MUNCIPAL SOLID WASTE MANAGEMENT IN PUNE (MS) CURRENT CHALLENGES AND FUTURE SOLUTUONS FOR DEVELOPMENT

Prashant Bamne[1], Dr. Sonali Mhatre[2]
Dr. Babasaheb Ambedkar Technological University Lonere (M.S.) India

Abstract -Proper waste management may be a basic key to environmental property. During this study, the municipal solid waste management and disposal ways in Pune district in Maharashtra state of India is studied. The characteristics and composition of those wastes and therefore the environmental problems related to its management also are investigated. Structured questionnaires were accustomed acquire primary knowledge from a random size of population within the areas that have the best accumulation of plenty of solid wastes within the Government selected waste selling sites and open areas on the main streets among the metropolis. Environmental and health problems arising from the unsustainable management of the wastes were studied throughout this project. The results indicates that the waste dump sites (designated and no designated) on the main streets and several other open areas are left unattended for long periods specified the rubbish heaps; encroach on the roads thereby limiting the road users access, generate serious pollution problems, represent important once blown over by winds, and distorts the aesthetic read of the metropolis. The results conjointly show that the composition of the wastes within the metropolis is heterogeneous as a result of it contains each perishable and no biodegradable materials like e-wastes, plastic, synthetic resin materials, hospital wastes, and hair designer's wastes amongst others. The study was created on characteristics of organic and inorganic waste and experiments were conducted for conversion this waste into their byproducts. Finally the analysis highlights the importance of incorporation of the 4Rs Associate in nursing participation of all stakeholders with the event of an integrated waste utilization depot within the residential estates.

Keywords: -Organic, inorganic waste, municipal solid waste management, Recycling,

1. INTRODUCTION

Solid Waste Management – Of increasing global and Indian concern one of the main current challenges in many urban areas of the world, both in mega cities and in smaller villages, is considered to be municipal solid waste management. Due to rapid urbanization, economic development and population growth, the waste generation rates are increasing in several cities of the world, leading to diverse challenges. The ways in which solid wastes generated by human activities are handled, stored, collected and disposed of can pose different levels of risks to the environment and to the public health. Solid waste is therefore a vital municipal responsibility, yet municipal authorities in rapidly urbanized cities find it hard to cope with the accelerating pace of waste generation like Pune.

Pune is the 8th largest metropolis in India. It is in the Indian state of Maharashtra. The climate of Pune is suitable to reside in, hence a large number of people settle here. Students not only from other cities and States come here to study, but international students from various countries are also found here. Due to rapid urbanization and economic growth, the city has over the last decades faced great challenges of providing basic services like adequate housing and infrastructure (The World Bank, Population density in some areas exceeds 100 00 people per square kilometer. Furthermore, many people live in slum areas with inadequate sanitation facilities and poorly maintained waste management. This causes serious public health problems and environmental risks that affect the entire population of Pune.

Currently, 1,27,486 tons per day of municipal solid waste is being generated due to various household activities and other commercial & institutional activities. Municipal waste and certain industrial waste have comparatively significant impact on environment. A substantial amount of these wastes is extremely dangerous to the living organisms including human beings. It may downgrade groundwater quality by leachate percolation and also cause air pollution by emission of greenhouse gases through various course of treatment. Nowadays, E-waste and nuclear waste are other waste streams which are requiring attention due to fastest growing electronics & nuclear sector. To overcome this problem, effective solid waste management must be implemented.[ref]

The objectives of solid waste management are to control, collect, and process, utilize and dispose of solid wastes in such an economical way which protects health of human being and natural environment and the objectives of those served by the system. In this regard, in 1989, the U.S. Environmental Protection Agency (U.S. EPA) adopted hierarchy of waste management practices. The elements of hierarchy are:

- Source reduction
- recycling of materials
- Combustion
- Landfilling

In India, initially there has not been much awareness about solid waste management and its hierarchy. However, since last few years, the scenario of solid waste management has been changing continuously. Still, there is a long way to implement an effective solid waste management practices. Even today, only few portion of solid waste generated is disposed through proper treatment. Lack of waste segregation is the biggest obstacle in implementing effective solid waste management. Though, Plastic and paper recycling sector is growing due to huge market demand for these commodities. Improper collection, unavailability of Transportation in some areas, lack of advancements in treatment technologies, financial shortage in municipalities are other factors for poor solid waste management practices. It is important to recognize the fact that there are varying degrees of hazards associated with different waste streams and there are economic advantage for ranking wastes according to the level of hazards they present. In this study, comprehensive review of municipal solid waste (MSW) of India has been provided to elaborate current status and to identify problems of municipal solid waste

management. It also summarizes future trends to make MSW effective. However, it covers brief discussion of other wastes where it is necessary

2. LITERATURE REVIEW

[Nothing written here about literature …you need to add some paper references regarding your topic and what is their interpretation]

3. CURRENT SCENARIO

Municipal solid waste management (MSWM) is one of the major problems in India and especially in urban areas. Due to rapid industrialization and intense population growth, more and more people migrate from villages to cities. These growing cities generate large amounts of MSW daily and the amount keeps increasing.

MSW consists of a combination of different kinds of refuse generated from the living community. MSW contains several different fractions, e.g. compostable organic matter, recyclables and non-recyclables. The quantity and composition of the waste depends on various factors like average income level, standards of living, population size, social behavior, climate, industrial production etc. In India, the major fraction of MSW in urban areas consists of compostable organic materials, about 40-60%. A comprehensive and integrated MSWM system is according to the United Nations Environment Program (UNEP) supposed to involve the following activities:

• Setting policies
• Developing and enforcing regulations
• Planning and evaluating municipal MSWM activities by system designers, users, and other stakeholders
• Using waste characterization studies to adjust systems to the types of waste generated;
• Physically handling waste and recoverable materials, including separation, collection, composting, incineration, and landfilling
• Marketing recovered materials to brokers or to end-users for industrial, commercial, or small- scale manufacturing purposes
• Establishing training programs for MSWM workers
• Carrying out public information and education programs
• Identifying financial mechanisms and cost recovery systems
• Establishing prices for services, and creating incentives
• Managing public sector administrative and operations units

A) MSWM in Pune

The current MSWM system in the state of Maharashtra is acknowledged to be highly improper and inefficient, particularly in major cities like Pune. The rapidly increasing amounts of municipal solid waste being produced in Pune in combination with poor management planning and insufficient financial resources, makes today's situation a severe problem Pune, being a coastal city, faces several additional problems as a consequence of the inadequate MSWM

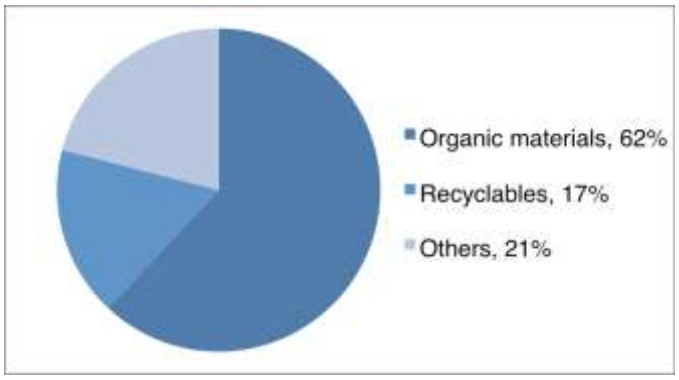

Figure1: MSW Characteristic, Pune [ref]

B) Waste Characteristic

In general terms, solid waste can be defined as waste not transported by water; that has been rejected for further use. It includes industrial, mining, municipal and agricultural wastes. It mainly consists of a large organic matter, ash and fine earth, paper and plastic, glass and metals. Composition of solid waste however varies depending on various factors such as weather, living standards etc. Classifies solid waste on basis of its source.

3.1 Type of Solid Waste

Solid waste can be classified in many ways according to its source, composition, phase, treatment required etc. Table 1 describes type of wastes on basis of its source. It includes residential, municipal, mining, agricultural, industrial etc. [ref]

Table 1: Type of Solid Waste

Source	Typical Waste Generators	**Type of Solid Waste**
Residential	Household activities	Food waste, paper, cardboard, plastics, wood, glass, metals, electronic items etc.
Industrial	Manufacturing units, power plants, process industries etc	Housekeeping wastes, hazardous wastes, ashes, special wastes etc.
Commercial & Institutional	Hotels, restaurants, markets, office buildings, schools, hospitals, prisons etc.	Bio-medical waste, Food waste, glass, metals, plastic, paper, special wastes etc
Construction and Demolition	New construction sites, demolition of existing structures,	Wood, steel, concrete, dust etc.

	road repair etc.	
Municipal services	Street cleaning, landscaping, parks and other recreational areas, water and wastewater treatment plants	Tree trimmings, general wastes, sludge etc
Agriculture	Crops, orchards, vineyards, dairies, farm etc	Agricultural wastes, hazardous wastes such as pesticides
Mining	Open-cast mining, underground mining	Mainly inert materials such as ash

3.2 WASTE GENERATION

As per CPCB report, municipal solid waste generation in year 2010-11 is about 1, 27,486 Tons per day. The same was about 1, 00,000 TPD (Tons Per day) in year 2000 as per report (of Ministry of Urban Development (MoUD), Government of India. During 2004-05, CPCB conducted survey through NEERI in 59 cities and estimated 39,031 TPD MSW generation. In year 2010-11, survey was again conducted by CIPET at the instance of CPCB and estimated 50.592 MSW generations.

Table 2: State of Waste Generated [ref]

State	Waste Generated
Maharashtra	19204
West Bengal	12557
Tamil Nadu	12504
Uttar Pradesh	11585
Andhra Pradesh	11500
Karnataka	6500
Rajasthan	5037

4. METHODOLOGY

Until 1980, there was not much data available about solid waste generation and solid waste management was paid very little attention. But, implementation of Hazardous Waste Management Rules (198. 9) under Environment Protection Act - 1986 has changed the attitude of government and local authorities

4.1 Methods of Collection

According to Municipal Waste Management Rules (2000), it is the responsibility of municipalities to prohibit littering of solid waste in cities, towns and in urban areas notified by governments. To facilitate compliance, municipal authority have to organize house to house collection through any of the methods:

A) Community bin collection
B) House to house collection
C) Collection on regular time interval (which must be pre informed)
D) scheduling by using bell ringing of musical vehicle (without exceeding the noise levels)

To increase collection efficiency, the integration of these methods is required. The transportation of municipal solid waste is generally carried out twice in a week or weekly basis by container carriers. However, in small towns and rural areas, open trucks, dumper trucks are used for waste collection. In recent times, with support of NGO and local communities, waste collection efficiency has increased remarkably in few rural areas. Since collection costs are 50-70% of solid waste budget, it is the most significant area for cost reductions. Interrelated variables such as labor costs, crew size, union restrictions, collection frequency, distance (travel time) to disposal and performance and annual costs of equipment must be considered during planning stage.

4.2 WASTE SEGREGATION BY 3R CONCEPT

Waste Segregation

Waste segregation is the biggest obstacle for effective solid waste management. It is common in developed countries like U.S., Europe and Japan; but countries like India most often collect MSW in a mixed form. It is mainly because of lack of public awareness and advancements in source separation techniques. However, paper and certain type of plastics are separately collected at source level by waste pickers or waste buyers. Source separation increases recycling efficiency. It also improves performance of waste treatment units due to good quality of feed and lesser amount of impurities.

3R Concept

Reduce: The term ‘Reduce’ can be defined as a reduction in the amount and/or toxicity of waste entering the waste stream. Use of green elements as raw materials, extension of product life cycle, optimum process design, reducing energy and heat losses, replacing raw materials by lighter material can help to reduce the amount of waste generation. ‘Reduce’ is the top ranking component of solid waste management hierarchy because it represents most effective means of reducing economical costs and environmental impacts associated with handling waste. Life cycle assessment is very important for effective source reduction of waste.

Reuse: The term ‘Reuse’ means usage (or utilization) of a product in the same application for which it was originally used. For example, a plastic bag can carry groceries home from the market over and over again, a tin can be used as a multi-purpose container. A product can also be reused for some other purpose, such as occurs when glass jars are reused in a workshop to hold small objects such as screws or nails. Remanufacturing is often used in this regard which means restoring a product to like new condition. It involves disassembling the product, cleaning and refurbishing the useful parts and stocking those parts in inventory. . While repair means only those parts that have failed are replaced.

Recycling: The recovery of materials for recycling is given second highest priority in the solid waste management hierarchy after source reduction. ‘Recycling’ simply means use of waste as raw materials for

other products. It includes collection and separation of recyclables and processing them to useful raw materials for other products. It can be classified as preconsumer and postconsumer recyclable materials. Preconsumer materials consist of scrap that is recycled back into manufacturing process without having been turned into a useful product. Postconsumer recyclables are products that have been used by consumers, such as newspaper or plastic bottles. Glass, aluminum, heavy metals, construction demolition debris are another example of recyclables. An example of resource recovery system for mixed solid waste.

5. SOCIAL AND CULTURAL ASPECTS

It is possible that the stigmas and the negative attitude and towards SWM is related to the deeply rooted Indian caste system. The caste system in India is one of the world's oldest social stratifications, dividing Hindus into a set of rigid hierarchical groups based on the iWork and duties (BBC, 2016). The caste system has been dictating almost every aspect of Hindu religious and social life for centuries. Communities have long been arranged on the basis of castes, where the lower castes have been discriminated and assigned tasks such as scavenging and street sweeping (Human Rights Watch, 2014). In recent decades, the influence of the caste systems has started to decline in conjunction with education and urbanization but it is undeniable that it is still influencing the Indian society to a great extent.

6. ECONOMICAL ASPECTS

6.1 Lack of funding & difficulty in obtaining funds

An economic bottleneck, inhibiting further development within the field of SWM, is the lack of funding and the difficulty in obtaining funds from the bank. According to PEARL, the

MCGM is one of the wealthiest and most robust urban local bodies in the country the lack of funding in Pune is therefore mainly based on the fact that not enough money and resources are allocated for creating a cost-effective and efficient MSWM.

It is also a major problem that there is currently no tax or tipping fee for MSW, which implies that MCGM has no income from the waste generators allocated specially for handling the waste 20 Most of the ULBs in India are depending on central and state government grants for funding the MSWM, but these funds are often inadequate as the bulk are absorbed by administrative expenses. Also, the problems do not always solely lie in the scarcity of the funds but in the administration of it - the ability to manage the funds professionally and deliver services in a cost-efficient way.

When it comes to the difficulty of obtaining funds for making investments, several of the interviewees pointed out the problem that banks are generally unwilling to give loans for investments in new SWM facilities. This is due to that the MCGM faces difficulties when give mortgage for land use. Since the land in India is government property and there are no specified land use zoning, land use conflicts are common according to the interviewees.

6.2 Inappropriate subsidies

Through financial arrangements like allowances and subsidies, it is possible to govern the actions of actors in a field in a certain direction. In Pune, there are currently no suitable subsidies or economic incentives promoting the use of processed waste products such as compost and RDF. Instead, there are subsidies on chemical fertilizers and the price on coal is generally lower than the price on RDF according to interview data.

Further, the potential customers of compost are often located outside the urban areas, on a distance from waste management facilities. Therefore, there is an additional cost for transportation when purchasing city compost. The commercial viability of composting projects is also further threatened as the demand for compost is seasonal..

6.3 Tipping fees

One of the main problems related to the lack of capital is that the present tipping fees are low or inexistent and hence fails to make SWM business profitable and attractive to investors. Tipping fees are the main and often sole financial source for the waste operator, making financial viability difficult to achieve with the current policies(IFC, 2013). In India, private companies are in general setting up treatment facilities after signing an agreement with an ULB (IDFC, 2009). Internationally, ULBs often pay some kind of fee to the private company for accepting the waste but in India that is not the case (IDFC,2009). Private waste processing companies are facing difficulties running a profitable business due to several reasons. SWM facilities often requires a large initial investment, and the inadequate tipping fees in combination with the inability of products such as compost and RDF to recover the costs of the operation further extends the problem. Furthermore, the burden of paying the tipping fee currently lies solely on the municipality, which also results in serious economical exposure for the municipalities as well (IFC, 2013).

6.4 Collection and transportation is costly

The expenses for collection and transportation of MSW stands for approximately 80-95% of the total budget allocated for MSWM. This makes up for an evident problem since very limited amounts of the already restricted resources reserved for MSWM in the first place remains left for processing and disposal. As mentioned earlier, the current waste management practices in Mumbai are stated to be inefficiently designed which overall makes it more expensive to pursue

Through the conducted interviews, it became clear that the current procedures for collection and transport implicate some major inefficiencies, leading to rising costs.

Pune is an unplanned city and the width of roads and lanes are varying significantly within the city. This poses a problem, not only since many areas are inaccessible for collection vehicles but also since efficient collection and transportation systems will require meticulous planning to ensure successful execution. The door-to-door collection is therefore not as organized as it could be, demanding a lot of time and manpower as well as financial resources. The same goes for the collection from bin arrangements due to their often inadequate size and placement further problems are related to inadequate collection vehicles, often obsolete and not optimally suited for their purpose. The vehicles should be better adapted to suit the prevailing Indian conditions. Due to the fact that collection and transportation is costly, the allocation of funds is corollary being insufficient. In combination with the inadequate enforcement of laws, the practice of open dumping of waste is still rampant in Pune and many other Indian cities since it is the cheapest and easiest way to dispose of waste.

CONCLUSION

The overall conclusion is that it is not enough that a small fraction of the society, with partially contradictory interests, is taking initiatives to improve the MSW in Pune. In order to achieve a sustainable long-

term solution, coordination and a more holistic system approach is necessary. The MSWM system can be seen as a typical case of a sociotechnical system. Changes in such systems involve several actions in different areas (e.g.social, technical, financial, institutional) and on different levels in the society. It is clear that the current challenges regarding the MSW in Pune cannot be solved solely through technical means. To support the technical solutions, it is important to view the technical systems as a part of a bigger sociotechnical system and incorporate them with organizational and political solutions as well. Hence, participation from and interactions between different stakeholders and actors is absolutely necessary in order to develop support for policies

REFERENCES

1. Government of Maharashtra. (2007). Greater Mumbai Disaster Management Action Plan Pune
2. Gupta, N., Yadav, K. K., Kumar, V. (2015). A review on current status of municipal solid waste management in India . Journal of Environmental Sciences , 37, 206-217.
3. Hati, K., Swarup, A., Dwivedi, A., Misra, A., & Bandyopadhyay, K. (2007). Changes in soild physical properties and organic carbon status at the topsoil horizon of a vertisol of central India after 28 years of continuous cropping, fertilization and manuring. Agriculture, Ecosystem and Environment , 119, 127-134.
4. Hoornweg, D., Hosseini, M., Kennedy, C., & Behdadi, A. (2016). An urban approach to planetary boundaries. Royal Swedish Academy of Sciences . Sperling. Human Rights Watch. (2014). Cleaning Human Waste "Manual Scavenging," Caste, and Discrimination in India. Retrieved 05 24, 2016, from https://www.hrw.org/report/2014/08/25/cleaning-human-waste/manual-scavenging-caste-anddiscrimination-India
5. IDFC. (2009). Waste to Energy: An Imperative for Sustainable Waste Management. Retrieved 05 19, 2016, from https://www.idfc.com/pdf/publications/policy_group_quarterly_3.pdf