# Waste Management: Prospects and Challenges in India

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**Abstract**

*In the last two and half decade, India has seen a tremendous growth and is looked upon as an emerging superpower. The role in South East Asia has enhanced and since then there is no looking back. To sustain this growth and for the country to thrive we cannot go wrong with our ecological dynamics as this is the era of climate change. There is also another side to this coin, where in this journey of growth we have degraded our mother earth and has been irresponsible to a maximum extent towards nature. The rate at which waste generation has increased has outpaced the greener technology advancement in this sector. The helplessness of government and municipalities has been well known. The threat from landfill sites to health and environment can no more be neglected. There is dire need of innovative ideas, technologies, techniques and policies which can manage this waste and mould it into wealth. Rather than recycling, upcycling is a better way as it is cost effective, ecologically friendly, and easier to achieve. Public Private Partnership is believed to be the successful model but there is a hidden opportunity for entrepreneurs who are keen towards "Make in India" as a common objective. This article revolves around the prospects and challenges of waste management in India towards achieving sustainable development. Let's make a better and more equitable India.*

***Keywords:*** *Sustainable, Upcycling, Waste Management, Landfill, Ecology. Entrepreneurs*

## Introduction

After the Liberalization of the economy in 1990's, the India's economy has grown at a staggering pace. People started reaping the benefits of the growth and the net disposable income witnessed a steep rise especially in the urban hinterlands. This development and growth attracted people from different parts of the country towards the urban areas. But in the rapid development process, the Waste Management remained an unheard phenomenon. Due to which the country now faces a severe issue of Waste Management. Annually the country is generating solid waste of around 100 MT (Million Tons). The spurring increase in the population and the changing lifestyle of people is challenging the garbage composition and dumping across the cities.

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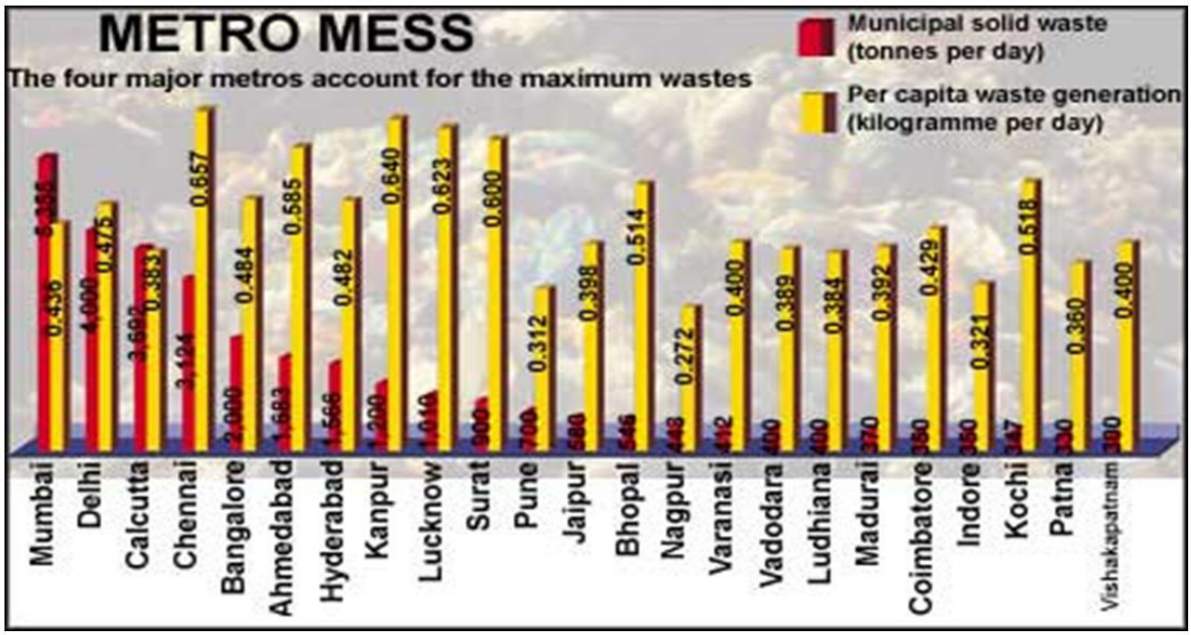


**Figure:1, Municipal Waste across major cities**

**Source:** Central Pollution Control

In the current scenario, the gigantic heaps of the dumps are either managed by the municipalities in the states or by the informal sector companies, but still the country lacks a central management for solid waste management. The waste so generated are haphazardly collected and transported to dumping grounds. These dumping grounds are generally located on the peripheries of cities. Most of these dumping materials are not treated and they are dumped in one place in the open. The dumping activity is generally handled by the unskilled municipal employees who work under hazardous conditions. But the bulk of the work is done by the people working in the unorganised sector. These rag pickers generally include underprivileged children's, women and others. Such conditions put their and others lives in the peril. The impact is not just limited to these people, but it also endangers the lives of other people and animals.

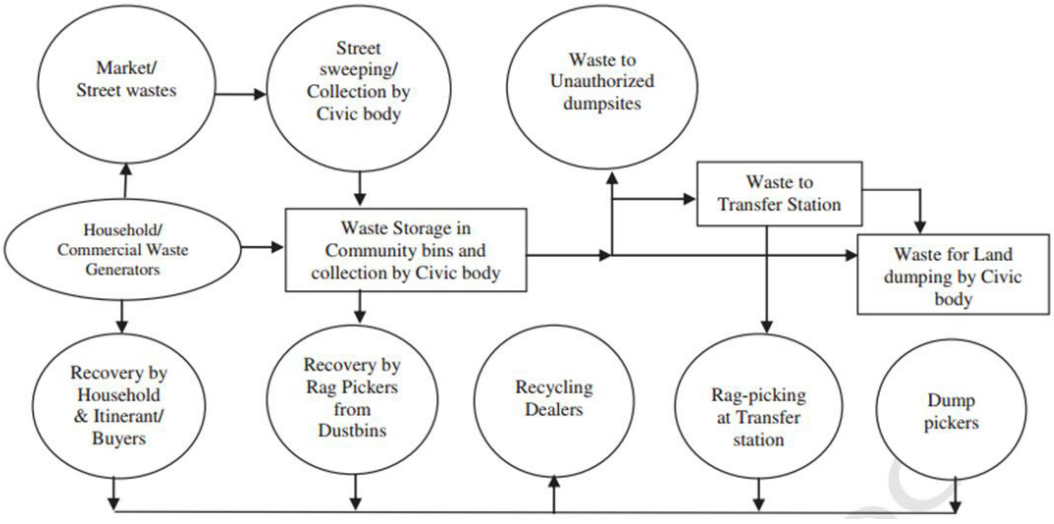


**Figure:2, Schematic flow Chart of common Municipal Waste management process**

**Source:** Joseph, 2002

The disposing activities of the garbage in the open dumping practices are prevalent around the country. Some of the commonly practised methods by which waste could be managed are: incineration, land filling and composting (Narayana, 2009). But these methods have been found largely inefficient and harmful not only to the environment and humans but to the innocent animals. The disposal activities lead to land degradation, air pollution, water pollution. The quantity and the characteristics of the waste might vary from place to place.

**Table 1.1 Chemical Characteristics of Municipal Solid Waste in Indian Cities**

| Population range (in million) | Number of cities surveyed | Moisture % | Organic matter % | Nitrogen as total nitrogen % | Phosphorous as $P_2O_5$ % | Potassium as $K_2O$ % | C/N ratio | Calorific value[a] in kcal/kg |
|---|---|---|---|---|---|---|---|---|
| 0.1–0.5 | 12 | 25.81 | 37.09 | 0.71 | 0.63 | 0.83 | 30.94 | 1009.89 |
| 0.5–1.0 | 15 | 19.52 | 25.14 | 0.66 | 0.56 | 0.69 | 21.13 | 900.61 |
| 1.0–2.0 | 9 | 26.98 | 26.89 | 0.64 | 0.82 | 0.72 | 23.68 | 980.05 |
| 2.0–5.0 | 3 | 21.03 | 25.60 | 0.56 | 0.69 | 0.78 | 22.45 | 907.18 |
| 5.0 and above | 4 | 38.72 | 39.07 | 0.56 | 0.52 | 0.52 | 30.11 | 800.70 |

All values, except moisture, are on dry weight basis.
Source: Manual on Municipal Solid Waste Management, Ministry of Urban Development, GoI.
[a] Calorific value on dry weight basis.

**Source:** Gupta, N. (2015)

So the questions are: Can this problem become an opportunity for entrepreneurs? And does it hold any economic value to the society? Where does this waste-to-energy fit into this? The answer lies in the report of global waste management outlook report. It quotes that "Making a decision about how we can manage the waste we create, is one of the most important contributions humanity can do to reduce its impact on the natural world. For this, Global Waste Management Outlook (GWMO), an initiative of United Nations Environment Programme (UNEP), and the International Solid Waste Association (ISWA), have collectively announced some goals and released a report" (Ojha, 2015).

In India, almost 50 percent of the garbage is organic which could be treated and converted into manure. Cities like Pune, where a private enterprise is responsible for converting 300 TPD (tonnes per day) of the biodegradable waste is into 15,000 standard cubic meters of bio-CNG. In Solapur, Maharashtra an organic recycling company is converting 400 TPD is generating 2 MW of electricity and 40 TPD of manure (Indian Express, 2016). Similarly, there have been few initiatives by private enterprises, but those are not sufficient to deal with per day waste output. In the current wave of the startup development, waste management can be a hugely profitable business. For years it had been seen as a work of the marginalised and impoverished community, but now with appropriate technology and science, entrepreneurs can contribute to the nation's growth. This will also provide employment to many people and will reduce the disastrous impact. In Brazil, for example, waste picking has been recognised as an organised sector. Worldwide around 15 Million people are proudly indulged in making money through handling solid waste. The paper includes all these aspects through which we can move towards a sustainable development path. We can deal with the challenges, obstruction and opportunities in the waste management sector.

**Obstruction**

- **Segregation of Waste**

The biggest problem in the country is the lack of awareness among people regarding the segregation of household waste. Unlike in western nations where they have different dustbins for organic and non-organic waste, in India, we have poorly maintained dustbins at every nook and corner. Hence it becomes very difficult for the municipality to segregate the waste at the destination. Bangladesh is an exceptional example of segregating waste and managing the fertility of soil by then turning waste to manure (Iftekhar Enayetullah & Maqsood Sinha, 2015).

- **Lack of Political Will and Burdened Municipalities**

Till now the government of India does not have an adequate national policy for waste management and this absence led to serious health and environmental problem across India

(Balasubramanian, 2015). The Municipal Solid Waste Management Handling Rules, 2000 indicated that all the municipal authorities should take the responsibility of the collection, transportation, disposal and segregation of solid waste. But most municipalities' solid waste management practices are highly inefficient. Other administrative obstructions such as the difficulties in the decision making and the problem of cost planning. The latest Swacch Bharat Mission of government has raised some hopes by its ambitious plans, but it would be too early to comment on its success. The Municipalities bodies under the state government are mostly understaffed as most of its financial budgets are utilised in the waste dumping practices.

- **Behaviour Change**

Indian people have the worst hygiene and sanitation ethics. Our people have habits of littering the garbage in the open. Most of the drains in major cities are clogged wit garbage leading to severe epidemics like Chikungunya, Malaria etc. Lack of awareness about waste management has led to such indiscriminate garbage dumping. For years the government and courts have imposed heavy fines for polluting environment, but sadly it had no impact on the behaviour change. For Indian, we have imbibed the truth that waste out of the site means that it is no longer a threat to health.

- **Lack of Availability of Data**

Very few researchers have ventured into this field and India has no time series data or panel data in connection with solid or liquid waste. So it is very difficult to analyze the economy of the waste management. Hence it becomes difficult for private entities to enter into the market without prior assessment of future prospects. It becomes very difficult to understand the relationship between cost and benefits of the waste management policies. This inaccessibility of the area and the unavailability of the data is one of the major problems faced by waste planners in the country.

**Challenges**

Even though waste management is a profitable and ecologically friendly business, but itself it has certain challenges.

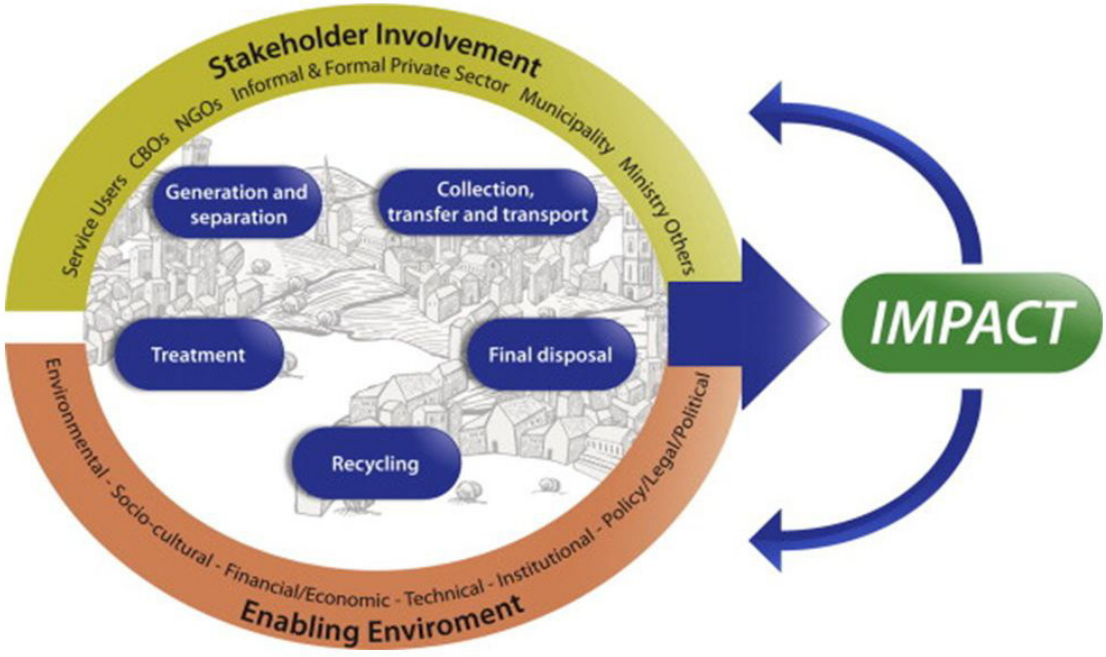


**Figure : 3, The integrated sustainable waste management model**

**Source : WASTE, 2004; adapted from ISSOWAMA Consortium, 2009**

- **Infrastructure**

In order to setup an operation unit of waste management, one needs infrastructure facilities in the form of land and labour. Government and local municipalities alone cannot alone provide the required capital. They need to partner with the private enterprises (be waste wise, 2016). The waste needs to be collected and transported to the recycling centers. So it is very important to develop a logistics mechanism between the waste producer and the waste processing facility.

- **Incentives**

In order to encourage the participation of the masses in the waste management, peoples must be incentivized. These incentives could be direct and indirect. In direct people are paid directly with money whereas indirect recycling involves providing models like a waste to power. Incentives can motivate people to participate while they benefit from the outcome. For entrepreneurs, this is a way to lure typical Indian audience who are skeptical and reluctant. This way the problem of household segregation of the waste can be solved.

- **Collection, Transport and Transfer**

Generally in India municipalities do not collect waste frequently. According to Balasubramanian (2015) "In India, urban local bodies spent around Rs 500 to Rs 1,500 per metric tonne of solid waste, out of which 60% to 70% is usually spent on collection alone, and 20% to 30% is on transportation". The most challenging is a door to door collection frequently. According to Guerrero, Maas, & Hogland (2013) "The door to door collection is done by a variety of systems. They are: Rickshaw (e.g. Kathmandu, Beijing), Animal traction (e.g. Nicaragua, Lahore), Wheelbarrow (e.g. Hambatota, Lusaka), tractor (e.g. Langeberg, Balangoda), Truck (e.g., Kuthaya, Nakuru), Compactor (e.g. Banda Aceh, San Jose), Tricycle (e.g. Cañete, Gazipur), Motorcycle (e.g. Quezon City, Ambon) and Hand Trolley (e.g. Masaya, Jogjakarta)".

**Waste is Wealth**

Municipalities of our metropolitan cities spend a large part of their annual budget in solid waste management but only a small proportion of these waste get actually collected, transported and disposed of (Gupta, Mohan, Prasad, Gupta, & Kansal, 1998). The proportion of the people who actual have access of these services are even low and the path for clean India promised by the government doesn't seem to be straightforward. To have a greener and cleaner India we need a collective work of corporate, scientist, researcher, and academician. The approach of waste management in the developed country and developing countries are quite different. In developing country like India, we are more concerned to find a sustainable approach to waste recycling and reuse whereas in developed countries they focus more on reducing the waste produced.

Waste generated ranges from 200-500 gram per capita per day in cities which have a population from 1 lac to 50 lac. The per capita waste generated is higher in the larger cities and the populated cities. Indian waste has a large proportion of compostable material. As per NEERI studies, compostable matters ranges from 30% to 57% in Indian waste. The share of recyclable material is between 5% to 10%(Kumar, 2005).Take the city Ranchi which has a population of 10 lakhs (Census, 2011). In India we have more of a wet waste rather than dry waste as in the west and most of this wet waste is organic. Therefore, let's take 400 grams of waste is generated per person in Ranchi out of this 50% is organic waste which includes fruit and vegetable, brown cardboard and other organic stuff. Now the total organic waste generated comes out to be 200 tonnes. After composting as per the conversion ratio 75% of this waste gets converted to organic manure therefore 150 tonnes of organic manure can be generated from this waste. The price of this organic manure ranges somewhere around Rs 200-600 per 10 kg of manure, therefore, we can gain Rs 45 lakhs at the rate of 300 per 10 kg of out of this waste. The organic waste takes around a month to get converted into manure. This is how we give back to nature and can make money in a sustainable manner. This process can also help in building rural-urban nexus by bringing the urban waste in the form of manure to the villages and villagers can return back the favour in the form of agricultural produce. The inorganic waste generated can be converted to brick to be used in houses and plastic could be used in building roads.

The amount gained from charging the household a monthly fee for collecting their garbage could be used in establishing the recycling plant. Firstly we need to develop a city profile where the waste management scheme will be indulged in future. Secondly, the study of population growth is of dire need since the population and the waste have quite a close relationship and as the population of a city enhances it enhances the waste generated by the masses. Thirdly we need to conduct a household survey regarding the details of waste (Dry or Wet) and at last we need the governance system of the area to be studied well. To understand the existing structure, process of decision making, the flow of funds and finances, monitoring and information system these steps will come handy(Of & Practices, 2015). For this plan to succeed government help would be needed in the enforcement of the law, providing subsidies, providing land etc. The behavioural change needs to accomplish among the masses and the segregation of waste need to done at home itself.

**Recommendations**

In the pursuit of greener and cleaner country and in the backdrop of the Swacch Bharat Abhiyanto be achieved, we will need some very stringent steps to be taken. The time has come for all the stakeholders come together for a common goal and to build a great nation for our coming generations. Let's come together hold the hands and march towards a more sustainable India.

- **A ban on throwing of waste**

No waste shall be thrown on the streets, open areas and water bodies.

- **Segregation at the source**

The waste shall be stored in 2 different bins or bags, one for biodegradable and other for recyclable waste. Hazardous waste should be kept away from these wastes. Community bins shall be provided in slums.

- **Collection of waste**

The separate internal road for free movement of garbage should be there. The collection should be regular. A well organised informal sector workers or rag-pickers should be engaged. The Proper working condition for them should be ensured. The update of garbage being picked should be there on the MIS (Management Information System).

- **Provision of litter bins at public places**

Provision of litter bins at railway stations, bus stations, market places, parks, gardens etc should be made and people should be encouraged to use it.

- **Processing of disposed waste**

Processing technology should be ecological, more efficient and cost effective. Decentralised composting with the public and NGO should be encouraged. The organic waste should be returned to the farm in the form of manure. Recyclable waste should be returned to the recycle industry. The technologies like incineration and other should be avoided as their worth in our country has not yet been proven(Material, 2010). Proper disposal rules should be followed at the landfill sites(Ahluwalia et al., 2011).

- **Land to be made available for disposal of waste**

As the city expands the dump sites which are located outside of the city come inside, these issues could be avoided by forming a committee atthedistrict level and at the state level that willwork in coordination to identify the land, provide the possession of the land for landfill sites and processing plants. These sites should have a respectable distance from the city and construction around it should be avoided.Proper scientific disposal techniques should be used at these sites to avoid contamination of ground water.

- **Institutional strengthening and capacity building**

Institutional strengthening of family, society and community is the key. Community involvement at different levels and improving the accountability of public and private sector is needed to be done(Ministry Of Urban Development, 2011). Professionalism in the administration and will to achieving the goal can improve the situation.

- **Management Information System**

Monitoring of manpower and machinery can help in planning for future. GPS tracking of the garbage collection could be done. Annual report on the total waste generated in the city should be prepared.

- **Public awareness**

IEC (Information, Education, and Communication) technique for public awareness should be used. Waste reduction, reuse, recycling (3R) should be advocated to reduce the burden on the local bodies.

- **Enforcement**

Suitable additions should be introduced in the Municipal Acts & Rules to punish those who litter the streets special cleaning charges could be added. Municipal Solid Waste Rules, 2000 should be strongly enforced by the governing bodies.

- **Technological Enhancement of Waste Management**

The government should encourage more research and technological intervention in the waste management sector. Stress should be given for waste to energy conversion mechanism inamore sustainable way.

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