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Original Research Article

Community Perception towards Solid Waste Management in NCT of Delhi, India

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ABSTRACT

Solid waste generated by domestic, commercial and industrial activities is often indiscriminately disposed off and its unscientific management leads to serious environmental problems. One of the important challenges posed by rapid urbanization is management of waste generated by ever increasing population. Community participation has a direct bearing on effective municipal solid waste management. Investigation on community attitude, perception and willingness towards solid waste management was carried out in the NCT of Delhi. The collection of households data was on the basis of the field survey through personal interviews conducted using the tools of enquiry like structured questionnaire and field observations. It was observed through the field survey, that maximum 60 per cent of the respondents had expressed that they were ready to participate in different capacities. It included both physically and financially participation for the better management, 98 per cent households are preferred daily collection and 81per cent of the households are preferred to segregate the waste into different bins. The majority of the households about 78 per cent are willing to use the recyclable products which they were using to carry vegetables, grains etc. from whole shop/markets, as they have aware about reduce, recycle, refuse and reuse (4R's). Greater level of community engagement in reduction of waste at the source through campaigns in a scientific manner is needed.

Keywords: Community, Perception, SWM, Reduce, Recycle, Refuse and Reuse

1. INTRODUCTION

The concentration of population at different places posed many challenges for the planners. Along with the question of provision of basic amenities and services a major challenge is to manage the huge quantity of waste generated in places. Among other things, solid waste generation is a consistently increasing problem at the global, regional and local levels. Solid waste comprises organic and inorganic waste materials produced by various life style activities of a community. Several studies have indicated that ineffective disposal of solid wastes tend to pollute the environment (air, land and water) at both the local and global levels. The problem reaches critical dimensions in developing countries rather than in developed countries due to unplanned urbanization and economic activities. India too is faced with this problem with ever increasing population. It has seen a considerable increase in MSW (municipal solid waste) generation in the last few decades. The problem is further aggravated in urban areas on account of high density of population. The problems and issues of municipal solid waste management (MSWM), therefore, deserve immediate attention. It cannot be denied that rapid population growth has overwhelmed the capacity of most municipal authorities to

provide even the most basic of amenities and services. Today the most important subject that affects and worries mankind is the issues concerned with waste management. Waste management practices especially the municipal solid waste can differ for developed and developing nations, for urban and rural areas, and for residential, commercial and industrial producers. Waste collection methods vary widely among different countries and regions. Domestic waste collection services are often provided by local government authorities, or by private companies in the urban cities. Countries and experts alike spend lot of time and resources to come out with a solution to the problem of environmental degradation and climate change. A problem created by mankind due to thoughtless act of consumerism (Sebastian, 2010). Community participation has a direct bearing on efficient Solid Waste Management. Yet, the municipal authorities have failed to mobilize the community and educate citizens on the rudiments of handling waste and proper practices of storing it in their own bins at the household, shop and establishment level (Asnani, 2006).

MSWM continues to remain one of the most neglected areas of urban development in India. In many cities more than half the solid waste generated remains uncollected. This large quantity of uncollected waste becomes the simultaneous cause of environmental pollution and ground water resources contamination. Delhi 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 per cent. Delhi is a commercial hub, providing employment opportunities at an accelerated pace of urbanization, resulting in increased municipal solid waste generation the management of which is a critical issue. Waste management problems in cities include searching for new lands for disposal, pollution generation while processing and its disposal all prove cumbersome jobs. Urban waste problems are not confined to the cities alone. They greatly affect peripheral regions also because the demand for disposal spills over across a wider area. Uncontrolled dumping of waste has created successive environmental threats. The present research work was aimed at investigating the perception and willingness of household solid waste management system in Bangalore Urban city as a case study.

2. MATERIALS AND METHODS

2.1 Study Area

The present study is focused on the National Capital Territory [NCT] of Delhi. According to Census, 2011, it is the second largest metropolis in India and the sixth largest metropolis of the world. Being the national capital, it has a large number of government offices, institutions, organizations, foreign Embassies etc. Delhi is geographically placed in North India between latitudes 28°24'17" to 28° 53' 00" North and longitudes 76°50 '24" to 77°20' 37" East. The total area of NCT Delhi is 1484.46 sq. km. (0.04 per cent of the total geographical area of India) (Anand, 2010). About 94 per cent of the total area and 97 per cent of the population are under the jurisdiction of the MCD. The remaining 6 per cent area falls under New Delhi Municipal Council and Delhi Cantonment Board together. The North-West district is largest and the Central district is the smallest in terms of area.

2.2 Data Base and Research Methodology

The present study is a systematic analysis based on primary and secondary data. Secondary data was collected from the Municipal Corporation of Delhi (MCD), Central Pollution Control Board (CPCB), New Delhi Municipal Council (NDMC) and various departments of the Government of the National Capital Territory of Delhi (GNCTD), and Centre for Science and Environment (CSE). A number of reports and information were also collected from non-governmental organizations (NGOs).

The collection of Primary data was on the basis of the field survey through personal interviews conducted using the tools of enquiry like structured questionnaire and field observations. The primary survey was conducted for the 12 zones of the MCD, six localities were selected from the different zones and from different locations on multiple random basis. From each locality, 50 households were selected from the different income group localities criteria of Delhi Development Authority (DDA) like the high income group (HIG) and the middle income group (MIG) flats were selected for HIG and MIG families respectively. The resettlement colonies were taken into consideration for inclusion of the low income groups (LIG) household survey.

3. RESULTS AND DISCUSSION

3.1 Status of Solid Waste Management in NCT of Delhi

In Delhi, there has been significant increase in the generation of municipal solid waste. High waste generation rates in Delhi reflect higher proportion of commercial and industrial activities as compared to other cities. Data collected on daily quantity of municipal solid waste generated in Delhi (1993-2011) indicates that there has been considerable fluctuation in its quantum during this period. There was continued rise in municipal solid waste in the years 1993, 1994, 1995, 1996 and 1997. The mean daily waste generation increased to 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 to 4599 tonnes in the same year. In MCD area of Delhi, the average per capita waste generation is 2.89 kg per capita per day but among all zones of MCD, highest 0.41 kg is recorded in Shahdara (S) zone followed by West zone (0.36 kg) and Central zone (0.35 kg). The community bin waste collection methods have been mainly adopted in India. In Delhi MCD, NDMC and DCB are responsible for storage and managing of waste receptacles in their respected jurisdiction, whereby public employees and equipment are assigned to the task. As per Delhi Municipal Corporation Act, 1953, it is the duty of the residents to deposit solid waste from their houses into municipal receptacles. In MCD area, there are two types of waste storage points existing - one is the dhalao system covered structure more or less closed to the outside, they are 1494 in number and secondly, there is the street dustbin system which accounts 342 in numbers. Street dustbin size varies from place to place. Due to lack of municipal receptacles, open sites have also been identified in some areas as local garbage collection points. There are 433 open sites which have been selected for local garbage collection within the MCD jurisdiction.

Spatial variation is found in the collection of garbage in MCD zone. In core areas of Delhi like, Karol Bagh, Sadar Paharganj, the collection efficiency is good as compare to outer zones. The areas such as Najafgarh and Narela zones recorded least waste collection efficiency. It is concluded that the collection efficiency is increasing with the time. Presently the collection efficiency is increasing and now it is about 80-85 per cent and rest quantity of waste (about 15 to 20 per cent) remained uncollected. Transportation of solid waste is an intermediate yet important activity. It is the vital link between collection and disposal of garbage. It has been estimated that approximately 60-75 per cent waste is collected for transportation to the disposal sites and the main constraints are non-availability of sufficient vehicles and frequent breakdown of vehicles. Recently, the MCD used 722 vehicles 585 RRTs, and 137 loaders. In the MCD area about 600 auto tippers were also used for primary collection of waste from houses. In Delhi the land–filling started in 1975 nearby Ring Road. In 1978 two other landfills were started at Timarpur and Kailash Nagar, till

date 16 landfill sites have been filled up with garbage of Delhi since 1975 in various parts of Delhi. The collection of waste from all the parts of Delhi is going to four operational landfill sites namely Bhalswa, Gazipur, Okhla and Narela-Bawana located in North, East, South and North-West Delhi respectively. The twelve zones of the MCD, two zones of the NDMC and one of Delhi Cantonment Board area are depositing their waste at different landfill sites which are located in various parts of Delhi.

Presently, four composting plant are existing in Delhi. In Delhi one incineration plants are also in processing. The first composting plant was set up in Okhla in 1981. It was semi–mechanized plant of 150 tonnes per day capacity for composting the waste. The second plant was established in Okhla by NDMC (New Delhi Municipal Council) in 1985. The plant capacity is 200 tonnes per day for composting the waste. Now it is working below than full capacity. Third composting plant was setup in Bhalswa with the private sector named Exnora Private Limited Company. It is the joint venture between MCD and EPLC. The Bhalswa composting plant was established in 1999. The capacity of this composting plant is 500 tonnes per day. The fourth plant was established in Tikri Khurd (APMC) in 2001, by Spiral Services to process 125 TPD of green waste of APMC fruit and vegetable market in Delhi.

In Delhi, like other urban areas of India, recycling of MSW is a widely prevalent activity involving both the formal and informal sectors. Commonly, waste pickers and collectors collect recyclables such as paper/cardboard, plastics, metals, glass, rubber, leather and textiles. The degree to which a particular material is recycled depends on the income levels of the residents. The average income varies according to collected waste. Generally a waste picker earns US $ 1.35 per day, whereas a waste collector earns about US $ 2.50 per day. (Talyan et al.2008). Estimates vary, but there are 80,000-100,000 waste pickers and 17,857 waste collectors involved in the recycling industry in Delhi (MCD 2004).

3.2 Socio-Economic Characteristics of Households

Table 1: Table Showing the Socio-Economic Characteristics of Households

Variables	Respondents	Percentage (%)
Gender		
Male	170	56.67
Female	130	43.33
Age		
Below 20	9	3
20-40	168	56
40-60	99	33
Above 60	24	8
Education		
Illiterate	46	15
Primary	23	8
Middle	08	3
Matric	30	10
Senior Secondary	28	9
Graduation	91	30
Post-Graduation	60	20
Professional or Technical	14	5
Family Size		
Small (below 4 members)	135	45.0
Medium (5-6 members)	113	37.7
Large (7-8 members)	38	12.7
Very Large (above 8 members)	14	4.7
Occupational Structure		
Govt. Service	102	34
Private Service	66	22
Professional	15	05
Business	54	18
Retired	18	06
Other	45	15
Income		
Below 10,000	36	12.0
10,000 – 20,000	65	21.7
20,000 – 30,000	53	17.7
30,000 – 40,000	73	24.3
Above 40,000	73	24.3
Living in Present Locality		
Since past 1 year	36	12
Since past 3 years	38	13
Since past 5 years	41	14
Since more than past 5 years	185	61

Source: Primary Survey (2015)

Rapid urbanization processes posed many challenges before planning authorities. Government and the local administration tried and is trying their level best to provide all basic amenities to this population. While doing so, one difficult challenge before the administration is to manage waste generated by this large population. The problem is more critical in developing nations than the developed nations, as their economic growth as well as urbanization is more rapid. There has been a significant increase in MSW (municipal

solid waste) generation in India in the last few decades. This is largely because of rapid population growth and economic development in the country. Due to rapid growth of urban population, as well as constraint in resources, the management of solid waste poses a difficult and complex problem for the society and its improper management gravely affects the public health and degrades environment. Socio-economic characteristics (gender, age, education, income etc.) were investigated to analyzed respondents attitude, perception and their willingness to participate in municipal solid waste management.

3.3 Community Attitude of Households towards Solid Waste Management

Table 2: Table Showing the Attitude of Households on Solid Waste Management

Attitude	Respondents	Percentage (%)
Awareness about solid waste generation		
Yes	240	80
No	60	20
Recycling the waste		
Yes	80	27
No	220	73
Source of waste management information		
ULBs	15	5
Friends and Neighbor	20	7
Media	140	47
NGOs	80	26
No Information	45	15
Collection Frequency		
Daily	224	75
Thrice a week	27	09
Twice a week	44	15
Once a week	05	02
Methods of MSWM		
Recycling	87	29
Composting	105	35
Incineration	89	30
Vermin-composting	19	6
Environmental Problems Due to Waste		
Spreading of Garbage	145	48
Air pollution	100	33
Contamination of Water	44	15
Deterioration of Land Quality	11	04
Mode of People's Participation in MSWM		
Physical	89	30
Financial	30	10
Both	181	60
Waste as a resource		
Yes	186	62
No	36	12
Can't say	78	26
Four R's is Best Approach Solution to MSWM		
Certainly	166	55
Might be	89	30
Can't say	45	15

Source: Primary Survey (2015)

Attitude is a hypothetical construct that represents an individual's like or dislike for as item. Attitudes are positive, negative or neutral views of an 'Attitude Object'. People can also be 'Ambivalent Towards' a target, meaning that they simultaneously possess a positive and a negative bias towards the attitude in question (Kumar and Nandini, 2013). A clean city is a result of consistent efforts done by the city managers and the civil society. The decision-making process for managing solid waste in urban areas is going through a paradigm shift from the "decide, announce, and defend" premise of local authorities to more involved public participation. Solid waste management (SWM) is an activity in which public participation holds the key to success. An urban local body (ULB) can never be successful in SWM without active community participation. The solution is not in the hands of one stakeholder but depends on the interest and participation of all stakeholders. In this context, creating awareness, environmental education and advocacy campaigning programmes are vested with NGOs, media, trade associations and other social institutions.

About 80 per cent of the households are aware about the generation of solid waste and only 20 per cent of the households are not aware about the municipal solid waste generation. Due to their busy schedule in the daily life, they just want to dispose their waste out the house. When asked about the recycling of the waste only 27 per cent of the households are motivated and are involved in recycling and remaining 73 per cent of the households are not recycling their waste due to lack of awareness, responsiveness and time. In Delhi, a household survey was conducted which showed that 38 per cent households give their garbage to private sweepers, who put the waste in the dustbins or dhalaos in most of the area. The garbage of 4.7 per cent of households was being collecting by the NGOs and RWAs, and these were seen in the higher and middle income group colonies. 23.3 per cent of the households

usually deposited their waste personally. It has been observed that in colonies, 52 per cent of the lower income group people collect their waste personally. Majority of households (47 per cent) are aware about waste management information through Media. Beyond this 26 per cent, 7 per cent and 5 per cent of the households are aware about the waste management information through NGOs, Friends and Neighbor and Urban Local Bodies. 15 per cent households have no information on waste management.

Collection frequency is vital at the household level. In Delhi about 75 of the household are preferred to dispose the waste on daily because of the location of their house is near to the dhalao or community dustbin. About 15 per cent of the household are preferred to dispose the waste twice in a week because the household size is medium and the generation of waste is comparatively low. About 9 per cent of the household preferred to dispose the waste thrice in a week because their family size is very small and generation of waste is very low. However, very few (2 per cent) households dispose their waste once in a week.

During the course of the survey, it was found that overall 36 per cent of the households are dissatisfied by the services provided by the MCD. In the middle income and lower income groups of these areas there was a higher level of dissatisfaction with the services, rendered by the MCD. Most of residents pointed out that the present system of municipal solid waste management should be changed. Regarding the treatment of waste materials, 29 per cent of the households suggested that the recycling of waste was the best way for waste management among different available options. According to 41 per cent of the households composting and vermin-composting are the best methods for managing the solid waste. In this context, three-fourth of the residents belonged to HIG and LIG localities. There are 30 per cent of households who suggested the incineration method which is best for solid waste management. Total 89 out of 300 of the respondents advocated for this process. In this context 33.5 per cent belonged to MIG and 33 per cent of respondents belonged to HIG and the rest of the respondents belonged to LIG localities (Table 2). They suggested that, it is a good process and it completes the growing requirements of energy in Delhi.

An effort was made to know, how people can participate in municipal solid waste management practices. It was observed through the field survey, that maximum 60 per cent of the households had expressed that they are ready to participate in different capacities. It included both physically and financially, by both, those who belonged to higher income group colonies, as also those who belonged to the middle income group localities. There were 30 per cent of the households belonging to the lower income group who had gotten ready to participate physically. Among all the people, who were ready for giving their financial contribution, there were 10 per cent and the majority belonged to the middle income group residential areas. It is interesting to note that maximum respondents were ready for physically and financially participating in the successful implementation of the waste management programme.

On the basis of empirical study 62 per cent of the households knew that a considerable part of the garbage could be converted into resource. However, most of them were graduates and well qualified. It is obvious that the waste may be converted into resources, but this resource recovery depends upon the human needs, knowledge, skill, technology, etc. Out of 100 HIG households 76 per cent of the respondents were of the opinion that the garbage may be converted into potential resource. In the middle income group, there were 68 per cent of the people and 41 per cent of the households belonging to lower income groups who responded that waste may be transferred into resource. On the other hand, 26 per cent of the people failed to answer this question. On the basis of the field study,

as assessment was made of how many people knew about the four R's – the best practices strategy solution to municipal solid waste. In this context, a number of people, belonging to the study area were well aware of the benefits of the waste management. The waste is convertible in manure making, electricity generating, methane gas manufacturing and so on. The four R's stand for Reduce, Reuse, Recycling and Resource Recovery. In this context, there were 55 per cent of the households, who were sure that it is the best solution to overcome the solid waste management problems. It is interesting to know, the majority of respondents, who have felt four R's is the best strategy solution to MSWM belonged to higher income groups and were followed by the MIG and LIG localities. About 30 per cent of households reported that four R's might prove to be the best measure for managing the waste in integrated way. While, there were a considerable number (15 per cent) of households who failed to form any opinion, in this context.

4 Perception and Willingness of Households Towards Solid Waste Management

In order to make improvements for future situations, a majority of the respondents [which accounts 38 per cent] favored regular collection of waste and upgrading the solid waste management capacity of many of the areas of Delhi. In this context, majority of households belonged to the lower income group residential areas and were followed by the middle income group colonies. The disadvantageous location and damaged receptacles (dhalaos/dustbins) gave rise to resentment among the residents. Even the present design and location of dhalaos and dustbins was not widely accepted by the people. Lastly, 11 per cent of the households suggested that proper maintenance of collection centres should be taken on priority. On an average 17 per cent of the households wanted that the responsibility and accountability of staff members should be fixed for the efficient and effective functioning of the MCD. Out of the total, 15 per cent households suggested that municipal solid waste management system should be handed over to the private sector for improvement under the present conditions which were going from bad to worse (Figure 1). Because of privatization of services, quality of system would be better. Remaining 19 per cent households are in favour of creating awareness and participation of the masses, so that they could enhance and upgrade the actual solid waste management in various areas of Delhi.

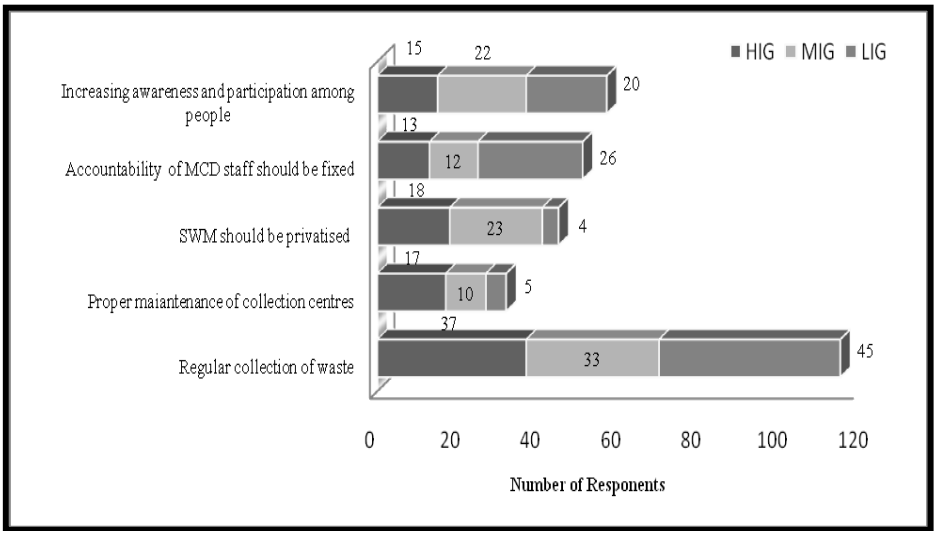

Figure 1: Suggestions by Respondents for Best Method of MSWM in Delhi

Majority of households of all occupation categories had focused on regular collection of waste and enhancing the level of awareness and public participation for solid waste management process. They argued that people's involvement and creating of awareness was very important for the success of this system. Government of Delhi should incorporate these suggestions while formulating and implement ting any plan for waste management, it becomes imperative to take a regular and periodic feedback from the public, so that the planning may be formulated in accordance with the prevailing local conditions of the problematic areas.

4. CONCLUSION

The waste disposal challenges facing urban areas vary from one region to another. For a country that has paid little attention to the issue of SWM, it becomes imperative to recognize the extent of the problem and its growing magnitude. SWM is a vital, ongoing and large public service system, which needs to be efficiently provided to the community to maintain high standards of aesthetics and public health. Municipal agencies have to plan and execute systems in keeping with the increasing urban areas and population. The present study concludes that most of the households feel that the lack of staff penalty and non-execution of law is the basic problem for the effective management of waste. Thus, provision of strong penalties and effective execution of the law will be the major tool to reduce the problem of solid waste management in NCT of Delhi. It is found the awareness about environment is very low among the residents of Delhi.

RWAs, Community groups, NGOs and public-private partnership involvements in necessary in the form of information, motivation and technical assessment. Besides involvement of the users is essential for sustainable benefits. There is an urgent need to implement the Management and Handling Rule, 2000 in strongly and systematic manner. Prevalence of corruption should be curtailed down in order to achieve the set goals. Responsibility and accountability of MCD staff should be fixed. Fair and transparent functioning should be ensured. Integrated Solid Waste Management is the key to mitigation the problem (Anand and Singh, 2014) and it should be implemented from local level to state level. On the part of government, measures should be taken to promote the consumption of recyclable items by the people and make it necessary to adopt 4 R's (Reduce, Reuse, Recycle and Recycling) principle for the sustainable future of urban Delhi.

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