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AN ANALYSIS ON VARIOUS POLICIES AND SOLUTIONS OF MUNICIPAL WASTE MANAGEMENT SERVICES: A CASE STUDY OF MCD

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An Analysis on Various Policies and Solutions of Municipal Waste Management Services: A Case Study of MCD

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Abstract – Municipal solid waste management (MSWM) is one of the major environmental problems of Indian cities. Improper management of municipal solid waste (MSW) causes hazards to inhabitants. Various studies reveal that about 90% of MSW is disposed of unscientifically in open dumps and landfills, creating problems to public health and the environment. In the present study, an attempt has been made to provide a comprehensive review of the characteristics, generation, collection and transportation, disposal and treatment technologies of MSW practiced in India.

Municipal Solid Waste Management (MSWM) is one of the most problematic and neglected aspect of Indian Cities. The high population growth and industrialization put strain on the basic infrastructural and municipal services. Presently, in Delhi the municipal solid waste generated about 6000 to 8000 metric tonnes per day and quantity of this has been consistently rising over the years. Delhi had an average size of 5.06 persons in 2005. Assuming a similar average household size, and a population of 15-20 million, there would be 4-5 million households in NCT of Delhi today, these becoming the largest source of solid waste generation. Starting from collection, transportation and disposal, the Municipal Solid Waste suffers from weak administrative and managerial problems. With this background the present article is an endeavour to examine the spatial and temporal aspects of waste management facilities i.e. generation, storage and collection, transportation, disposal, and processing. The data has been analyzed using simple statistical techniques keeping 12 zones as unit of observation. The study concludes that, there were spatio-temporal variations in the quantity of waste generation in all MCD zones. The spatial analysis of the number of receptacles, vehicles and safai-karamcharies reveals that their availability gradually declines from core to periphery zones of MCD. Presently, all existing three landfills (Bhalswa, Gazipur and Okhla) are fully packed and overflowing. Among four landfill sites, Bhalswa is receiving maximum garbage from six zones of MCD whereas Gazipur, Okhla and Narela-Bawana followed it. Simultaneously, it is necessary to reduce the burden on landfill sites in the near future. There is also an urgent need to increase the numbers and efficiency of Composting and Energy Production plants from the municipal solid waste because composting can only provide answer to problem of MSW.

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INTRODUCTION

Rapid industrialization and population explosion in India has led to the migration of people from villages to cities, which generate thousands of tons of MSW daily. The MSW amount is expected to increase significantly in the near future as the country strives to attain an industrialized nation status by the year 2020 (Sharma and Shah, 2005; CPCB, 2004). Poor collection and inadequate transportation are responsible for the accumulation of MSW at every nook and corner.

The management of MSW is going through a critical phase, due to the unavailability of suitable facilities to treat and dispose of the larger amount of MSW generated daily in metropolitan cities. Unscientific disposal causes an adverse impact on all components of the environment and human health (Rathi, 2006; Sharholy et al., 2005; Ray et al., 2005).

Generally, MSW is disposed of in low-lying areas without taking any precautions or operational controls. Therefore, MSWM is one of the major environmental problems of Indian megacities. It involves activities associated with generation, storage, collection, transfer and transport, processing and disposal of solid wastes. But, in most cities, the MSWM system comprises only four activities, i.e., waste generation, collection, transportation, and disposal.

The management of MSW requires proper infrastructure, maintenance and upgrade for all activities. This becomes increasingly expensive and

complex due to the continuous and unplanned growth of urban centers. The difficulties in providing the desired level of public service in the urban centers are often attributed to the poor financial status of the managing municipal corporations (Mor et al., 2006; Siddiqui et al., 2006). In the present study, an attempt has been made to provide a comprehensive review of MSWM for Indian cities to evaluate the current status and identify the problems of MSWM. The study also aims at encouraging competent authorities/researchers to work towards the improvement of the present system through suggestions and recommendations.

The Municipal Corporation of Delhi (MCD) has a large jurisdiction of 1,497 km2 and serves a population of more than 14.5 million. Municipal solid waste management (MSWM) is a core function of the Municipality and has remained a key challenge for it. Historically MCD has been concentrating on street sweeping, secondary collection and transportation, and waste dumping activities in MSWM. These activities were carried out mainly by MCD staff itself with a staff strength of more than 50,000 and an annual expense of more than Rs 4000 million (US$ 90 million). Due to a number of reasons ranging from the need to comply with the new regulation on waste management, to various court cases for bad services as well as the huge internal management challenges of employing such a large workforce, MCD was keen to develop an alternative service delivery model that would address the need for development of new practices, techniques and technology to meet the Government of India (GoI) regulations on waste management and improve the MSWM services within the city.

The development of an alternative service delivery model particular to Delhi was a very challenging exercise due to vast scale of operations, limited data available on operations and performance, and limited experience of implementing the new MSWM regulation in megacities, among others. This paper aims to discuss key elements of the project structuring and development process and the logic of the decisions taken in the development phase. Very early in the exercise itself it was clear that an “utopian model” was not feasible, and so alternative but intermediate service delivery models would need to be developed which are in line with the future vision of the sector.

Most of civilization began and developed around the river banks. Things were manageable during different successive periods. The industrialization and urbanization have been made an aggravated situation. At the end of the 19th century, the industrial revolution had witnessed the rise of the world of consumers. The concentration of population had been developed along with industrial sites. Rapid Urbanization process posed many challenges for planners. The Government, local self-governments make their best efforts to provide all basic amenities and services for meet the demand of poses challenge before the administration for managing the huge quantity of waste generated by this large size of population. The solid waste generation is a continually growing problem at global, regional and local levels. The solid waste is those organic and inorganic waste materials which are produced by various activities of the society. All these have lost their value to the first user. Several studies indicate that the ineffective disposal of solid wastes pollutes the environment (i.e., air, land and water) at local and global levels. The problem becomes more critical in developing countries rather than in the developed countries. It is because of rapid growth of urbanization and economic activities. As a result, there is considerable increase in MSW (municipal solid waste) generation in India during last few decades. It is mainly because of rapid population growth and economic development in the country. In urban areas, particularly in highly urbanized areas of the developing world, problems and issues of municipal solid waste management (MSWM) deserve immediate attention. Most of the governments, know the importance of MSWM. However, rapid population growth overwhelms the capacity of most municipal authorities to provide even the most basic amenities services and rendered for the people report. This tremendous increase in the amount of MSW generated is due to changing lifestyles, food habits and living standards of the urban population. The collection efficiency is below 70 percent (CPHEEO, 2000). Cities are now facing the problem of air pollution and handling of solid waste. According to World Health Organization (WHO) five million people die due to disease caused by faulty disposal system and poor collection practices of waste over the years. As per the report of WHO, there are twenty two disease which are directly related to improper management of solid waste. The rodent and vector insects transmit various diseases like dysentery, cholera, plague, typhoid, infective hepatitis and other (Singh 2004). Municipal solid waste management continues to remain one of the most neglected areas of urban development in India. In many cities almost more than half of the solid waste generated remains uncollected. This large quantity of uncollected waste becomes cause for the environmental pollution as well as contaminates the ground water resource.

Delhi city is the most densely populated and urbanized city of India. The decadal growth rate in population during the last decade (2001-2011) was 20.96 percent. Delhi is also a commercial hub, providing employment opportunities and accelerating the pace of urbanization, resulted in increase of municipal solid waste generation and its management is posing a big problem. The level of infrastructure and services, rendered by the urban centres has not been coping with the pace of urbanization.

The Municipal Corporation of Delhi (MCD), services 95 per cent of the city. The New Delhi Municipal Corporation (NDMC) and the Delhi Cantonment Board (DCB) service the remaining area equally. Not only is the area under MCD the largest, it also has to cater to the higher densities of population. And as we already know, more people means more waste!

Journey of waste from bins to landfills: The first step of the collection process is the domestic helper who takes our kachra to the waste bin or the dallow. The waste lies in bins, raising a stink and waiting for the elusive MCD garbage truck to arrive. Meanwhile it is attended to by rats, dogs, cats, cows and the ragpickers.

The truck, when it comes, is loaded manually by MCD safai karamcharis. In the process, a lot of waste is strewn around. The workers themselves do not wear any protective gear and face a serious health hazard. On an average, only 60 per cent of the waste gets picked up every day.

Sanitary landfill: In Delhi, about 98 per cent of the garbage is disposed of in landfill sites at Gazipur, Bhalaswa and Okhla. These sites are filling up fast and will not last beyond the current decade. New sites are being planned at Tajpur, Jaitpur, Goeshalla, and near village Sultanpur and village Deoral. Ideally, a landfill should be lined to check leaks that pollute underground water and can contaminate the soil. However, none of the landfills in Delhi are either lined or have provision for gas recovery. They are unscientifically managed.

Composting: Garbage processing has never been a priority with the MCD. It currently operates two waste composting plants at Okhla and Bhalaswa to convert organic waste into manure. The Okhla plant does not function to its full capacity. The plant at Bhalaswa converts 500 tonnes of garbage into manure every day. Other methods like incineration, vermicomposting, biomethanation and fuel pelletisation are not practiced in Delhi.

It is now becoming clear that only centralized systems of waste management are not enough to control waste. Experience over the past few years has shown that community-led initiatives help decentralize waste management, and make it sustainable at local levels. If the goal is that of setting up a better waste management system, the community, after identifying the problem, would help evolve a system that is best suited to its needs. The end result should be a system that is not dependent on the municipality or any other official body. However, there needs to be an interface between the community project and the local municipality.

It also requires that the people within the community are responsible and have a better understanding of the problems and related issues. Such community projects can be a model for environment-friendly waste management initiatives.

MUNICIPAL SOLID WASTE

Municipal Solid Waste (MSW) is the trash or garbage that is discarded day to day in a human settlement. According to MSW Rules 2000 MSW includes commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes. Waste generation encompasses activities in which materials are identified as no longer being of value (being in the present form) and are either thrown away or gathered together for disposal. Municipal Solid Waste consists of the following kinds of waste.

The other kinds of waste found in urban settlements are;

1) Industrial or Hazardous Waste and

2) Bio-Medical or Hospital Waste and

3) E-Waste.

The Industrial hazardous waste is managed through Hazardous Waste (Management and Handling) Forth Amendments Rules 2010. Hazardous waste is typically identified with properties of ignitability, corrosivity, reactivity and toxicity. Hence urban local bodies must ensure that industrial waste in their command area does not get mixed with the municipal solid waste stream, failing which will result in economic losses (as hazardous waste treatment costs much more higher than the municipal solid waste) and health & safety hazards (Contaminants like heavy metals, chromium, mercury, etc. when found in the municipal waste stream will contaminate the compost produced by the city. When farmers buy the compost it will indirectly affect the food chain.) while treating such wastes.

According to the Hazardous Waste Management Rules 2010, the onus of managing and treating hazardous waste lie with the waste generator, and the urban local body has to ensure that such waste does not contaminate municipal waste stream in their area of authority.

MSWM IN INDIA

Local governments have always been central to running waste management services. As in other countries, local governments from their initiation as an institution for governance had responsibility for waste management as an essential service. Local governments, however weak financially or technically, - often with the support of state governments – have been providing basic cleaning and waste management services. With the rapidly growing population in urban areas, the expansion and

strengthening of urban services, including MSWM, had lagged far behind acceptable standards.

Although this was evident in most cities, it was only after the plague in Surat in 1994 and the subsequent Public Interest Litigation that the crisis in MSWM services was brought to the fore across the country.

When the Municipal Solid Waste [Management and Handling] Rules 2000 (MSW rules) were gazette under the EPA Act, a new set of standards and monitoring mechanisms was set forth and, for the first time, local bodies would be monitored by higher tiers of government for the solid waste management services they provided. As an impact of this regulation, local governments are actively looking at alternative service delivery models especially involving the private sector. Some reasons for this increasing focus by Municipalities on alternative arrangements are:

- Many requirements of the MSW rules have not been fulfilled by municipalities in the past – such as primary door-to-door collection or sanitary landfilling – and therefore there are very limited skills and knowledge within municipalities to handle these activities.

- Most municipalities lack the finance to expand operations into new, unserviced geographic areas or into new activities;

- The increased need to focus on efficiency improvements to reduce cost and reallocate expenses within the waste management chain to activities like treatment and disposal;

As a result of this, many models are emerging and are being experimented with across the country and India today represents a fertile ground for experimenting with alternative service delivery models in municipal waste management.

MSWM SERVICES IN DELHI

Delhi was a small town in 1901 with a population of just 4 lakhs (0.4 million). Delhi's population started increasing after it became the capital of British India in 1911. During the partition of the country, a large number of people migrated from Pakistan and settled in Delhi, and in the decade 1941-51 the population growth rate was 90%. Migration into the city continued even after Partition. The 2001 Census recorded a population of 1.38 crores (13.8 million) residing within Delhi with 3.81% annual growth rate and 46.31% decennial growth rate during 1991-2001.

As the country's capital, with vibrant trade and commerce and excellent employment opportunities, Delhi has attracted people from all over the country and its population today reflects the characteristics of almost every region of India. Delhi thus reflects the wealth and diversity of India wherein diverse religions, languages, customs and cultures co-exist. Religious, cultural and social functions of different socio-cultural groups are celebrated in Delhi.

Delhi is among the top three States or Union Territories in terms of per capita income (Rs 38,864 or US$ 880 in 2000-01). More than 80% of the state income is from the tertiary sector. However, with the continuous inflow of labourers and unemployed persons, the number of people living in sub-standard areas is increasing. More than the 45% of Delhi's population resides in slums, unauthorized colonies and other unplanned settlements.

With the rapid pace of urbanization, the rural area within the state of Delhi is shrinking. The number of rural villages has decreased from about 300 in 1961 to 165 in the 2001 census. The percentage of rural population of Delhi has also declined from 47.24% in 1901 to 6.99% in 20015.

The Municipal Corporation of Delhi (MCD) is among the largest municipal bodies in the world, providing civic services to an estimated population of more than 12.7 million citizens in the capital city. It is next only to Tokyo in terms of area. Within its jurisdiction are some of the most densely populated areas in the world. Delhi, with its urban and semi-urban population of 12.3 million (1997 data), is estimated to generate more than 6000 tonnes of solid waste every day. While Delhi has been growing in terms of its population, any efforts on part of the MCD (which has its jurisdiction on 94% of the land area of the state of Delhi), the New Delhi Municipal Corporation (NDMC)6 and the Cantonment Board7, which are the three municipal entities which are responsible for municipal solid waste management in Delhi, are being undermined by increases in the generation of waste, the dearth of land demarcated for waste processing facilities, encroachment onto existing sites, and paucity of funds, leading to contamination of groundwater and surface water resources, and to air pollution, in the vicinity of Delhi.

The Conservancy and Sanitation Engineering (CSE) Department of the MCD is responsible for solid waste management within the jurisdiction of the MCD including rural and urban villages, slum clusters, regularized unauthorized colonies, roads, streets and public conveniences. The statutory responsibilities of the CSE specifically related to municipal solid waste management include:

- Garbage collection, transportation and disposal;

- Sweeping across an area of approximately 700 km2;

- Repair and maintenance of the dhalaos (waste storage facilities) and street dustbins (waste containers) under its jurisdiction;8

- The repair and maintenance of the refuse removal vehicles and equipment, and other municipal vehicles.

MCD maintains a large fleet of vehicles for transportation and secondary collection of waste from various waste receptacles to the disposal site. The main types of vehicles used are: Refuse Removal Trucks (RRTs), Loaders, Mini Dumpers, Tractor-trailers and also Buffalo carts in rural areas. The CSE Department has nine workshops for the maintenance of their vehicles servicing all the 12 zones.

The secondary waste collection operations begin early in the morning with the assignment of collection points (dhalaos, dustbins and open sites) to each driver mainly using two types of beats10 – loader beat and manual beat. A loader beat involves a front end loader accompanied by 4 to 6 refuse removal trucks. Manual beats are assigned in the congested areas where loaders cannot go and in which refuse removal vehicles are loaded by manual labour (4-6 Safai Karamcharis per truck).

DELHI'S WASTE CONFLICT

Here has been a policy shift in 21st century metropolises regarding solid waste management that involves the privatisation of certain aspects of the system, such as the incineration of waste, but more importantly, it represents a comprehensive and holistic transformation in which the entire system becomes integrated. Delhi has been at the forefront of this shift. While the increased role of the private sector in the various stages of waste management is indeed signifi can't, we argue that this systemic transformation and comprehensive integration of solid waste management needs more attention.

Authorities in Delhi proclaim that waste management is in a state of crisis – waste is commonly dumped in the open illegally and the three existing landfi lls are over capacity. For example, Delhi's chief minister, Sheila Dikshit, claimed, "The Municipal Corporation of Delhi (MCD) was ineffi cient and corrupt as was proved by the accumulation of garbage across the city" (The Hindu, 2012). This narrative portrays the crisis as a failure of management rather than a public health and urban planning issue.

As a result, waste management has become a technical problem to be solved by experts. It is in this context the solution that has gained favour is the integration of the stages of waste processing into a single system. As we will demonstrate, this integrated system includes the collection and transfer of waste generated by households and fi rms, and finally its ultimate processing (e g, incineration).

Intense confl ict has emerged between the authorities in Delhi and residents who have opposed the privatization of various stages of waste management. For example, those residing near proposed waste-to-energy plants argue that the plants will emit toxins and result in negative health impacts. We focus on this ecological distribution confl ict from the perspective of waste workers1 in the informal sector (Demaria 2010) who are currently responsible for transferring recyclable materials from the formal waste management system to the informal recycling facilities (Gill 2010).

Indeed, the systemic integration of waste management poses a major threat to the livelihoods of waste workers because they must increasingly compete with private fi rms for ownership and control over recyclable waste at multiple stages. There are approximately 1,50,000-2,00,000 waste workers in Delhi (Chaturvedi and Gidwani 2011), most of whom belong to vulnerable communities and are unable to fi nd alternative livelihoods. These workers provide environmental services in the form of high level of recycling in working conditions that are extremely hazardous.

This gives rise to an important ques tion as to how the waste workers' working conditions can become just, safe and s ecure in the context of the ongoing integration of Delhi's solid waste management system.

Before we propose how to include waste workers fairly and safely in the integration of solid waste management, it is necessary to explain how policy is currently undergoing a major shift. The conflict over access to waste was set in motion years ago when a sanitation crisis (i e, the cholera and gastroenteritis epidemics in Delhi) was followed by protests and public interest litigations (PILs) which demanded that the state improve solid waste management.

The PILs led to the creation of various e xpert committees, both at the national and city levels, whose reports outlined problems and offered prognoses. The Municipal Solid Waste (Management and Handling) Rules, 2000 was an outcome of this process and paved the way for the transformation of waste management. Furthermore, during this period, India began to transform from "a recycling to a throwaway society" (MoUD 2005). As a result of economic growth, the volume of waste produced in Delhi increased while its composition changed and it became more valuable. Thus, at the time that the state sought new solutions to waste management, it became a profi table business.

LEGAL AND INSTITUTIONAL FRAMEWORK

The Delhi Municipal Corporation Act 1957 has section 42 C, 355-5.8; stating the functions and role of MCD and citizens in disposal of the waste. The violation of the sections 353, 354, 355(2), 356 and 357 are subject to fines ranging from Rs. 25 – 100 Section 357 (1) "Keeping rubbish and filth for more than 24 hours", carries an additional daily fine of Rs. 10. The brief obligation of MCD is to provide receptacles, depots and places for waste disposal; and not necessarily house to house collection. It is the obligation of occupiers to use these for disposal of their waste.

Municipal solid waste management being the responsibility of Local Bodies, the following municipal entities are responsible for their respective areas:

Municipal Corporation of Delhi (MCD): Thus the MCD area includes urban areas, rural and urban villages, slum clusters and regularized unauthorized colonies. The services of CSE include collection, transportation and disposal of municipal solid waste; road sweeping; cleaning of surface drains, construction and maintenance of public conveniences.

S. No.	Item	Area (sq. km)	Number	Responsible Department
1	Total area	1397.30		Conservancy and Sanitary Engineering Department (CSE), presently changed to the Department of Environmental Management Services (DEMS)
2	Urban area (approx.)	595.00		
3	Rural area (approx.)	795.00		
4	Administrative zones of MCD		12	
5	Total number of employees		More than 52000	
6	Number of workers (*Safai Karmachari*)		About 50000	

New Delhi Municipal Council and (NDMC) : The activities include street sweeping every day; removal of the garbage deposited in 'dhalao' (masonry dustbins) and metallic bins; and transporting the waste to MCD landfill sites at Ghazipur. The green (mainly horticulture) waste is transported to the NDMC compost plant at Okhla.

S. No.	Item	Area (sq. km)	Number	Responsible Department
1	Area	42.74		Health Department
2	Sanitation Circles		13	
3	Number of employees involved with sanitation		1800	

MUNICIPAL SOLID WASTE GENERATION (MSWG)

Solid waste is an inevitable consequence of production and consumption activities in any economy. It is positively correlated with the level of income and highly urbanized economics, generating higher levels of per capita solid waste. Generation of MSW has an obviously related to the population of the area or city. It is because of the bigger cities generate high quantum solid and liquid waste. The information about the quantity of municipal solid waste generation is very useful in evaluation and reviews the present methods of waste management and it is also important for formulating the plans and strategy for future action plans. Delhi is one of the biggest cities in the world and it is known as most polluted city too. The Environmental Protection Training and Research Institute (EPTRI) estimates place MSW generation in Delhi at 4,000 tonnes per day whereas National Environmental Engineering Research Institute (NEERI) study estimates the present solid waste generation in MCD area of Delhi 6000-7000 tonnes per day. A study carried out by MCD for estimating the quantity and characteristics of MSW during the year 2005 and it has indicated that Delhi generates about 8567 tonnes of waste every day. The waste generation in MCD area, NDMC, and Delhi Cantonment Board area is about 6300 tonnes, 900 tonnes, and 100 tonnes daily respectively (IL& FS Eco smart Report, 2005). According to CPCB, 2010-11, Delhi is generating highest quantity of municipal solid waste with 6800 tonnes per day followed by Greater Mumbai and Chennai. A study carried out by WTERI (Waste-to-Energy Research and Technology, 2012) has estimated that Delhi generates 11,500 TPD or 4.2 million TPY the highest waste among union territories. The per capita generation of MSW in Delhi is approximately 0.5 Kg/capita/day (Ahmad, 2012).

In Delhi, there has been significant increase in the generation of municipal solid waste. High waste generation rates in Delhi Reflects higher proportion of commercial and industrial activities as compared to other cities. Data collected on daily quantity of municipal solid waste generated in Delhi since (1993-2011) indicates that there has been considerable fluctuation in quantum during this period. There were continued rise in municipal solid waste in the years 1993, 1994, 1995, 1996 and 1997. The mean daily generation increased 5816 metric tonnes in 2011 from 3340 metric tonnes in 1993. It is matter of fact that the weighbridge machines were introduced in the year 2001 at various landfill sites, as a result accuracy in data generation has been increased and annual figure of waste came down 4599 tonnes in the same year. Whereas, before that it was based on number of trips of vehicles and one trip was estimated equivalent to 4 tonnes of waste while many times trucks were half full with garbage. In 1998 municipal waste reduced than the previous year. The trend clearly shows that there has been significant increase in the generation of solid waste in the last few decades. Since 1993-2011 about 54 percent growth has been recorded in MSWG. In 2005 the MSWG was relatively higher than that of the year 2006. Further since, 2007 it was reduced to a considerable extent than the previous year. Subsequently, a steady growth was experienced. In the years 2008 and 2009, the waste generation rate has increased. It is because of hectic construction activity was in progress related to hosting of Commonwealth Games in 2010. The trend line of MSWG is clearly shows that waste generation is continuously increasing year by year. In 2012 NDMC area has generated 82832.94 metric tonnes waste and it is little increased to 2011 (10731.45 MT.).

In this field survey, 100 respondents from each income groups have taken. Higher income group (HIG) respondents have been selected from Defence Colony and Mayur Vihar Phase II of MCD while middle income group (MIG) people have been chosen from Pachim Vihar and Rohini Sector 2, pocket 5 ward. Jhangir Puri and Nangloi wards were taken for lower income group (LIG) people for the household survey. Therefore, 300 respondents have been surveyed from six localities of Municipal Corporation of Delhi. In this field survey, respondents were asked the approximate amount of waste generated by their families in a day. It was very difficult to know the waste generation in kilograms so they were given the range because it also fluctuates day to day. The quantum of household waste is directly associated with the level of family income, family size and level of education. Out of total 300 respondents, 21.33 percent of them reported that their families were generating less than one kilogram of garbage per day and 49.67 percent respondent's families were creating 1.1 to 2 kgs of waste daily. 20.33 percent of households were under the capacity of waste generation 2.1 to 3 kgs, while 7.67 percent families were those who were producing 3.1 to 4 kgs garbage. 1 percent respondents were reported that their families were generating more than 4 kgs of waste per day. Income group wise, in HIG area, 52 percent households were generating the garbage above 1.1 to 2 kgs per day while in the MIG and LIG localities, maximum families were generating the waste up to 2 kgs per family per day. Therefore, in the context of maximum quantity of waste generation per family, HIG area occupied first position followed by MIG and LIG area.

CONCLUSION

The informal policy of encouraging the public to separate MSW and market it directly to the informal network appears to be a better option. The involvement of people and private sector through NGOs could improve the efficiency of MSWM. Public awareness should be created among masses to inculcate the health hazards of the wastes.

Littering of MSW should be prohibited in cities, towns and urban areas notified by the state government. Moreover, house-to-house collection of MSW should be organized through methods like collection on regular pre-informed timing and scheduling.

Management of municipal solid waste in the city is far from satisfactory. There are problems in the solid waste management practices prevailing in the city at every level, i.e., collection, transportation, processing and disposal. Mismanagement of solid waste is a matter of serious concern for public health and environment. In MCD zones there is no clear cut standard for the placement of waste receptacles. Present design and location of waste receptacles is not accepted by the people. The distribution of safai-karamcharies and transportation vehicles in MCD zones is uneven. Presently, all three landfill sites are fully packed and overflowing. Government must encourage composting, vermin-composting, incineration, refused derived fuel etc. processing and treatment methods for reducing the solid waste disposal problems because the processing of the waste is only the answer of municipal solid waste.

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