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## MUNICIPAL SOLID WASTE MANAGEMENT IN GUWAHATI: A CASE STUDY

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### Abstract

*This article highlights the problems of solid waste management in the city of Guwahati. The institutional responsibility of solid waste disposal system is assigned to the Guwahati Municipal Corporation. But the service provided by the corporation is neither efficient nor sufficient. This has created enormous problem in the city. Therefore, an attempt has been made in this article to examine people's willingness pay to solve the problem.*

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### PROBLEM

Management of solid waste is becoming a major problem in many urban areas. Although it may not have direct threat to human or environment, but too much waste will affect the environment and quality of human life, if the waste is not properly managed. Unmanaged and increasing quantum of solid waste due to changes that have taken place in technology and life style is a major problem in most of the cities. Rapid increase in population, massive expansion of the urban areas and the changing lifestyle have also aggravated the problem (Ajadi et al.,2010). At the same time quality of environment plays an important role in determining quality of life. Berger (1998) concentrates on pressure state response framework for assessing environment and proposes a full system approach that is based on the recognition that human and environmental well-being are to be sought as an interlinked goal. Without taking into consideration the aspects of

environmental well being, the extent of human development is not complete. This is so because of the fact that an improvement in quality of life requires the preservation of ecosystems and maintenance of environmental quality besides improving income and material condition (Casey, 2008).

Management of wastes is one of the most challenging tasks for the developing as well as developed countries. Because waste absorbing capacity of the environment is very limited and reduced wastes is must to make cities more sustainable for improving quality of life. It improves livability in cities (Newman, 1999). Reduction in the quantity of wastes is important for any city to sustain in long run for the reason that wastes generation has direct bearing on quality of life (Baud et al., 2001). Especially for India, waste is a major problem (Dahiya, 2003). According to Dahiya it is mainly due to lack of institutional cover and poor financial situation of

administration. The author proposes community driven development initiated by the civil society itself.

There is spatial as well as cross sectional variation in waste disposal habit and management (Ajadi et al., 2010). In a study by Afon Able (2007) has found that there are differences in waste generation pattern over the years and across different types of residential areas. Studies have been conducted to see whether waste management practices and importance given by government authority to rich and poor area varied or not (Shadbegian et al. 2009).

Many authors have measured willingness to pay for managing the problem of solid wastes owing to the fact that the problem of wastes has direct bearing on human life. It is not only the high income and middle income group who have been found to show willingness to pay for management of solid wastes but low income group also plays a proactive role for management of the problem of solid waste (Murad, 2007 and Anand, 1999). Sometimes respondents living in those areas receiving waste collection services are willing to pay more than those who do not receive waste collection services. But these differences have not been found to be statistically significant (Afroz et al., 2009). Waste management is a basic service which is crucial for maintaining good living condition. Therefore, local stakeholders' participation in social and environmental activities is necessary to resolve such socially undermining and environmentally degrading problems. In fact, a good relationship among private sector, people and local authority may improve the condition of the city (Kassim et al., 2006)

The problem of solid waste has raised its ugly heads in the city of Guwahati in the last few years. Guwahati is the main urban centre of the entire North East India and is the hub of commercial, business, educational, socio-cultural, political and other activities. The intensity of the problem is increasing with increase in the pressure of population and change in lifestyle of the residents. Total MSW generated per day varies between 350-500 metric tonne of which 53.69 percent is compostable and 23.28 percent is recyclable (CPCB, 2006). The institutional responsibility of solid waste disposal system is assigned to the Guwahati Municipal Corporation (GMC). Such conservancy services are under the supervision of the corporation's Public Works Department staff. The GMC is neither providing door-to-door solid waste collection services nor

supplying adequate number of dustbin in the city. The situation is worse in those places where dustbins have been placed. These dustbins are not cleared on time. As a result they spill over the sides and make the surroundings dirty. MSW disposal system in the city has been noticed to be miserably poor. They do not have systematic collection, proper transportation and adequate disposal systems. The GMC is disposing waste in an indiscriminate manner.

The household wastes comprise the major portion of urban solid waste. If wastes from households can be collected in a systematic manner, the severity of the problem can be reduced to a great extent. But door-to-door waste collection service requires a master plan and huge amount of resources. Alternatives suggested are introduction of private agency or private public partnership (PPP). But once private agency is involved, question of payments arises. As has been reported by the GMC authority, the main impediment in the way of reducing the menace of solid waste is inadequacy of funds. But to maintain good quality of environment and life, it is very urgent to solve the problem of solid waste management. Therefore, the study tried to appraise if people were willing to pay at household level provided door to door solid waste collection service were rendered. The objectives of the study are to study the solid waste disposal habit in different types of residential area and to estimate the expected probability of willingness to pay in different types of residential areas if door to door solid waste collection service is provided.

#### **SIGNIFICANCE OF THE STUDY**

The study assumes significance in the context of the living environment in the city of Guwahati as it is degraded and the problem of solid wastes has emerged as a major challenge. With the growth of solid wastes some other environmental problem like water logging, dust pollution have also cropped up. Therefore, the study is important to improve living condition. A better environment assures a healthy society, which in turn could assure better productivity, income, savings, and wealth. Peoples' willingness to pay appears to be "affirmative news" to overcome fund shortages, which could be mobilized to improve living condition. Discovering willingness to pay is an estimate of accounting price. Willingness to pay may be a non monetary measure in absence of any other market related tools to assess the dimension of community support for eradicating the problem.

#### **SCOPE AND LIMITATION**

The study can predict of households are willing to pay or not. The study has a scope to predict the amount of money that people are willing to pay. Therefore, the study has a scope to eliminate the household solid wastes problem in the city.

The main limitation of the study comes from the use of contingent valuation method which is a stated preference method. Therefore, the study may be biased by personal value judgment.

#### **METHODOLOGY**

A study has been conducted in the city of Guwahati at household level to collect primary information about the problem of solid waste. Respondents have been asked about their demographic characteristics, level of education and income level. The study has been conducted in areas under the jurisdiction of the Guwahati Municipal Corporation (GMC) which comprises 60 wards. Two stage sampling has been applied for collecting primary information. In the first stage 10 percent of the total wards i.e. 6 wards have been selected purposively to represent heterogeneity of the city as far as possible.

For selecting wards three distinct attributes have been taken into consideration such as traditional (old) area, commercial area and newly established area and two wards have been taken from each category for sampling. Habitation in the city mainly started in the traditional area and commercial areas grew up in the proximity of traditional area. In the last two decades habitation has started spreading towards the fringe of the city. Therefore, to take into account the variation in residential setting, these three types of residential patterns have been taken into account. Settlements in the traditional areas started almost 100 years ago. These areas have several historical features and dominated by traditional morphological features established during the British rule. Although these are mainly residential areas, retail and commercial activities have also been found in these areas. Commercial area is hub of transportation and hotel activities, educational, administrative and wholesale or retail trade activities. It is the busiest and most lively part of the city. Newly established areas refer to those fringe areas where people have started living in the last two decades or so. The main reason behind the expansion of the city towards fringe is migration of population. People from all the districts of Assam and neighbouring states have migrated on large scale to Guwahati during the last twenty years. While the central locations of the city have reached

saturation level in terms of requisite vacant land for residential purposes, there has been a perceptible shift of such developments to the fringes of the city. Locations like Zoo-Narengi Road, Khanapara, Beltola and Basistha are developing as alternative residential destinations. But settlements in the fringe areas are not well planned.

In the second stage, after selecting the wards to represent traditional, commercial and newly established residential areas, emphasis has been given on selecting some localities on the basis of observation and available secondary information to represent different income groups in each of the six wards. The number of households surveyed is 360 and they have been randomly selected. In most of the cases, household head has been interviewed. But in absence of the family head any other available adult member has been interviewed. While sampling, emphasis has been given on picking up houses which are not close to each other in a locality.

To know how much the respondents were willing to pay for such type of solid waste disposal service, the Contingent Valuation Method (CVM) was applied in this study (Raje et al., 2002; Ortiz, 2004; Blore et al., 1997). In this method, survey questions are used to elicit people's preferences for public goods by finding out how much they are willing to pay for specified improvements in them. Thus, the method is aimed at eliciting their willingness to pay in the form of currency. It circumvents the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the good in question. The hypothetical market may be modeled after either a private goods market or a political market. Because the elicited willingness to pay values is contingent upon the particular hypothetical market described to the respondent, this approach is called the contingent valuation method (Mitchel et al., 1993).

The iterative bidding game (Asgari, 2004) used in the survey was conducted in the following manner. Firstly, the item to be valued was described. Willingness to pay application began with an interviewer suggesting an initial starting bid. If the respondent was willing to pay the initial bid, the bid was raised upward until a negative response was obtained. A negative response to the initial bid resulted in revising the bid downward until an acceptable amount was found. If the respondent said 'yes' to the initial bid, it indicated his or her willingness to pay greater or equal to that

amount. If the respondent answered 'no', then that sum of money could be taken as an upper bound on true willingness to pay. Depending on the design of the contingent market, the final bid was a measure of Hicksian compensating or equivalent surplus for the item being valued (Boyle et al., 1988).

The bidding price used for the interview was based on real situation. Door to door solid waste collection service was provided to a limited number of families in Rajgarh locality of the city by a group of few people who charged Rs. 150 per month per household. On the other hand, the quantity of waste per person generated was reported to be 150 to 160 gm with per day wastes generated between 350 metric tonne to 500 metric. It was also reported that monthly expenditure on solid waste management by the GMC was Rs.70 lakh out of which Rs. 22 lakh was spent on transportation<sup>1</sup>.

The respondent was offered an initial bidding price of Rs. 70 for the willingness to pay question<sup>2</sup>. And the lowest bidding price offered was Rs.30. If the family was very poor also, it was expected to afford Rs 1 per day and it could lead to a contribution of Rs. 30 for solid waste collection services. Moreover, the lowest bidding price of Rs.30 was being charged by a private agency in the locality of Milan Nagar in the city of Dibrugarh<sup>3</sup>. As the bid went upward there was an increase of Rs.40 and as the bid came downward, there was a decline in the amount by Rs.40.

Before asking about willingness to pay, a brief idea about the problem of solid waste and other hazards associated with the same was given to the respondent. Then the respondent was asked if he was willing to pay Rs.70 provided door-to-door solid waste collection service was introduced. When this amount was refused, the respondent was asked if he or she would pay Rs.30. If respondents were not even willing to pay Rs.30, then it was considered as a case of zero willingness to pay. If the respondent was willing to pay Rs.70, the respondent was asked whether he or she would accept Rs.110. Provided that the response was positive, the respondent was again offered the highest bidding price of Rs. 150. But before concluding, the respondents were asked the reason in case of zero willingness to pay. For further treatment of the data, dichotomous choice values were derived using the negative response to the willingness to pay proposal as 'zero' and any positive response as 'one' to estimate a logit function.

Main determinants of willingness to pay

considered in the survey are education of the respondent, type of residential area and income. Education 'E' is expected to have positive correlation with willingness to pay because education makes people aware of environment. The variable has four categories: qualified below matriculation, qualified above matriculation and below 12th standard, above 12th standard and below graduation, and graduate and above. Here the first category is the reference category. The variable 'R' represents the residential area where the respondent resides. Residential area has three categories: commercial area, traditional area and newly established residential area. Newly established residential area has been considered as the reference category. Income 'I' is also another important factor in determining willingness to pay. Income is also a categorical variable having three categories low income, middle income and high income. Low income is the reference category.

#### STATISTICS USED

Logit analysis was used to find the probability of accepting willingness to pay proposal. It is a specialized form of regression analysis to predict and explain a binary categorical variable. This is an estimation technique for equations with dummy dependent variables by using a variant of the cumulative logistic function:

TABLE 1: Solid waste disposal system in different residential area

Means of solid waste disposal	Commercial area	Traditional area	Newly established residential area
Streets and open space	15.5	2.0	10.1
Irregularly cleaned dustbin	14.1	45.5	19.5
Throw in backyard or burn	9.9	22.0	45.4
Private agency	2.8	2.0	1.7
Regularly cleaned dustbin	57.7	28.5	23.3

Source: Fieldwork

At the same time it has been found that who throw garbage in the backyard or burn is the lowest in the commercial and the highest in the newly established residential area. The newly established residential areas are relatively sparse which have enough space to dispose of garbage in the surroundings. It has been found that the percentage of regularly cleaned bin is very less in traditional and newly established residential area. Besides, in commercial area also, the facility is not adequate. Private agency is involved in all these three areas but it is almost insignificant. It has been found that whether the area is traditional, commercial or newly established, majority of the respondents are disposing of household wastes in unscientific manner.

TABLE 2: Willingness to pay in different residential areas

Area	Commercial area (in percentage)	Traditional area (in percentage)	Newly established residential area (in percentage)
Willingness to pay			
Zero willingness to pay	41	28	44
30.00	43.7	43.0	64.6
70.00	21.1	29.0	20.6
110.00	19.7	23.0	9.0
150.00	15.5	5.0	5.8

Source: Fieldwork

In the newly established area the percentage of zero willingness to pay is the highest. The most common answer for zero willingness to pay is that they need not require that service because can dispose of the waste themselves. Respondents who are willing to pay Rs. 30 are the highest in newly established residential area. As the bidding price increases the percentage of respondent decreases in all three types of areas. But the rate of fall is the highest in the newly established residential area.

Table 3: Mean willingness to pay

Types of residential area	Mean value of willingness to pay (in Rs.)
Commercial area	72.81
Traditional area	66.00
Newly established residential area	52.43
Combination of three areas	60.22

Source: Fieldwork

It has been found that mean value of willingness to pay is the highest in the commercial area and the lowest in the newly established residential area. On the whole, taking all these three areas combined, value of mean willingness to pay is Rs.60.22. It is smaller than the initial amount of bidding which starts at Rs. 70. Zero willingness to pay has been shown by 17.8 percent of the respondents.

To determine probability of willingness to pay, a logit function has been estimated. Here, the dependent variable is a binary variable where 1 stands for showing willingness to pay (Yes) and 0 stands for refusal to willingness to pay (No). The independent variables (covariates) are monthly household income, level of education and residential locations. Table 3 gives the results of logit analysis. E (B) is the predicted change in odds for a unit increase in the covariates. The Hosmer and Lemeshow Test of goodness of fit provide the p value to be .95. It indicates that the fitted model is satisfactory.

From Table 4 it is clear that people living in commercial area is 2.5 times more likely to accept

willingness to pay proposal for door to door solid waste collection services. The variable is significant at 10 percent. But the coefficient value for traditional area is negative and odds ratio is also very low. Nor it is highly significant variable. It means either respondent from traditional area are not having any kind of inconvenience from solid waste or the existing system is working properly. But it has been found that respondents throwing wastes in regularly cleared dustbin is only 24.9 percent. Respondents using irregularly cleared dustbin is as high as 45 percent and 30.1 percent people do not use dustbin at all. They may have sufficient space in their backyard also. This point needs further study.

Table 4: Results of Logit analysis

Variables	B	p values (Wald statistics)	Exp(B)
(Newly established residential area) <sup>R</sup>			
Traditional area	-.240	.560	.786
Commercial area	.905**	.075	2.471
Low income group <sup>R</sup>			
Middle income group	2.005*	.000	7.428
High income group	2.740*	.000	15.488
(Qualified below matriculation) <sup>R</sup>			
Qualified above matriculation and below 12 <sup>th</sup> standard	.870**	.099	2.387
Above 12 <sup>th</sup> standard and below graduation	1.818*	.000	6.162
Graduate and above	1.864*	.000	6.452
Constant	-1.248*	.001	.287

Source: Fieldwork

Note: R stands for reference category

\*, \*\*significant at 1 percent and 10 percent level respectively

Income has been found to be a powerful predictor. In comparison low-income group, middle-income group is 7.4 times more likely to accept willingness to pay proposal for door-to-door solid waste collection services. The high-income group is even more likely to pay which is 15.5 times more than that of low-income group. It has also been found that if a person is qualified above matriculation, he or she is 2.4 times more likely to accept to proposal. But the odds ratios are almost equal in case of respondents whose qualification is below graduation and who are even more qualified.

## CONCLUSION

From the above discussion it has been found that on an average people are willing to pay Rs. 60.22. Zero willingness to pay occurs only with only the low income group but the percentage showing it is meager (17.8 percent). The problem of zero willingness to pay can be handled by other means like pursuing them to pay, introducing lower slabs or by making them work instead of paying money. Commercial areas are having higher number of regularly cleaned bins yet mean value of willingness to pay is comparatively high in this area. It clearly reflects that either the existing waste management facility is not

sufficient or they want cleaner environment. Respondents in the newly established residential areas have reported that the number of bins used in this area is lesser in comparison to other two types of areas and the mean value of willingness to pay shown by them is also low. Therefore, special care has to be taken in this area before the situation is worsened.

#### RECOMMENDATION

Finally, depending on the findings it can be said that door to door solid waste collection service may be implemented in the city as people have shown willingness to pay. Sustainable waste management needs involvement of all stakeholders. It is high time to realize that for a developing area like Guwahati it is very difficult for the local bodies to manage the problem of solid waste alone. Therefore, the PPP concept can be implemented to provide waste management service in Guwahati.

#### NOTES:

1. Information on per person waste generated, expenditure on waste management has been collected from workshop engineer of the GMC in absence of any other reliable written evidence.

2. If per person waste generated is 155gm and the mean of maximum and minimum quantity of the total waste generated is 425 metric tonne per day for the city, expenditure on waste per kg becomes Rs. 16.47 and per person monthly expenditure is Rs. 76.58. The lump sum has been taken as Rs.70.

3. Dibrugarh is another urban centre in the state of Assam having 29.74 sq. km. area and 1.34 lakh population as per 2001 census. The city has a municipal board consisting of 22 wards. The current solid waste generation in the city is about 20-25 tones per day.

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