

Status of Municipal Authority and Public Co-Operation for Solid Waste Management: A Case Study in Dayalabagh Area, Agra

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ABSTRACT

Solid waste management is one of the most challenging problems in urban cities, which are facing serious environment pollution issue due to improper management of municipal solid waste. MSWM can be done in well manner with the cooperation of municipal authority and public. This paper presents the assessment of status of cooperation between municipal authority and public. Extensive field investigations were carried out with the help of questionnaire survey and in-depth interview, to know the MSWM status (as per MSW rules, 2016) by municipal authority of Dayalbagh area, Agra. MSWM by residential public and street vendors was also assessed with the help of questionnaire survey. After assessing MSWM measures taken by Municipal authority and public, individually, co-operational status of municipal authority and public was also revealed. Some recommendations were also given after analyzing the results. Based on the recommendations, municipal authority can make much better plans for providing better services in it's area.

Keywords: MSW- Municipal Solid Waste, MSWM- Municipal Solid Waste Management

INTRODUCTION

Municipal solid waste management is a crucial issue for sustainable development of any nation. With passing time population of the world is increasing day by day and lifestyle has completely been changed from past two decades. Improper municipal waste management not only causes hazards to inhabitants but it becomes the pollution causing issue for the environment of that place. Urbanization and changing life style seem a major cause for increasing municipal waste all around the world (Vij. Dimple, 2012). Generally municipal waste management is the service provide by the municipal authority of that place, but keeping a place clean and saving environment is not only the duty of a municipal authority but also the moral duty of the inhabitant public of that place. For proper and more effective municipal solid

waste management non-formal sector and private sector should be organized and should participate more widely in collection and recycling (Souro D. Joardar; 2000). In the assessment of status of municipal solid waste management in metro cities, state capitals, class 1 cities and class 2 towns in India, by Bhattacharya et. al., (2009), the status of Agra city was in very pitiable condition. Solid waste management is a challenge for the cities' authorities in developing countries mainly due to the increasing generation of waste. SWM is not one but many's behaviour that can be done in proper manner with the cooperation of public and private sector. Household waste can be reduced at the source by the people if they are aware about it. This promotes waste reduction at source hence amount of municipal waste can be reduced to a large

extent if waste is prevented at source. And the remaining generated waste after reduction should be treated in hygienic manner Here this study has been undertaken in small community area, name Dayalbagh, of Agra. Agra, the city of Taj (one of the seven wonder of the world) is centre of attraction among the tourists of worldwide.

Agra has a special place in Uttar Pradesh as it is the place, which is visited by a large number of tourists. To attract more tourists, a city should be clean and environment should be healthy. Municipal solid waste management is main facet to make environment healthy.

How public or inhabitant of a place manage it's waste also depends on the awareness and education of the inhabitants of that place. So in this case study public was divided into two parts – resident public and street vendors of Dayalbagh area. Solid waste management is a crucial issue for sustainable development of any nation and many global initiatives are being taken for solid waste management from past two decades. Till now no work has been done to analyze public and municipal authority's efforts towards SWM in Agra. This present case study was undertaken to analyze the status of MSWM by municipal authority and public of a small community area of Agra.

Objectives of the study

Waste management is a big problem in almost every area of Agra District. Sound waste management can be done easily if every individual understands his responsibility towards environment and his surroundings. Main objectives of presents study are-

- To establish role of public, street vendors and municipal authority in solid waste and management.
- To rate the public on a scale of different classes according to their awareness and efforts they are making for solid waste management.
- To correlate and assess the role of both public and municipal authority.

Area of study, at a glance

The place Dayalbagh lies in the extended part of the city of Agra in Uttar pradesh. It is situated at a distance of 13 kms from the center of the city. Although Dayalbagh lies in the outer fringes of the city of Agra, it is an important part often frequented by visitors. Dayalbagh is a beautifully decorated and planned region of Agra. The region is easily accessible from the city center. The area is designed to accommodate tourists and to cater to all their needs. Dayalbagh is a nagar pancayat city located in Agra districts which is divided into 10 wards. Dayalbagh is most populous Nagar Nanchayat with about 3000 population in Agra region. The total area of Dayalbagh is 2235 acre. The municipal authority of here is Dayalbagh Nagar Panchayat which provides it's services in it's 10 wards. Dayalbagh is located in the north of Agra city bounded on west, north and east by river Yamuna. Geographical coordinates of Dayalbagh in Agra are 27° 13' 0" North, 78° 1' 0". Total area is 2235 acres of which 63% area is covered by greenery.

Dayalbagh is a Nagar Panchayat city located in Agra districts which is divided into 10 wards. Here solid waste management and sanitation is provided by Dayalbagh Nagar Panchayat. Dayalbagh Nagar Panchayat controls solid waste management in the different Mohallas of 10 wards.

Ward no.	Ward name	Extension of ward
1.	Soami Nagar(north)	6/184 to 251, 7/1 to 7, 11/1 to 24
2.	Karyavir Nagar(west),Saran ashram nagar(east)	2/75 to 116
3.	Karyavir Nagar(north),Prem Nagar (east)	2/1 to 74 , 2/117 to 130, 3/187-234
4.	Vidyut Nagar (east)	4/102 to 263, 1-14 to Basant Awas
5.	Dayal Nagar ,SaranAshram Nagar(west)	1 to 32, 1/1 to 41
6.	PremNagar(north), Vidyut Nagar(west)	3/100 to 186, 3/235 to 270, 4/1 to 101
7.	Swet Nagar(south), Radha Nagar colony	5/105 to 182, 5/342 to 401
8.	Swet Nagar(south)	5/1 to 104, 5/18 to 341
9.	Soami Nagar(south)	6/1 to 183
10.	Prem Nagar(west)	3/1 to 99

Table1. **10 wards of Dayalbagh**

Population of Dayalbagh area is about 3000 with 96% literacy. It is a self contained colony. It is an organized community and works under the leadership of Sant Satguru. The lifestyle of people, here, is very simple. With 96% literacy people, here, believe in doing hard work and lead a simple life.

METHOD AND METODOLOGY ADOPTED

To achieve the research objectives information from community level of society was gathered through qualitative methods. Qualitative information was gathered from in-depth interviews and questionnaire survey of street vendors, residential public of Dayalbagh area and officers of Dayalbagh Nagar Panchayat.

While quantitative data related to waste generation amount and rate in Dayalbagh area was gathered by questionnaire survey of officers of Shiromani Nagar Committee and Dayalbagh Nagar Panchayat.

QUESTIONNAIRE SURVEY AND IN-DEPTH INTERVIEW OF PERSONEL AT MUNICIPAL AUTHORITY-

The questionnaires were designed for different categories of respondents. For officers of municipal authority questionnaire contained the questions regarding- area of jurisdiction, population of area, colonies under different wards, functions carried out by the authority, waste generation categories and amount, waste storage, collection and disposal strategies, waste management

strategies, problems facing in MSWM, financial support from government, expectations and co-operation from resident public.

QUESTIONNAIRE SURVEY OF STREET VENDORS

Street vendors (fruit seller, vegetable seller) of Dayalbagh area were also interviewed and examined with the help of questionnaire. Questionnaire of street vendors contained questions regarding education of respondent, separate collection of waste, disposal mode of waste, willingness to use bins if not using, opinion on polythene ban drive, willingness to make area clean by managing the waste.

QUESTIONNAIRE FOR HOUSEHOLD RESIDENTS

Questionnaire designed for household residents contained questions regarding knowledge about SWM, problem faced by them in area, opinion on major issues that affect environment, waste generation amount category wise and collection strategy at home, awareness about categories of waste, separate collection of waste, waste reduction strategies, family member participation in MSWM, willingness to participate in composting, recycling, willingness to make effort by managing household waste.

SAMPLE SIZE AND SAMPLE SELECTION

To determine the role of street vendors 50 fruit sellers and vegetable sellers from boundary between New Agra and Dayalbagh to girls' hostel (1st) DEI, were contacted.

OBJECTIVE 1. The first objective of the present case study was to establish a role

To determine role of household public, 100 households of 10 wards mentioned above were contacted to know their habits and their knowledge of waste management and segregation.

Survey respondents were selected in-situ using a random sampling technique called *equal probability systematic sampling*, which involves the direct selection of subjects from the sampling frame. Specifically, the selection of housing units from the sample frame was based on the following two criteria: 1) the housing unit belonged to any ward mentioned above and 2) the respondent was a resident of the housing unit and above the age of 18.

SURVEY PROCEDURE

To implement the survey, residents of Dayalbagh area were contacted and communicated by different means as face to face communication, by email or on phone. The questionnaire was spread among people either by giving in hand or by email. If respondent faced some problem in understanding the questions in questionnaire, it was resolved.

Entrance of any unknown person is not allowed in Dayalbagh colonies so permission from chairman sir of Shiromani Nagar Committee was taken to enter in different colonies of Dayalbagh. The questionnaire implementation of households was done from 15.09.2016 to 30.09.2016. And questionnaire interview of street vendors was done in the month of August. In-depth interview of officers of Dayalbagh Nagar Panchayat and Shiromani Nagar Committee were done from August to September 2016.

RESULTS

of municipal authority, street vendors, household residents. Following results

were gathered after questionnaire survey and in-depth interview of officers of Dayalbagh Nagar Panchayat and Shiromani Nagar Committee -

	Category of waste	Waste generation per day
1	Domestic waste	900kg/day
2	Recyclable waste	450kg/day
3.	Non-biodegradable waste	450kg/day
4.	Biomass	1500 kg/day
5.	Electronic and hazardous waste	No specific data available
6.	Waste from establishment	150 kg/day approx

Table 2. Waste generation amount in 10 wards of Dayalbagh area

Strategies followed by Dayalbagh Nagar Panchayat

1.As per the municipal solid waste(Management and handling) rules 2000, schedule 2, littering of solid waste on road/street/lanes/open areas is prohibited. This is ensured by proper storage of waste at source generation by households, shops, establishment. So segregation of waste at sources of generation is emphasized by Dayalbagh Nagar Panchayat.

2.Dayalbagh Nagar Panchayat is following management and handling rules 2016 given by Government of India. Bin standardization policy, given by CPBC and Government of India, is practiced in Dayalbagh area by Dayalbagh Nagar Panchayat.In this bin standardization policy different colored waste bins are used, as instructed in Management and handling rules 2016.

COLOR OF BIN	TYPE OF WASTE
Green bin	Biodegradable waste
Black bin	Non-biodegradable waste
White bin	Recyclable waste
Red bin	Electronic and hazardous waste

Table 3. type of bins used for different types of waste

These different colored waste bins are kept on roads in Dayalbagh area. So that people throw different types of waste in these bins.



Figure 1. Different colored bins on roads of Dayalbagh area

3.Though Dayalbagh Nagar Panchayat is following the rule of using separate bin for different kind of waste but these bins are not designed properly because these bins open from the bottom so sometimes waste scatter on the road which becomes so unhygienic.

4. Along with the bins kept on the roads, every housing unit is given different colored bin to collect different types of waste separately to ensure the segregation of waste at generation.

5. Collection and transportation of waste is done as-
 Green bin(biodegradable organic waste)
 - picked up daily by Safaisevak

Black bin(non-biodegradable waste) -
 picked up alternate day by Safaisevak
 Blue bin(polythenes, plastics) -
 picked up once in a week by Safaisevak
 Brown bin(papers, cardboard etc.) -
 picked up once in a month by vendor

6. Collection of waste is not on advance level in Dayalbagh area, because in advance method mechanization is increased, in this method waste from bins of house directly goes into collection cart. But in Dayalbagh Safaisevak brings his cart from door to door, then bin from every house is picked up by Safaisevak then it is emptied in his handcart. But, yes, of course, present collection method is also sufficient to maintain sanitation condition in proper condition.

7. CNG driven dumper is used to transport the waste to the disposal site. Though CNG dumper are ecofriendly, yet they are less efficient. But Dayalabagh Nagar Panchayat is looking forward for its better replacement.

8. The collection and disposal site of Dayalbagh area is land owned by RSS(Radhasoami satsang sabha).

9. Because waste is segregated at the origin, so it eliminates the step of segregation while managing or processing the waste. This also saves the energy consumption.

10. In Dayalbagh area, landfilling and aerobic composting is practiced. Rest of nonbiodegradable waste is given to vendors or rag pickers.

11. Landfilling is practiced on the land behind the office of Dayalbagh Nagar Panchayat.

Though composting is not in advanced stage, yet it is performed in eco-friendly manner. Only aerobic composting is practiced here.

12. No recycling or thermal treatment is performed in Dayalbagh area.

13. Ultimate objective of Dayalbagh Nagar Panchayat is to have "zero waste output system" in which waste is converted into organic composter recycled or disposed through authorized vendors.

14. Entire recyclable waste(plastics, papers, cardboard, tincans, metallic waste, glassware etc.) and electronic and other hazardous waste are disposed off through authorized vendors.

15. Entire kitchen waste along with biomass generated in Dayalbagh in converted into organic manure by aerobic composting.

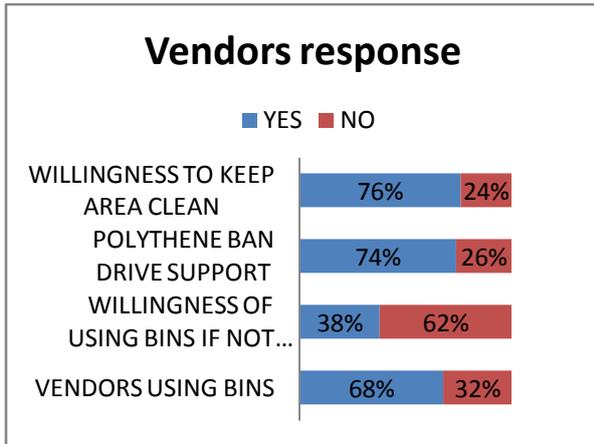
16. For composting no extra land is required as existing land is sufficient for more composting.



Figure 2. Landfilling site behind the office of Dayalbagh Nagar Panchayat

Role of street vendors

To establish the role of street vendors questionnaire survey was done. By getting the response from vendors results were prepared and analyzed. Most of the street vendors were either uneducated or less educated. Below bar is reflecting some of results.



By analyzing this bar graph it can be concluded that majority of street vendors are using their bins to collect garbage. But those who are not using garbage bins are in majority who are unwilling to use bins. Sometimes government imposes a polythene ban drive to discontinue the use polythene to save environment. 74% street vendors supports polythene ban drive and 76% street vendors shows willingness to keep the area clean by managing the waste generated. The results are very encouraging from even less educated group of public. The positive results from street vendors can be assumed the result of strict rules imposed by Dayalbagh Nagar Panchayat. those who are unwilling to make efforts towards SWM, are the same persons who are not even using bins for collection of their waste. Their attitude is the results of less education and lack of awareness.

Role of Resident Public

To establish the role of public questionnaire survey was done. The questionnaire contained several question to know about public habits regarding MSWM. Brief results are shown in table given below-

Question	Percentage of people with different responses
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1.Awreness about SWM	YES-71%	NO- 29%
2.Problem related to SWM in area	Yes -15%	NO-85%
3.Awareness about categories of wastes	Yes -61%	No -39%
4.Mode of waste collection	Close container-97%	Open container-3%
5.Separate collection of waste	Yes- 91%	No -9%
6.Applying waste reduction in daily life	Yes- 56%	No-44%
7. Family member participation in SWM	Yes- 68%	No-32%
8.Willingness to make efforts for SWM by managing household waste	Yes-83%	No- 17%

Table 4. Results of household waste management

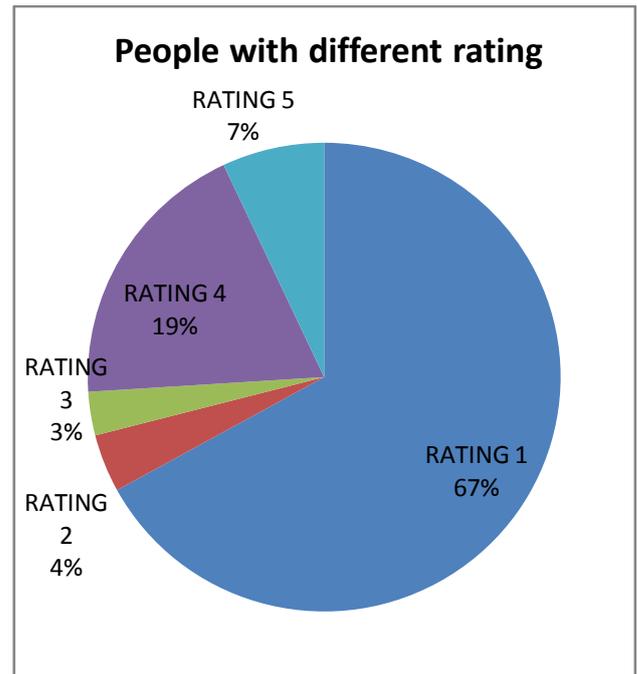
Results in above table 4 showing that majority of houseold public is aware about SWM. 91% are collecting their waste separately which is very encouraging. Along with segregation of waste at generation people are applying waste reduction in their daily life. 97% are used close container for collection of waste. And 83% are willing to make efforts by managing their household waste.

Objective 2. Scaling of resident public on the basis of their awareness and efforts they are giving towards SWM

After taking responses of household public, scaling of public was done on the basis of their awareness and efforts they are giving for SWM. People were rated on a scale of 1-5, containing different categories of public. The 5 ratings were according to different classes, these classes are as –

Rating	Classes
1	People aware about SWM, making efforts and interested in making more efforts.
2	People aware about SWM, not making effort any effort but interested in making efforts
3	People not aware about SWM, not making any effort and not interested in making efforts
4	People not aware about SWM, but making efforts and interested in further making efforts
5	People not aware about SWM, making efforts in pressure and not interested in making further efforts.

Table 5. Different rating with different classes



People were rated on the basis of their attitude and efforts they are making presently towards SWM. And on the basis of their efforts and attitude, different classes with different rating were prepared.

From the above pie chart it can be deduced that 67% people are with rating 1 it mean 67% people are presently giving efforts towards SWM by managing their household wastes and interested in making more efforts further.

After that 19 people out of 100 are with rating 4 which means 19 people out of 100 are those people which are not aware about SWM, but making efforts by managing their household waste and interested in making more efforts further.

7 out of 100 people are those who are not aware about SWM, making efforts under the pressure of rules of municipal authority but not interested in giving efforts further.(with rating 5)

Objective 3.

To establish a correlation between cooperation of public and municipal authority

In the first objective of the present case study role of municipal authority was determined. After analyzing all the results it was concluded that Dayalbagh Nagar Panchayat is making best efforts to provide best services to its residents. Dayalbagh Nagar Panchayat not only following the recent management handling rules, 2016 given by Government of India, but also taking extra efforts for welfare of public and area. Several meeting on definite intervals are done to spread awareness among people about SWM. People are instructed to follow the rules. In short, Dayalbagh Nagar Panchayat putting best efforts to its best to providing best services to the public and making the area clean. Above all, it is expected from public also to cooperate by following the rules.

By analyzing the role of public in first objective of the present study, it was concluded that in less educated group of public, majority of street vendors are also making efforts by using bins and putting the waste in right types of bin placed on the road.

And by analyzing objective 2 of the present study it can be easily seen that majority (67%) of highly educated public is aware about SWM and giving output by managing and segregating their household waste at origin as instructed by Dayalbagh Nagar Panchayat. They are taking many different measures in their houses – as some people use the food from community kitchen which reduces food waste, they use an item multiple times in different forms to reduce the amount of waste. They live a simple life to

ensure less waste generation. People here, believe in “waste nothing”. These are very good measures everyone should apply in daily life to protect the environment.

So it can be concluded finally that public and municipal authority are working in cooperation with each other to make the area clean and keep the best environmental conditions in Dayalbagh area.

DISCUSSION AND RECOMMENDATIONS

Gopal Dayal et. al.,(1989-1990) assessed the impact of climatic conditions on solid waste characteristics at Agra city. 450 samples were analyzed to compare the various physical and chemical properties of solid waste generated by different groups in different seasons. Though this work was related to solid waste but it was not concerned with waste management it concluded with climatic effect on physical and chemical properties of waste generated in Agra city.

In 2000, **Souro D. Joardar** presented an article in which he emphasized briefly on waste generation, collection, disposal scenario across urban India. This article also highlighted the issues in institutional arrangement for solid waste management. This articles also touched the impact of financial health of municipal authority and limitation and potential of alternative actors particularly the waste collectors and vendors of non formal sector. This article seems quite close to the present case study because this article in conclusion suggested that non-formal sector and private sector should be organized and should participate more widely in collection and recycling.

Bhattacharya, et. al.,(2009) assessed the status of municipal solid waste management in metro cities, state capitals, class 1 cities and class 2 towns in India. In this work extensive field investigations were carried out for quantification and analysis of physical composition and characterization of MSW in each of the identified city. Agra was one of those 59 cities in which this work was done. In conclusion of this assessment Agra city was in very pitiable condition regarding Solid waste management.

Till now no work has been done to analyze public and municipal authority's efforts towards SWM in Agra. This case study analyzed the cooperation between municipal authority and public in qualitative manner.

The results of street vendors, reveals that some vendors do not use bins for collection of their waste and dump the waste on road, this makes the area unhealthy and dirty. These people are either unaware about collection strategy of waste or do such type of things intentionally so there is need of spreading more awareness about SWM and making more strict rules for keeping the area clean.

In the same way 29% in household residents were not aware about solid waste management, and 39% were not aware about biodegradable and non-biodegradable waste, it means there is need of more public environment awareness.

Some people said that they feel uneasy in separate collection of waste due to non-cooperation of other family members, this indicates that there is need to conduct more campaign by municipal authority to

make every person realize about his responsibility towards environment.

The other problem people said about was, uncontrolled use of polythene. So there is a need to limit the use of polythene.

From the results it can also be seen that organic waste generation is maximum in Dayalbagh area, this organic waste is not harmful to the environment and can be recycled through composting methods etc.

As per municipal authority rules, each housing unit should collect different type of wastes separately, if the waste are collected collectively then Safaisevak will not pickup their waste. The effect of this rule is reflecting in survey results that 91% collect their waste separately.

More than 50% seem willing to participate in any one of waste management program this is showing that people are ready to give efforts towards SWM.

Though these results cannot be assumed 100% true because in questionnaire method there are many errors like sometimes respondent may not answer truly, or respondent may misunderstand the questions etc. Also to implement the questionnaire to the respondent, interviewer should be proficient in local language and should understand the problems that a respondent may face while answering the questions of questionnaire. The social status of the interviewer may also impact the respondent, because the respondents may feel an intrinsic pressure to respond in a way that does not reflect the truth, and may answer the way they think the interviewer wants them to answer.

According to Bertrand and Mullainathan (2001), the interactive nature of the survey procedure plays a large role in shaping the responses to subjective questioning where the respondents want

to avoid looking bad in front of the interviewer.

CONCLUSION

Purpose of the study was to assess the status of cooperation between municipal authority and public in Dayalbagh area.

In conclusion, municipal authority and public are working in cooperation with each other yet there is need to develop more strategies, like there is no recycling center in Dayalbagh so municipal authority should think about these types of program. And public also, those who do not want to give efforts by managing household waste, should understand their responsibility towards environment.

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