Accepted 15 February, 2023)

ABSTRACT

A rise in urban populations has necessitated the need for municipal solid waste management (MSWM). Municipal corporations and urban local authorities are legally obligated to reduce and effectively handle solid waste. The local municipality of Dehradun is experiencing numerous issues due to increased MSW output and difficulty in appropriately handling it. The paper covers several government initiatives implemented in Indore city to manage its waste better. This research will also provide a thorough understanding of legal aspects in Indore city to be enlisted in clean cities of India. Dehradun has much flexibility to enhance its position and make it the cleanest city in India. Dehradun and Indore, two tier-II Indian towns, will be the focus of this article, for comparison of waste management practices.

Key words: *Municipal solid waste management, Indore city, Solid waste management, Waste Treatment, and Management, Dehradun city*

Introduction

Solid waste management is an essential part of a city's infrastructure. The need for additional human capital grows as the city becomes increasingly urbanized. These situations are the result of every economic growth and have negative impacts on SWM. To mitigate these impacts complex, MSWM strategies are necessary. The environmental consequences of a flawed SWM system may be dire. SWM produced approximately 1.59B tons of CO₂ worldwide, accounting for around 4.9% of greenhouse gas discharge. The harm caused by improper SWM procedures worldwide is enormous. Furthermore, they hurt both macro- and micro-ecosystems. Clogged drainage systems serve as a sanctuary for germs, which may cause several illnesses. Only 19 percent of the world's garbage is recycled, reused, or composted (Sohkhlet and Nagargoje, 2020).

In India, collecting, transporting, and getting rid of MSW are all done in a wildly unsubstantiated and disorganized way. It is becoming more difficult for the government to deal with the problem of overflowing landfills in major cities due to an alarming increase in garbage being dumped mostly around towns or cities (Gupta *et al.*, 1998). Due to the improper method by which the garbage is thrown, these landfills are exceedingly difficult to recover and have significant environmental repercussions, such as groundwater contamination and global warming. It is common to burn garbage at landfill sites without incinerators or other technologies. This results in higher total suspended particles and particulate matter emissions, which may sometimes be as polluting as vehicle emissions. Solid waste recycling has remained an unorganized industry due to the lack of appropriate waste segregation procedures and educational campaigns highlighting the

(¹Research Scholar, ²Assistant Professor)

significance of waste management (Luthra, 2020). Except for a small city, the rest of the state has yet to adopt modern technology for MSW management. Despite this, the trash and recycling industry provides a significant economic boost to the country primarily because of the burgeoning global market for waste and recycled goods (Dolla and Laishram, 2020).

Dehradun and Indore are two cities in India that are part of the Smart Cities Mission, an initiative of the Indian government, and are categorized as tier II. In addition, they were also a member of Swachh Survekshan from its beginning. According to the August 2020 annual list, Indore was ranked as the cleanest city in India for the fourth consecutive year. In contrast, Dehradun was ranked 124, which is better than its previous ranking of 384 but lower than other areas in the state. The primary purpose of this study is to identify an effective and ecologically viable SWM plan for Dehradun that can be executed in comparison to Indore. The following are the key objectives of this paper:

- Examine both cities MSW management strategies
- Comparison of MSW in Dehradun and Indore municipal corporations
- Demonstrate how Indore city existing measures might be applied to the city of Dehradun to overcome its issues
- Legal and policy framework for MSWM

Current condition of MSW in Dehradun city

In recent years, the urban population of Dehradun has expanded dramatically, leading to an increase in urban waste. Since becoming the capital of the Uttarakhand province in 2001, Dehradun population has increased above 32 % (1.28M in 2001-1.69M in 2011) (Kundu, 2011). Between 2001 and 2011-12, the number of industrial units in Dehradun expanded dramatically from 247 to 3044 (DIC Dehradun, 2012). As a result, the urban area of Dehradun generates 291,8 MT of municipal waste daily (Report 2015). When it comes to disposing of municipal solid waste, there are two options: either perform some collecting and then dump at the Shishambara plant or dump here and there sites that also include hazardous materials like chemicals and manufacturing waste. Anaerobic waste decomposition activates methane emissions, which increases global warming risks (UNFCCC, 2012). This improper disposal exposes residents of local and dis-

tant towns to health risks, such as methane gas emissions (Vidush 2017). In addition, students at the nearby school had respiratory issues due to the recent dumpster fire (Mirror 2017). Residents of Shishambara have been asking the administration to shift the site elsewhere since 2017, when it shifted from Sahastradhara to Shishambara. Two separate fire incidents also occurred at the dumping site in April and May 2022.

The Bindal river water, a minor stream that flows throughout the city, has become contaminated (Vidush, 2017). In May 2018, SPECS examined water samples collected from the branches of Ganga, Bindal, Rispana, and Suswa. The study shows that the water is highly contaminated with pollutants such as Cr, Zn, Fe, Pb, Mn, oil, and grease, hazardous to land, reservoirs, living beings, marine life, farming, and domesticated. All sorts of household and industrial garbage are thrown into these waterways, contributing to a wide range of health problems in the area. Only in just two wards in Dehradun is waste segregation taking place. Harrawala and Nathuawala are the only wards that segregate waste from the point of collection, thus reducing waste generation by up to seventy percent.

Swachh Bharat Mission (SBM) and Jawahar Lal Nehru National Urban Renewal Mission (JnNURM) programs under Indian Govt. are working towards an effective SWM to attain a clean India by the 150th birth anniversary of Mahatma Gandhi (Jn NURM, 2005; Rules, 2000; SBM, 2014). Public-private partnership (PPP) is a viable method to discard SW due to the availability of an effective private industry and several successful instances of Nagpur, Chennai, and Pune populations. The introduction of PPP (GoI-ADB-PPP initiative 2011) may be an efficient solution to solve this issue since many municipalities are having financial difficulties and are unable to set up and integrate SWM on their own. Uttarakhand government, the central pollution control board, and Supreme Court have all shown their support to National Green Tribunal need for a solution to this issue in a timely way (NGT, 2015). Unsegregated garbage was collected door-to-door by a private firm and deposited at the designated landfill site at Sahastradhara, Dehradun, under the government flagship JnNURM 2005 program. Waste is deposited in one location, where it is left to decompose and release greenhouse gases, to the annoyance of the general population. Pressure groups interfered with the functioning of the private operator hired by

the Municipality as a result of dumping issues. As a result, the public has begun to demonstrate against this litter dumping and trash cans overflowing. There is much litter in dustbins since they aren't cleaned regularly.

When consumption was minimal, and things like plastic were seldom used, municipal garbage was mostly made up of biodegradable materials. Composting and direct usage as manure by farmers meant that the towns didn't have to deal with any severe issues from these waste products (Ravi and Vishnudas, 2018). Plastics and other non-biodegradable materials have become more common in manufacturing and packaging, which has resulted in a rise in the amount of these items in municipal garbage. Because of a lack of control over waste disposal techniques in suburban agricultural communities, these materials were detrimental to farmers and growers. In India, the prevailing belief is that the government is responsible for disposing of all the garbage generated by all sectors of the economy. Authorities and the environment will benefit much from the system only when society recognizes that they alone are responsible for disposing of the litter they have created. Municipal authorities must implement effective SWM, which must be done in a way that has the fewest negative implications for society. The industrialized industrial civilizations of Europe and North America have built a centralized technologically based MWMS (Ganesan, 2017).

MSW in Indore city

There are 85 wards and 19 zones in Indore. Each ward is home to an average of 6,000 people and a slew of businesses. Residential, commercial, and industrial generators may rely on the city's services to dispose of their trash. The door-to-door is utilized for households and apartments, whereas semi-bulk and bulk producers use bulk system for their collection. As a result of the implementation of these technologies, the city now has complete coverage of all wards and is able to collect the fees due from each one. Based on the quantity of garbage they produce each day, the waste producers of Indore are classed as either Domestic, Semi-Bulk, or Bulk Generators on the basis of the garbage they produce each day. There are many various classifications of garbage that are created, and each one is broken down into subcategories. Wet, Dry, and Domestic Hazardous waste generated less than 25 kg per day are separated into their respective categories. Similarly,

semi-bulk generators create between 30 kilograms and 110 kilograms of garbage per day, whereas bulk generators produce more than 60 kilograms of waste each day. Partitioned tippers known as Nigam trucks collect the household generators' separated garbage. Each chamber in a Nigam truck is designated to a certain sort of waste. According to the area and quantity of waste created, the chambers are constructed in the ratio of 50:50, 60:40, and 85:15. Waste collection trucks entering the plant for dumping purposes are initially confronted by a computerized weighbridge at each processing facility. To determine the kind of garbage, the trucks are weighed both before and after they are unloaded. All of the information regarding the garbage carried, the amount, kind, source of waste, time, and vehicle data are recorded on a receipt that is then submitted at the facility. There are material recovery facilities locations where all the dry wastes are unloaded and processed further. There have been eight high-tech, ultra-modern garbage transfer stations built by Indore Municipal Corporation (IMC) to boost its secondary collection system, which has resulted in a decrease in the secondary collection system total cost and the transportation system. Due to the fact that all of the garbage generated at the Devguradia digging area was managed, the business transformed it into a garden, constructed a perimeter wall around it, and then planted 60,000 plants in it. Residents living adjacent to the IMC formerly had to endure a miserable area with frequent fire and the emission of a foul stench, but the IMC success is an example for other Municipal Corporations to follow.

Ultimately, it was Indore citizens who made the whole system a big success. When it came to managing its MSW, Indore, like many other Indian cities, was confronted with an existential issue. Indore SBM was built on the basis laid by the Information, Education, and Communication department (Chauhan, Gautam, and Mishra 2020). It was possible to affect a behavioral shift in all segments of society, from the general public to company owners and industry experts, using everything from street plays and graffiti to Radio programs and social/digital media campaigns.

Policy for MSW improvement in Dehradun city

The Municipal Corporation of Dehradun, the Government of Uttarakhand, and the development authority are responsible for carrying out efficient SWM. The Indian government has given money to

municipal organizations, with SWM playing a pivotal role in boosting city infrastructure and quality of life. The urban development ministry carries out waste management tasks according to a set organizational framework. These departments' duties include having a well-balanced town planning strategy and offering citizens access to the minimal urban infrastructure (CDP, 2007). The Ministry must adopt the policy and provide the requisite resources for the Municipal Corporations to execute it successfully. Every municipality must strive toward efficient and scientific SWM as part of the SBM, another ambitious undertaking of the Indian government (SBM, 2017).

Draft SWM Strategic Plan Prepared by Department of Urban Development (MoUD, 2015) to Offer Advice for improvement. Strong recommendations on the use of the option of waste to energy conversion were made by one research (Kalyani and Pandey, 2014). In research they did in four Indian cities, the Confederation of Indian Industry (CII) produced suggestions on using incinerators (CII, 2017). Another research focused on the issues with Dehradun waste management and placed special emphasis on raising public knowledge of trash management (Vidush, 2017). Another research used supervised artificial neural networks and non-linear autoregressive neural networks to project solid waste generation in the Uttarakhand city of Dehradun (Saini, *et al.*, 2017). A consultant created a DPR for the Urban Development Directorate with recommendations for the budget, the implementation strategy, and the sustainability of Dehradun waste management (Global, 2008). Another research suggested a user-friendly expert system for managing Dehradun solid waste (JN, 2013). Most research focused on the environmentally friendly disposal of municipal garbage via recycling and waste-to-energy conversion. These have been used in several settings, particularly South Korea (Ryu, 2010). However, doing so would involve significant upfront construction expenditures (CAPEX) and ongoing operating expenditures (OPEX), and the financial situation of municipal corporations would preclude doing so (DMC, 2016). For Rs 350 crores, the town of Agra might build a waste-to-energy facility in February 2018 to handle around 500 MT of trash per day. For a waste volume of around 450 tons per day, at an estimated cost of Rs 1 billion, the Indore Municipality has designed for SWM to convert into energy infrastructure. In January 2016, the Tambaram

and Pallavaram municipalities unveiled a facility to handle 300 tons of waste per day and generate more than Rs 100 crores of electricity. Despite the Indian Govt. subsidy offer, Dehradun Municipal Corporation would not be able to fund the construction and operation of such a sort of plant on its own with designated budget allocated. Apart from financial limitations, administrative challenges like those related to human resource management prevent municipal organizations from moving forward with such projects. As a result, an integrated strategy that either receives funding from the government or uses the PPP method is required.

Integrated MSW approach as per cleanest Indore city

Indore has been declared the cleanest city in India for the fifth time in six years, consecutively, according to the Swachh Amrit Mahotsav in New Delhi conducted by MoHUA. The winners of Swachh Survekshan, 2021 will be honored by President Ram Nath Kovind. Indore was also recognized in the Safaimitra Challenge and the Five Star category in addition to this accolade. A new record for India's cleanest city is set in Indore, which takes up the Swachh Survekshan Awards 2021 for the fifth time running. The causal theories are crucial to public policy development, but the challenges stay buried until we get excited about them (Stone 1989). We also know how to employ evidence translators to effectively combine evidence and knowledge to create a policy translation (Ingold and Monaghan, 2016).

The Uttarakhand development authority is in charge of ensuring that all requirements, such as available land, ecological certification, or other legal need for the plan smooth implementation are followed.

The Dehradun Municipal Corporation must issue a 'Request for Proposal' to request bids from interested parties. The MoUD of the Government of Uttarakhand may build this PPP by providing viability gap funds to the concessionaire since this integrated system needs initial capital infrastructure (PPP Cell, 2005). The vendor would cover its costs by charging residents and other waste-collection companies user fees during operation.

It is proposed that a plan along the lines of Build, Operate and Transfer for integrated SWM of Dehradun must be implemented with an emphasis on environmentally responsible, scientifically

sound, and efficient waste management. This plan can be implemented with the following features.

- MSW from living and non-living areas of the town on a door-to-door basis, followed by transport of the waste to the place where it is either discarded or processed.
- Instructions for all construction businesses, including demolition and construction companies, on how to dispose of their waste at the area mentioned above, which is a processing facility.
- Implementing in public spaces options for garbage collection that do not involve the use of trash cans. This is a one-of-a-kind method for emptying garbage cans packed to their utmost capacity. This is easier to handle but more aesthetically pleasing and sanitary than the alternative.
- Because aerobic composting of organic waste is an essential activity, installing a facility for composting organic waste using aerobic methods is necessary. No greenhouse gases are released into the atmosphere when composting is carried out in this manner.
- The anaerobic digestion of organic waste results in the creation of biogas, which may then be utilized as a source of energy. This can create electrical output in either the form of a generator or as fuel, depending on how it is used.
- A facility that processes the garbage collected by local municipalities into a kind of energy derived from waste (RDF). RDF, which stands for refuse-derived fuel, can be used in place of coal as an appropriate fuel source for burning in industrial settings.
- A facility that generates electricity while thermally decomposing combustible solid waste into ash residue through controlled combustion. This process occurs while the plant is concurrently converting garbage into energy. Because of South Korea adoption of this technology (Kim and Jeong, 2017), the country is presently producing an amount of power comparable to 1.70MT.
- Garbage from construction and demolition projects may be processed using technologies for inert waste management to generate low-quality building materials that can be utilized in the construction of roads. These materials can also be used in other applications.
- Within the Utrakhand government, the MoUD is responsible for ensuring that all of the criteria

essential for the effective implementation of the project are satisfied. The availability of land, the resolution of any environmental problems, and the resolution of any other relevant legal challenges are some prerequisites that must be met.

Conclusion

For the past four years, Indore has held the title of the cleanest city in India. For other significant cities coping with waste management difficulties, both in its early years and now, Indore stands as a shining example. Dehradun waste issues will be resolved only by employing Kudumbashree staff and implementing a more decentralized waste management system that gathers garbage appropriately divided in each of the city wards. Since a sizable portion of the populace has chosen to handle their solid waste at home, the Corporation must collaborate with people to construct biogas plants and develop markets for the manure they produce. Dehradun lacks a landfill alternative because of its geography and political system. Technology and engineering innovation are required to recover an abandoned landfill. The windrow composting and automated compositing procedures at the Brahmapuram plant need to be improved to achieve landfill reclamation. It is essential to build waste-to-energy facilities as soon as feasible to relieve landfill strain and protect the environment from unfavorable consequences of waste management. It's time for Dehradun political and business leaders to outline their long-term strategies for developing an effective MSW management system through enacting stringent laws and implementing necessary corrective actions.

Acknowledgement

We thank the editor and anonymous reviewers for their valuable suggestions that improved the quality of this article.

Funding: There is no external funding available for this work.

Conflict of interest: The authors declare no conflict of interest.

Consent for publication: Both authors are agree to publish the work in this journal.

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