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Municipal Solid Waste Management in India

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ABSTRACT: *The majority of non-hazardous organic waste from a metropolis, town, or village that has to be collected and transported on a regular basis to a processing or disposal facility is referred to as municipal solid waste (MSW). MSW sources include individual houses, business organizations and institutions, as well as industrial sites. This paper discusses the overview of municipal management waste in India, Challenges of MSW in India and Public-private partnership in MSWM in India. The necessary circumstances for maximizing the advantages of public-private partnerships, as well as the obstacles and unnoticed character of rag-pickers, are also explored. The paper indicates that in developing nations like India, the construction of devolved solid waste processing facilities in major cities/towns and the growth of the formal recycling industrial sector are critical. This studies help in future study to understand the community hard waste organization in India.*

KEYWORDS: *Disposal, Hazardous, Municipal solid waste (MSW), Municipal, Segregation*

1. INTRODUCTION

India has the world 's 2 gdp and the world's second-largest population. Between 2001 and 2026, India's demographic is expected to increase by 36 percent, or 1.2 percent each year, from 1029 billion to 1400 million persons (Abdulredha et al., 2020). The population of rural areas is 742 million, while metropolitan areas have a census of 285 thousand. The nation's urbanisation rate has climbed from 17.6 % to 28 % in the last 50 years, with a predicted increase to 38 percent by 2026. The impressive population

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concentration in Class I countries (metropolitan cities), As seen by the growth in the numbers of metros between 23 to 35 in the previous decade, industrialized agglomerations with a population of more than 1 million are an important aspect of India's urbanization. Greater Mumbai is India's most populous metropolitan area, with a populace of 16.4 billion inhabitants, following by Calcutta and Gurgaon (Yukalang et al., 2017).

In general, the more prosperous the economy and the larger the proportion of urban people, the more solid trash is generated. In India, one of the most ignored aspects of the metropolitan system is solid waste management. In 1996, India's urban population created roughly 114,576 tonnes/day of municipal solid waste (MSW), which is expected to rise fourfold to around 440,460 tonnes/day by 2026(Izzati Abdul Rahman et al., 2020). Changes in urban population lifestyles, dietary choices, and living conditions have resulted in a massive rise in MSW generation. In India's biggest metro cities, collection effectiveness varies from 70 to 90 percent, In many smaller cities, however, collecting effectiveness is under 50%. It has been found that rubbish is dumped at public landfills in Hindu towns on the edges of town when it came to trash collection, with little regard for environmental deterioration or human health.Furthermore, financial and infrastructure restrictions, such as the shortage of land for safe garbage disposal, as well as a lack of knowledge and indifference at all levels, obstruct progress toward efficient and safe waste management in cities(Pinha & Sagawa, 2020).

1.1 Challenge of Municipal solid waste management (MSWN) in India:

- *Segregation:*

At the home level or in the communal bin, their is no systematic and methodically deliberate MSW separation. (Pinha & Sagawa, 2020). Trash processing is mostly performed by the unorganised, and garbage manufacturers seldom do it themselves. Because the disorganized industry separates just useful discarded components from wastewater in order to assure them a higher financial reversion in the recycling market, segregation and sorting occur in incredibly dangerous and dangerous circumstances,

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and the efficiency of separation is comparatively lesser. Several times during transit and disposal, the separated elements were mixed up again owing to inappropriate handling. The lack of segregation prevents trash from being properly disposed of in a scientific manner(Khandelwal et al., 2019).

- *Gathering:*

Community containers made of steel, cement, or a combination of the two are often used to collect household garbage. Also gathered are street sweepings, which are dumped in public bins. Unless specific corporate buildings or industrial units charge local officials to transfer their rubbish to a disposal site, these communal trash Several key business industries in the area employ dumpsters as well.of home waste dumping bins (Lee et al., 2016).

- *Reduce, reuse, and recycle*

This includes operations such as gathering items from garbage that may be profitably salvaged and used to create new goods. Trash is thrown into community dumpsters without being separated, making optimal recovery impossible. Rag-pickers, on the other hand, generally separated and sold recyclable materials Polymers and glassware, for example. Rag-pickers in Puducherry collect almost all recoverable material and recycle it into the material stream through recycling(Bartolozzi et al., 2018).

- *Transportation*

Bullock carts, hand rickshaws, In India, MSWM forms of transportation include dumpsters, vehicles, tractors, promos, and dumpers. Trucks with a capacity of 5–9 tons are employed in smaller cities without an effective cover system(Daskal et al., 2018). MSW is carried via With 65, 15, and 20 percent of waste carried by stationary compactors, mobile crushers rhythm, and tarpaulin-covered trucks, respectively, stationary crushers, mobile compactors/closed rhythm, and tarp trucks. Trash carrying vehicles are usually maintained at ULB-run workshops, although many of those

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institutions could barely do basic repair. It's no wonder that when these vehicles break down, the efficiency of the whole collection, transportation, and disposal process decreases significantly. In certain urban areas, such as Mumbai, there are just a few transfer stations(Akbarpour Shirazi et al., 2016).

- *Disposal:*

Almost every city, town, and hamlet in India has selected an improper MSW disposal method. The current state of MSWM application and technologies in 59 cities (Giurea et al., 2018). There was an increase in garbage creation in 40 of these cities, a decline in 7 cities, and a similar pattern in 6 cities. Despite the fact that these cities' populations grew during the decade, the author provided no evidence that there was a substantial cause for garbage creation to decrease. However, it's likely that the garbage created did not make it to the approved disposal location and ended up in the city's outskirts, along the road, in low-lying regions, in drains, in green areas, and so on.

- *Dumping in the open*

In India, MSW is often disposed of in a regular manner in low-lying areas, contravening sanitary landfilling regulations(Abdulredha et al., 2020). MSW is placed along the highways on the edges of town since almost no ULBs have sufficient hygienic landfill capabilities. During the monsoons, unscientific dumping produces floods and is a major contributor of ground water contamination, as well as subsurface water contamination via leachate percolation.

- *Landfill:*

A landfill is a piece of land where rubbish is dumped into or into. The goal is to prevent any waste from coming into touch with the environment, especially groundwater. Open, unregulated, and poorly managed dumping is frequent in India, resulting in significant environmental deterioration. In cities and towns, 60 percent to 90 percent of MSW is immediately disposed of on land in an inadequate way(Daskal et al., 2018). These

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approaches are incompatible with sanitary landfilling procedures. During the rainy season, the dumping is often done in low-lying locations that are prone to floods, increasing the risk of surface water pollution. Groundwater contamination, albeit mostly unmeasured, is unquestionably a concern presented by garbage disposal. Heavy metals have been quickly leaking into coastal waterways as a result of such dumping activities in numerous coastal municipalities. The daily cover procedures are inadequate, making leakage more likely. This is mostly due to a lack of information and expertise on the side of local government officials. This pushes local governments to limit the use of even well-known protections and procedures(Colvero et al., 2020). However, it appears that landfilling will continue to be the most widely used waste disposal method in India in the coming years, during which time certain improvements will be required to ensure sanitary landfilling, Notwithstanding the fact that large cities like as London, Bombay, Kolkata, and Madras have a trash disposal land constraint.

1.2 Public private partnership with MSWM in India:

When neither the public sector nor the Stakeholders' goals and desires may be met via the business industry, the public-private partnership (PPP) paradigm is frequently implemented at the ground level. MSWM looks to be a good candidate for PPP mode in the Indian context, since ULBs alone are incapable of completing the job set by MSWR. A total of USD 5 million is necessary yearly to offer MSWM solutions that are sufficient for Indians towns, and this amount of price may be raised only via the PPP model to solve MSWM-related issues. The PPP approach in India is still in its infancy, There isn't a single successful tale within MSWM. Many firms, on the other hand, regarded MSWM as a commercial potential, and over 40 PPP projects are already operating in India for various MSWM sectors (segregation at public bins, collecting, transportation, and waste to electricity).

Zen Global Finance Ltd (RDF), ESSEL Infra (MSWM), Enkem Engineers Ltd (biomethanation in conjunction with Entec, Astria), Future Fuel Engineers (India) Pvt. Ltd (biodegestion in collaboration with ECOTEC, etc.) are some of the Indian firms

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active in MSWM. However, effective execution, superior services, risk sharing, cost savings, and income creation are all characteristics of a successful cooperation. Power pooling, lack of management of ULBs, cost-cutting, impunity, political hazards, and a shortage of competition are all issues that need to be addressed, on the other hand, are key threats. Both the public and commercial sectors should make significant contributions to tackle the difficulties connected with MSWM(Soltani et al., 2015). The efficiency of ULBs in dealing with SWM can only be improved if both sectors work together. The relationships between different facets of the PPP system, such as social, economic, and managerial characteristics, should be assessed. To make PPP work for MSWM, it must have a successful collaboration, a well-defined relationship, and a clear delineation of responsibility, Due to the dynamics among the various participants, responsibility and adaptation are required.

By starting the Clean Kerala Mission in 2002, Kerala became one of the few Indian states to take successful waste-reduction measures. Later, in 2007, the Malinya Mukta Keralam campaign was started, which was successful in establishing the necessary conditions for a Mission Mode Exploit Plan to realize the aim of Clean Kerala. Reduce, Reuse, Recycle, and Recover are the four pillars of the Mission 2002 Strategy. Phase I was executed with the support of women's self-help organizations, students, NGOs, and volunteers from "Kudumbasrees," as well as public officials, in five corporations and 26 municipalities. Phase II included an additional 27 capitals and 25 villages. This time, the focus was on applying technical interventions to maximize composting, as well as power and dung collection. Green Kerala Company Ltd purchased 187 tonnes of low plastic from Malayalam local authorities and sent them to Triton Robotics for sustainable recovery.

It has established a facility to produce pyrolysis oil from plastic trash. Kerala also intends to collect and handle e-waste, which is a significant urban contaminant. It has signed a Memorandum of Understanding with Earth Sense Recycle Pvt. Ltd. Other measures to make Kerala plastic-free include a prohibition on the use of plastic carry bags, cups, plates, and flex boards by the government. As part of the "Zero-Waste Kovalam" initiative, Kerala Tourism launched the "Plastic-Free" campaign at Kovalam

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beach. Plastic bags have been replaced with cloth/paper bags. Campaigns have been undertaken to encourage segregation, collection, and usage of hazardous waste at the source, with a focus on scientific waste management. The fundamental goal of "Zero-Waste Kovalam" was to implement strict licensing standards, choose suitable technology, and build institutional capability at the ULB level. At addition, biodegradable waste/paper containers were erected in the school. In the garden, vermin-composed/biogas slurry is put to good use. Students are also being encouraged to learn how to make paper bags, cloth bags, and trash management as part of their school curriculum.

A typical emerging country like India has been transformed by the informational society. Since the revolution in information technology, a typical developing nation like India has been grappling with the challenge of safe and effective e-waste management. The cost and accessibility of a wide variety of electronic equipment, along with advances and shifting trends, has resulted in a high rate of obsolescence. India is the world's fifth largest producer of e-waste, with an annual production of over 15 lakh metric tons (MT) and a compound annual growth rate of around 25%. E-waste accounts for around 7% of all solid trash created in India. A combination of big and small electrical and electronic devices used in households and companies accounts for over 60% of e-waste. The Indian Ministry of Environment, Forests, and Climate Change issued e-waste regulations that took effect on May 1, 2012. The primary aspects of e-waste legislation are the establishment of EPR and the required registration of e-waste recycling companies with Pollution Control Boards. Bangalore boasts over 1,200 offshore and local electronic firms, making it one of the cities most vulnerable to the e-waste threat. Bangalore produces roughly There are 31 registered e-waste reprocessing businesses that handle dampen MT of e-waste per year, only three of which are actively recycling.

1. DISCUSSION

India is quickly transitioning from an agrarian to an industrial and service-oriented economy. Urbanization has increased to 31.2 percent of the population. Completed 377

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billion folks live in 7,935 cities and villages. India is a large nation with 29 states and seven union terrains (UTs)(Akbarpour Shirazi et al., 2016). Greater Mumbai, Delhi, and Kolkata are three megacities with populations of greater than 10 billion, There are 53 cities with a population of over one million people and 415 cities with a population of 100,000 or more. City with population over 10 billion include state centers, union territory, and various company locations. India has four seasons Individuals living in these zones have different consumption and waste generation habits than those living in other zones (tropical wet, tropical dry, temperate moist weather, and mountain climate). However, no concrete steps have been taken to evaluate geographic and regionally particular waste solid waste trends for these metropolitan cities, and scientists must reliant on the restricted information obtainable from a research performed by the Central Pollution Control Board (CPCB) in New Delhi, the National Engineering and Environmental Research Institute (NEERI) in Nagpur, the Central Institute of Plastics Engineering and Technology (CIPET) in Chennai, and the Federation of Indian Chambers of Commerce and Industry in New Delhi. Municipal solid waste administration includes separation, storing, collecting, transfer, transport, treatment, and burial of solid waste (MSWM), which is a vital component of sustainable urban growth. Unmanaged MSW contributes to the spread of a wide range of diseases(Liu et al., 2021).

2. CONCLUSION

The purpose of this research is to describe the current state of MSW as well as other essential issues such as problems for integrated SWM, the complexities of the PPP model, the heroine of rag-pickers, MSWM performs, and waste management legislation in India. It is critical to establish and execute low-cost SWM initiatives in developing nations like India. MSWM's failure may be attributed to a lack of awareness, insufficient technical understanding, insufficient finance, unaccountability, and the execution of laws and regulations. With increased capacity, better processes, and training, issues including correct site assortment, suitable weak personnel resources administration and a lack of financial assistance may be addressed. The issues connected with the

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development and adoption of relevant technologies, as well as a shortage of qualified staff, will need a realistic time period, and state governments, as well as central government entities, will need to take different activities to enhance MSWM in the nation. The complexities that may occur during implementation should be considered so that choices and tactics may be grounded in reality.

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