

Study on solid waste management in different income groups of Lucknow city

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SUMMARY : Management of solid waste in India's growing urban areas is a challenging problem. Current practices of unscientific dumping of domestic waste have created serious environmental and public health concerns. This study attempts to study the municipal solid waste management (MSWM) in the capital city of Uttar Pradesh, Lucknow, by a primary survey of 150 households segregated on the basis of income and settlement profile. Estimates of willingness to pay (WTP) were also measured based on parametric modeling. The study indicated that about 77 per cent of domestic waste was biodegradable; segregation of waste and their disposal and about 23 per cent of total waste generated was non-biodegradable which also included recyclable material. The entire study area was divided as a (low income group), B (medium income group) and (high income group) which produced 27 per cent, 28 per cent and 45 per cent of non-biodegradable waste, respectively. The mean WTP was found to be Rs.34 to 46 per month. WTP can be utilized for collecting monthly charges for door to door collection for different settlements in a better way.

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Rapid industrialization, urbanization and population growth (Singh *et al.*, 2011) have led to severe waste management problem in several cities of developing world like India (Narayana, 2009), Malaysia, Nepal, Bangladesh. Although MSW is the catastrophic potential of either global warming or stratospheric ozone depletion has posed threats to environment quality and human health (Singh *et al.*, 2011). India is an agricultural based country having present pollution of about 1200 million. Due to uninterrupted relocation of peoples in India, the share of urban population has increased from 10.84 per cent in 1901 to 31.16 per cent in 2011. It is expected that by 2025 urban population in India shall reach 50 per cent of the total population while the quantity of waste of municipal solid waste generated is expected to triple (www.geetenjalienvirotech). Municipal solid waste management encompasses planning, engineering, organization, administration financial and legal aspects of activities associated with

generation, storage, collection and transfer to all wastes collected and controlled by the municipalities and comprises of most diverse categories of waste (Kurian, 2002; Ramachandra, 2006). It comprises of waste from several different sources such as domestic waste, commercial waste, institutional wastes and demolition waste (Ramachandra, 2006). The uncontrolled urbanization of many Indian cities devoid of many infrastructural services such as water supply, sewage and municipal solid waste management worldwide are overwhelmed by several problems related to solid waste due to lack of serious efforts by town/city authorities' garbage and its management has become tenacious problem and this is not withstanding the fact that the largest part of municipal expenditure is allocated to it. It is not uncommon to find 30-50 per cent expenditure of staff and resource being utilized by urban local bodies for their operation despite this, there has been a progressive decline in the standard of service with respect to collection and

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disposal of municipal solid waste including hospital industrial waste, as well as measure for ensuring adequacy of environmental sanitation and public hygiene in many cities half of solid waste generated remain unattended giving rise to insanitary condition especially due to microbial parasites infectious in all segments of population (www.india.nic.in/public_info/swm). The explosion in urban population is changing the nature of solid waste (Kurian, 2002) in developing countries due to changing life styles (Reddy, 2011). Waste management practices differ in developed and developing countries, for urban and rural areas and for residential and industrial areas (Kurian, 2002). Management for non-hazardous residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities (Soni, 2007), while management for hazardous, commercial and industrial waste is usually the responsibility of the generators.

MSWM continues to remain one of the most neglected areas of development in India. The 23 metro cities in India generate about 30,000 tons of such wastes per day. Piles of garbage and waste of kinds littered everywhere have become common sight in our urban life. It is estimated that solid waste generated in small, medium and large cities and town in India is about 0.1 kg, 0.3- 0.4 kg and 0.5 kg per capita per day, respectively. Studies carried out by National Environmental Engineering Research Institute (NEERI) indicated that the per capita generation rate increases with the size of the city and varies between 0.3 to 0.6 kg/day. in the metropolitan areas, values up to 0.5/capita/day have been recorded. The estimated annual increase in per capita waste quantity is about 1.33 per cent per year (Kurian, 2002). According to central pollution control board (CPCB), of the 50-90 per cent of the total waste generated, 94 per cent of the waste generated are disposed unscientifically and only a small fraction (<10%) is intermittently processed in mechanical compost plant (Shekdar, 1999). Various studies also revealed that about 90 per cent of urban MSW was collected and disposed of unscientifically in open dumps in low lying areas (TERI, 1988). Hence, there is an urgent need of policy shift towards establishment of better waste management in an effort to move towards attaining a sustainable society to serve the future generation from adverse impacts of solid waste management.

Status of solid waste management in Lucknow city:

Lucknow city has a present population of 21.85 lakhs. It is spread over an area of 3204 sq. km. The whole Lucknow town is divided into 110 election wards and 6 zones for solid waste management. Lucknow has been struggling with the problems of SWM. The Lucknow Nagar Nigam (LNN) is responsible for the collection, treatment and disposal of municipal solid waste generated in Lucknow city. Hence, LNN has initiated development of MSWM processing complex in

Lucknow city, with an objective of waste reduction and ultimately effective management. The existing SWM system of Lucknow does not have an engineered landfill site for disposal of wastes. The waste collected from secondary collection points is dumped in an unorganized manner at the dumpsite located at Ghalia/Dubagga, Hardoi-Kanpur ring road, Ramdashkeda village and Kursi road.

Prevailing system of waste disposal:

Usually the waste from the households is thrown on the streets and door to door collection is limited mainly to new areas. Municipal staff responsible for cleaning the street collects the waste and dumps it at the nearest waste depots. There are few depots, and travel time is fairly long leading to the dumping of garbage in any unauthorized depots. Some households have begun to contract private collectors to deposit the waste into the nearby depots, but this is not being institutionalized or regulated at any scale, and it is not uncommon to see street cleaners simply burning the waste. Poor regulation and monitoring poses many health risk and environmental risks, both at the source of waste and at disposal site (www.nswri.org/index.pup).

Waste generation and recycling:

In Lucknow city the municipal workers collect waste material 110 ton/day. The formal recycling systems are underdeveloped, but an appreciable quantity of solid waste generated at the household level is sold to the Kabariwalla (informal vendors) who purchase all recyclables. It is estimated that there are around 2000 Kabariwallas (scrap dealers) in Lucknow who pick up waste from the households and sell to retail traders. In addition to them, there are about 8000 rag-pickers who every day scourge the refuse dumps to recyclable paper. The recycling industry is valued at Rs. 25 crore per annum handling about 200 tonnes per day. The Lucknow Municipal Corporation (LMC) disposes about 1000 tonnes of waste per day. Around 60 to 80 per cent of waste comprises vegetable matter and rag pickers collect small proportions of manufactured waste.

Disposal arrangement:

The LNN has prime responsibility for solid waste management. Within the LNN, responsibility for primary collection of waste up to depots is under one department while secondary collection, *i.e.* from depots to disposal site, is with another department thus posing problems of coordination. There are about 3800 Safaikaramcharis working in the Nagar Nigam *i.e.* almost 1.8 sweeper per 1000 population as against the health department norms of 2.8 per 1000 population. Collection practices vary from sweeping some streets twice a day to no street sweeping. Some of the developers have engaged Safaikaramcharis. The Nagar Nigam

will be eventually responsible for this once the colony is handed over. In the peripheral areas and surrounding villages, there are no arrangements for street sweeping. A variety of vehicles are used to transport the waste from the depots the disposal sites. These include three wheelers, trolleys, tractor- trailers, tipper trucks served by mechanical loaders, dumper placers, and compaction rear end loaders. The municipality has a solid waste transport fleet of 75 vehicles of which on an average only half are in usable condition at any time since the average age of the fleet is around 15 years. The fleet collects an estimated 850 to 1050 tons of waste per day from approximately 500 depots with the frequency of collection varying from daily to once in a month depending upon the quantity of waste collected at a depot. The MSW is disposed of in open dumping site in under pressure to locate new disposal site. In some areas households practice segregation and the municipality and NGO's collect the organic matter separately for use at the disposal plant for generating gas. Some NGO's have popularized vermicomposting in some of the wards and charge households a nominal amount per month for services. The Nagar Nigam has employed 6000 Safaikaramcharis on various terms of contracts. The key issue here is one of efficiency of the existing staff and systems rather than on increasing numbers.

EXPERIMENTAL METHODOLOGY

To obtain basic data on MSWM, information regarding waste generation and disposal management; a manual survey was carried out in the month of January to March 2011. During survey, five areas were selected on the basis of income and settlements profile *i.e.*, Rajajipuram, Rajnikhand, Telibagh, Southcity and LDA colony. In these areas, 150 door to door surveys were carried out to find out amount of biodegradable and non-biodegradable waste generated and per person waste

generated. During the survey, willingness to pay (WTP) was also estimated through a standard questionnaire and later household's WTP was measured through parametric modelling. Houses were placed in groups on the basis of income as high income group as-C, medium income group as-B, and low income group as-A.

EXPERIMENTAL FINDINGS AND DISCUSSION

For this purpose, two polybags were provided in each house for separate segregation of biodegradable and non-biodegradable waste. The people were asked to collect waste separately in two polybags and after 24 hours polybags were collected, weighed separately in order to find out amount of biodegradable and non-biodegradable waste generated (Table 1 and 2, Fig. 1 and 2).

By doing survey of 150 houses it was estimated that
 Biodegradable waste = 76.18 per cent
 Non-biodegradable waste = 23.69 per cent
 Avg. waste/person = 185.40 g/person
 Avg. WTP = 45.61 /month/household

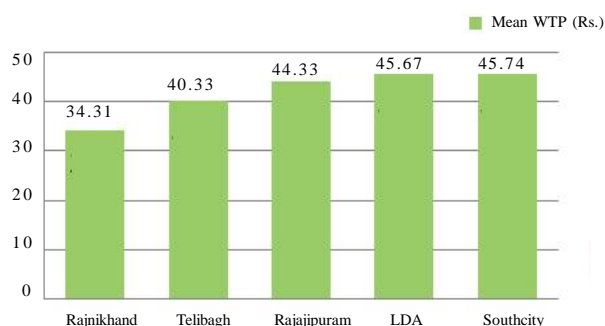


Fig. 1: Mean willingness to pay in Rs. per month in the different settlements of the study areas of Lucknow city

Table 1: Settlements profile and the amount of waste generated along with monthly willingness to pay

Sr. No.	Name of the area	Group	Daily load of per capita biodegradable waste (g)	Daily load of / capita non-biodegradable waste (g)	Daily load of / capita total waste (g)	Mean WTP (Rs.)
1.	Rajnikhand	A	138.49	34.51	172.89	34.31
2.	Telibagh	B	121.71	36.03	157.74	40.33
3.	Rajajipuram	B	129.45	38.15	167.60	44.33
4.	LDA	C	212.1	67.82	279.92	45.67
5.	Southcity	C	114.11	48.39	162.5	45.74

Table 2: Degradable and non-biodegradable waste according to income groups

Groups	Percentage of non-biodegradable waste generated	Percentage of degradable waste generated
A (Low income group)	27%	79.89%
B (Medium income group)	28%	77.20%
C (High income group)	45%	72.99%

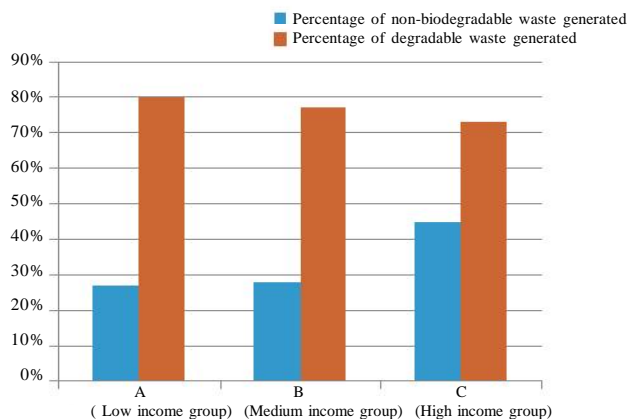


Fig. 2: Non-biodegradable waste generated by different income groups

Thus, by doing survey it was estimated that about 77 per cent of waste generated in Lucknow city was biodegradable, therefore if proper segregation of waste is done at household level this problem can be easily solved.

Conclusion:

After conducting the survey we came to the conclusion that there was no waste management system in more than 30 per cent habitable places *i.e.* in slumps and unorganized households. During conducting the survey all the three income groups produced approximate same quantity of biodegradable waste but high income group produced high percentage of non-degradable waste. As the living standard goes up consumption of paper and plastic also goes up. So, quantity of solid waste increases in higher societies. During the survey, it was found that even in main areas of Lucknow such as different blocks of Indiranagar and Gomtinagar, Nishantganj, Southcity, Eldico colony, Telibagh, Alambagh, Aliganj and Vikasnagar, Mahanager localities are totally devoid of SWM facility by municipality or other responsible authority; where every household in these localities is compelled to pay between Rs.20 to 50/- month to private scavenging staff. These private scavenging members are generally illiterate so they just dump the solid waste to any low lying areas, along the roadside or the railway tracks. Even a large group of people residing in the city don't know SWM practices thus they through mixed waste which causes solid waste management problem.

Suggested measures for appropriate MSWM in Lucknow city:

About 70 per cent of the waste generated in the city is biodegradable; therefore if proper segregation is done, this problem can be easily solved.

If waste is collected separately in two different dustbins *i.e.* in one biodegradable and in other non-biodegradable. Further, in each locality two persons should be appointed for

collection of waste routinely. They should collect waste separately so, that biodegradable waste should be taken for composting and non-biodegradable for recycling and rest of the waste for land filling. By this method much problem of waste can be solved out and this will also help to keep our environment clean.

By adopting these following methods mismanagement of waste can be minimized:

- Segregation of waste at household level should be encouraged and promoted.
- Primary level of collection should be ensured from each other house hold for these private agencies/NGOs should be involved.
- WTP can be utilized for collecting monthly charges for door to door collection for different settlements.
- The vehicles for transporting MSW from the transfer point of the disposal site should be appropriately designed, suiting the waste characteristics.
- Along with land fillings, composting of MSW should be next appropriate option.
- There must be some appeal to the local residents for proper MSW management. Competent authority should ask suggestion from local people for MSW management.
- Open waste should be stopped as these practices create an unhygienic conditions.
- Litter bins should be placed at public place as to prevent these places from littering.
- Well mechanized vehicles should be used for loading and transportation of MWS.
- Complete ban on throwing waste on streets. Abolition of open waste sites and other unhygienic streets bin.
- Sweeping of streets should be done routinely.
- Awareness about waste minimization is needed.
- 3 R initiative should be followed *i.e.* reuse, reduce and recycle.

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