Solid Waste Management In Tinsukia District Of Assam, India

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ABSTRACT:A solid waste management (SWM) system includes the generation of waste, storage, collection, transportation, processing and final disposal. India is the second largest nation in the world, with a population of 1.21 billion (census 2011), accounting for nearly 18 percent of world's human population, but it does not have enough resources or adequate system in place to treat its solid wastes. Effective solid waste collection and disposal is a vital component of public services provisions and should take priority in emerging cities. The failure of this service can result in several kinds of unfavorable outcomes in the long run, which may have adverse serious effects on public health and environment. The standard of solid waste management has always been evaluated on the basis of the role and performance of the service provider, without taking into account the preferences of the service receivers regarding the attributes and options of Solid Waste Management. However tackling the problem of solid waste requires a concerted action of both the service providers and service receivers. Most of the studies to assess the demand for a better solid waste management system conducted in India, has employed Contingent Valuation Method. But in order to assess the demand of households for alternative future resource management strategies, Choice Experiment is a better alternative. This study will provide important demand side pieces of information for policy makers which can be used to design appropriate solid waste management services based on the defined service attributes levels and the monthly service charge that the public will be willing to pay for those improved services.

Key Words: Solid Waste Management, willingness to Pay, Choice Experiment, Contingent Valuation

1. INTRODUCTION

Solid Waste Management (SWM) is the process which involves collecting and disposing of solid wastes which are unavoidable by-products of human activities (Mussa, 2015). Municipal Solid Waste (MSW) in India which includes garbage, metals, bottle or glass, plastics, paper, and fabric have been increasing in recent years because of population increase, increase in income, rapid urbanization, technology and improper throughway culture of people (Annepu, 2012). In general, the Municipal SWM is the collection, treatment and disposal of solid wastes generated by all categories of Municipal population in an environmentally friendly and socially satisfactory manner using the available resources most efficiently. Local Governments are generally responsible for providing the SWM services, and nearly all local government laws give exclusive mandate of collecting all the wastes disposed outside homes or establishments (Sansa and Kaseka, 2004). Effective solid waste collection and disposal is a vital component of public service provisions and should take priority particularly in emerging cities. Because, failing to have such services can result in many unfavorable outcomes in the long run; this may have serious adverse effect on public health and the environment. But, the expansion of such service provisions is often a challenging task for government of developing nations due to heavily burdened and stretched financial and economic resources that lead to relatively high opportunity cost of funds (Murad et al., 2007). The management of municipal solid waste resulting from rapid urbanization has become a concern for governments in most cities of developing countries. In these cities, the generation of solid waste continues to be a major challenge and an estimated 20-50 percent of the solid waste generated remains uncollected even though half of the local operational expenditure often allegedly goes towards this end (Ammanuel, 2001). Indian cities are often characterized by poorly rendered services including waste management- the most ignored of all basic services, on account of various reasons. The situation worsens with increasing population pressure in urban centers like Kanpur, one of the important metropolitan cities of North India, having an inefficient, outdated and unscientific waste management system (Zia and Devdas, 2008). According to UNEP (2004), the generation of solid waste has become an increasing environmental and public health problem everywhere in the world, particularly in developing countries. In most cities of the developing world rapid urbanization and population growth has produced tremendous amounts of solid and liquid wastes that degrade the environment and destroy the resources. In the past, most policies and frameworks governing solid waste management in developing countries have been directed at the service providers and less attention has been paid to the demand side aspect of the problem (Sans and Kaska,2004). A research on environmentally safe and ethical solid waste management system in Tinsukia municipal town must be justified. Tinsukia is the largest district in terms of sq. kms in the Upper Assam region of the state. Tinsukia town is growing very rapidly in recent years. Unplanned growth and developments of the town in recent years in the form of new housing construction has led to over-crowding and has created difficulties in construction of a planned drainage system in the town. Coupled with the faulty drainage system environmentally unlawful and unsafe disposal of urban solid wastes by residents of some parts of the town over the last two decades have been a major cause of the life threatens health hazards in the town. Again when talking about the major towns of upper Assam region, maximum quantity of waste is generated in Tinsukia town as per estimation and is the largest municipal body in terms of sq. kms.

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Table 1: Quantity of waste generated in Major towns of Upper Assam Region

Towns	Waste Generation (MT)	Area (sq. kms)
Tezpur	28	7.10
Jorhat	35	9.20
Dibrugarh	40	15.40
Tinsukia	42	20.00

Source: Choudhury & Dutta, 2017

Thus under such circumstances it is very crucial to conduct a research on environmentally safe and hygienic SWM system in the town in order to explore the possibility of community participation for a better MSWM system.

2. OBJECTIVES OF THE STUDY

- To identify the attributes that affects the willingness to pay by households for improved Solid Waste Management options in the study area.
- To estimates the implicit price of non-monetary attributes of Solid Waste Management in terms of their monetary attribute.

3. RESEARCH QUESTION

- Whether the households of Tinsukia Municipal town are willing to contribute for an improved solid waste management option?
- Do the socio – economic factors like income, age, education level, household size etc. affect the households' choice for a particular option of Solid Waste Management?

4. DATA SOURCE AND METHODOLOGY

4.1. Sampling Technique

Both primary and secondary data has been used in this study. Secondary data required for the study has been collected from different sources like District Handbook of Assam, Census Report, Survey Report of Tinsukia Municipal Board, Statistical Handbook of Assam etc. Supply side information required for the study has been collected from the municipality office by interviewing the officials who are involved in the planning and provisions of solid waste management services. In addition, the researcher has conducted observations of dumpsite and open dumps in a variety of places in the town. The primary data used in the study was collected from 220 randomly selected households through a sample survey. Sample has been drawn by following a multi-stage sampling technique. The data required for the study has been collected by personally interviewing the sample households with the help of a structured questionnaire. In the first stage Tinsukia district has been purposively selected for the study, since it is the largest district of upper Assam region of the state in terms of geographical area and second largest in terms of population. In the second stage Tinsukia district has been stratified into towns. There are 13 towns (census + statutory) in the Tinsukia district, of which Tinsukia town has been selected as study area because it is only the Municipal Body in the Tinsukia distrct of Assam consisting of 15 wards and 131 lanes. Again the fifteen wards have been classified into 5 strata, each stratum containing 3 wards based on geographical setup, viz; east, west, north, south and central zone and one ward has been selected from each stratum based on simple random sampling method. Finally, 7 percent of households were selected from each ward using systematic random sampling method which constituted a total sample of 220. It is worth mentioning that the sampling unit is the household not the individual, since if implemented, payments for SWM services will come from households, not individuals.

4.2. Econometric model specification for choice Modeling

The theoretical basis for choice modeling is the random utility theory (RUT). This theory poses the notion that individual consumers choose alternatives that provide them with the highest level of utility. In this setting, the probability of selecting an alternative increases as the utility associated with it increases. The utility that an individual derives from an alternative is considered to be associated with the attributes of the alternative (Adamowicz and Boxall, 2001). The Conditional Logit model has been used for this study, since choice among alternatives is treated as a function of the characteristics of the alternatives rather than (or in addition to) the characteristics of the individuals making choices. The CLM focuses on the set of alternatives for each individual and the explanatory variables include the characteristics of those alternatives. Generally it can be written as:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \qquad \text{-------------------------- (1)}$$

Where U_{ij} is the total utility derived from alternative j by individual i, V_{ij} is the vector of systematic explainable component (indirect utility function) with the assigned attributes as arguments and ε_{ij} is a vector of stochastic component. This stochastic specification of the total utility function means that the probability that individual i chooses alternative j can be expressed as the probability that utility associated with alternative j is greater than the utility associated with all other alternatives. In this setting the probability of choosing alternative j is given as:

$$P_{ij} = Prob\ \{U_{ij} > U_{im}\} \qquad \text{for all } j \in C,\ j \neq m$$
$$= Prob\ \{V_{ij}+\varepsilon_{im} > V_{im}+\varepsilon_{im}\} \qquad \text{for all } j \in C,\ j \neq m \qquad \text{-------------------------(2)}$$

Where C is the set of all possible alternatives. Assuming that the stochastic component or error term is identically and independently distributed (IID) with a type- I extreme value distribution[1], the probability that alternative j is chosen by individual i is:

$$Pij = \frac{e^{wVij}}{\sum_{j \in C} e^{wVim}} \qquad \text{---------------------------------- (3)}$$

[1] The IID assumption entails the property of independence of irrelevant alternatives (IIA – McFadden 1984). Violation of the IIA assumption may arise when some alternatives are qualitatively similar to others or when there are heterogeneous preferences among respondents (Bateman et al. 2002)

This specification is known as Multinomial Logit when it uses only individual specific characteristics as arguments or Conditional Logit when it uses attributes specific characteristics as arguments (McFadden, 1974)[2]. w is a scale parameter which is proportional to the standard deviation of the error distribution and is typically assumed to be one[3] (Ben- Akiva and Leman, 1985). Assuming a linear in parameters indirect utility function, Vij we can characterize it as (Louviere et al. 2000):

$$Vij = ASC_j + \sum_{k=0}^{n} \beta jkXjk \quad \text{--------------------------} \quad (4)$$

Where ASC_j is an alternative specific constant (ASC), X_{jk} is the k attribute value of alternative j, β_{jk} is the coefficient associated with the K^{th} attribute of alternative j. The effects of attributes in the choice set will be reflected by X variables while the ASC captures any systematic variations in choice observations that are not explained by the attribute variation. To introduce respondents' heterogeneity (that is, difference between the individual respondents) into the model, individual characteristics of respondents can be used as independent variables in the equations. This is an important part of the estimation process as the socio-economic variables may help to overcome Problems associated with violation of important assumptions that underpin the CLM[4] , they cannot be introduced alone in to the model. Because the respondents' characteristics do not vary across alternatives, 'Hessian Singularities' arises in the model estimation process unless the socio-economic characteristics are introduced as interaction with either the attributes or the alternative specific constants (Bennet and Blamey, 2001). One possibility for including socio-economic variables in the indirect utility function is to include these variables interactively with the ASC (Morrison et al. 1999, Colombo et al, Chuen-Khee et al. 2009). Utility for option j depends on environmental attributes (Z) and socio-economic characteristics (S). In this case the model is specified as:

$$V_{ij} = ASC_j + \sum_{k=0}^{n} \beta kXk + \sum_{k=0}^{n} \Upsilon ij(ASCj * Si) \text{ ---- } (5)$$

Where S_i represents the socio-economic variables for individual *i*, and *Yij* represents the vector of coefficients associated to the individual socio-economic characteristics interacted with the *ASC*.

5. RESULTS AND DISCUSSION

Improper collection and disposal of solid wastes has serious adverse impacts on public health and the environment. Contrary to that, improvements in the provision of solid waste management service can enhance environmental quality and the health status of residents. In order to estimate valuation of the management strategy or option, respondents are asked a series of questions about their preferences for alternative future resource management strategies. Individual consumers choose the alternative that provides them with the highest level of utility and utility of individuals depend on the characteristics or attributes of the alternative management strategies (Adamovicz and Boxall, 2001). Several studies show that the peoples' preference for an improved SWM plan depends on its attributes.

5.1. Analysis of Factors Determining Willingness To Pay Of Respondents' For Improved Solid Waste Management (SWM) Plan

Existing literature indicates that peoples' choice for a particular option of SWM is influenced by the characteristics of the service. For the present study seven service attributes has been selected. The attribute selection has been done after going through the literature and consulting with the experts who are involved in the planning and management of SWM in the study area. Pilot survey has also been conducted for this purpose. Conditional Logit Model has been used, since the choice among alternative options is treated as a function of the characteristics of the alternative. This model explains the importance of service attributes in explaining the respondents' choice for a particular option of SWM. Here the response variable is a dichotomous or binary variable taking the value 1 for choice option and 0 for non-choices.

$$Vij = ASCj + \beta 1*SEG + \beta 2*PCMD + \beta 3*DWC + \beta 4*CTWC + \beta 5*CCD + \beta 6*DTDC + \beta 7*AMT \text{ ------------} (6)$$

Where (j = 1,2,3; ASC =0 for j=1 and 1 for j= 2 or 3)

This model looks at the utility derived from the attributes considered.
In table:2, the coefficients of all the non-monetary attributes (SEG, PCMD, DWC, CTWC, CCD and DTDC) are expected to take on a positive sign because an increase in all these attributes will increase the utility of the respondents. The coefficient of monetary attribute is expected to take on a negative sign because an increase in cost will decrease the utility of respondents.
Two Conditional Logit Models were estimated. The first model is a basic model specification which shows the importance of the seven service attributes in explaining respondents' choice across different solid waste management options. The second model includes some socio-economic variables in addition to the service attributes in the choice sets.

Table 2: Description of the Explanatory Variables

Variables	Type	Definition	Value
SEG	Categorical	Segregation of waste	1 if yes, 0 otherwise
PCMD	Categorical	Pollution control measures at the dumpsite	1 if yes, 0 otherwise
DWC	Categorical	Waste collection on daily basis	1 if yes, 0 otherwise
CTWC	Categorical	Covered trucks for waste collection	1 if yes, 0 otherwise
CCD	Categorical	Covered community dustbins	1 if yes, 0 otherwise
AMT	Quantitative	Additional	Rs. 50, Rs.70

[2] McFadden is cited in J. Mogas et al. (2006)
[3] Assuming *w* equal to 1 implies a constant error variance.
[4] Most importantly, the CLM uses an assumption that the error terms are independently and identically distributed.

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Table 3: Results of the basic Conditional Logit Model

Variables	Coefficient	Standard Error	P > | Z |
SEG	1.644*	0.202	.000
PCMD	0.930*	0.150	.000
DWC	2.210*	0.226	.000
CTWC	1.860*	0.187	.000
CCD	0.374***	0.200	.062
DTDC	2.526*	0.199	.000
AMT	0.062*	0.005	.000
ASC	1.105*	0.437	.011

*denotes significance at 1 % level, **denotes significance at % level and , *** denotes significance at 10 % level
Summary Statistics: Cronbach's alpha= 0.76
Log-Likelihood = -409.503 R-squared = 0.533
LR Chi2 (8) = 937.49 Iterations Completed = 4
No. of Observation=2398 Sample =200

In the first model utility is determined by the levels of seven attributes in the choice sets (SEG, PCMD, DWC, CTWC, CCD, DTDC and AMT). Thus the model provides an estimate of the effects of a change in any of these attributes on the probability of choice. Table 3 reveals the results of the basic Conditional Logit Model (CLM). The value of R^2 is found to be 0.533 which indicates that about 53 percent variation in choices is explained by the hypothesized variables. The coefficients for all the attributes except Covered Community Dustbins (CCD) in the choice sets are significant at 1 % level. The coefficient for CCD is significant at 10% level. All the attributes in the choice sets have a priori expected sign. The positive signs of the coefficients for the attributes of Segregation (SEG), Waste Collection on Daily basis (DWC), Pollution Control Measures at the Dumpsite (PCMD), Covered Trucks for Waste Collection (CTWC), Covered Community Dustbin (CCD), and Door to Door collection of waste (DTDC) suggests that any improvements in the levels of these attributes increases the utility of the respondents. The coefficient of the monetary attribute i.e. Additional Municipality Tax (AMT) is negative which means that any increase in the municipality tax will lead to decline in the utility of the respondents. All the service attributes are significant factors in the choice of a SWM service and ceteris paribus, higher level of all the non-monetary a service attributes increases the probability that a SWM service is being selected. This indicates that the respondents are in favour of an improved plan of SWM but at the minimum cost.
Table 3 depicts that when the component of segregation (SEG) is included in an improved SWM plan then the probability of its selection increases by 1.64 units. Again, the probability of selecting an improved SWM plan increases by 0.93 units with the addition of the component PCMD, by 2.21 units with addition of DWC, by 1.86 units with addition of CTWC, by .37 units with addition of CCD and by 2.52 units with addition of DTDC.
The management of solid waste in urban areas is a critical issue for some developing countries in Asia which requires immediate attention (Subhan et al., 2014). Poor management and improper regular dumping of solid waste degrades the environmental quality and creates environmental pollution. Therefore community participation as an alternative approach to municipal own waste management is very important to tackle the waste management problem (Das and Gogoi, 2013). Existing literature indicates that the residents' WTP is influenced by several socio-economic and environmental attitudinal factors. For the present study nine socio-economic factors has been specified. These variables have been included in the model as interaction with ASC. Since the respondents' characteristics do not vary across alternatives, we can not include the socio-economic variables separately in the model (Jin et al., 2006).

Vij=ASCj+Y1*ASCj*AGER+Y2*ASCj*GENR+Y3*ASCj*EUDR+Y4*ASCj*MTHIN+Y5*ASCj*QUANT+Y6*ASCj*DIST+Y7*ASCj*HOWN+Y8*ASCj*HSIZ+Y9*ASCj*RYRS+β1*SEG+β2*PCMD+β3*DWC+β4*CTWC+β5*CCD+β6*DTDC+β7*AMT-------------- (7)

This model considers the attributes together with some selected socio-economic variables. The ASC captures the mean effect of the unobservable factors in the error term for each attribute. This provides a zero mean for the error term and causes the average probability of selecting each attribute over the sample to equal the proportion of respondents actually choosing the alternative.

Table 4 : Description of the Explanatory Variables

Variable	Definition	Type	Value
AGER	Age of the respondents	Quantitative	
GENR	Gender of the respondents	Categorical	0 for male and 1 for female
EDUR	Educational attainment of the respondents	Categorical	0 for below high school level and 1 for high school and above
LNMTHIN	Log of total household monthly income	Quantitative	
QUANT	Quantity of waste generated by household on weekly basis	Quantitative	
DIST	Distance of respondents' house from the nearest community dustbin in kms	Quantitative	
HOWN	Ownership of the house	Categorical	1 if yes and 0 otherwise
HSIZ	Size of the household	Quantitative	
RESY	Years of residents in the town	Quantitative	
ASC	Alternative specific constant	Categorical	1 for improvements and 0 for status-quo

The socio-economic variables (RESY, GNR, MARS, DIST, AGER, EDUR, MTHIN, QUAN and HOWN) have been included in the model by interacting them with the ASC to account for the heterogeneity in preferences. The results of the extended CLM are displayed in table 5

Table 5 : Results of the extended Conditonal Logit Model

Variables	Coefficients	Std. Error	P> ∣Z∣
ASC	-0.447	0.975	0.646
SEG	1.729*	0.209	0.000
PCMD	0.941*	0.151	0.000
DWC	2.273*	0.229	0.000
CTWC	1.980*	0.201	0.000
CCD	0.424**	0.205	0.039
DTDC	2.655*	0.211	0.000
AMT	-0.064*	0.006	0.000
ASC*AGER	0.028**	0.014	0.049
ASC*MTHIN	0.855*	0.256	0.001
ASC*EDUR	0.269**	0.133	0.046
ASC*DIST	-0.201**	0.093	0.030
ASC*GENR	1.029**	0.4656	0.027
ASC*HSIZE	0.141**	0.068	0.037
ASC*RYRS	0.012	0.010	0.274
ASC*HOWN	0.670	0.375	0.740
ASC*QUAN	0.008	0.027	0.764

*denotes significance at 1 % level and

** denotes significance at 5 % level

Summary Statistics:

Log Likelihood = -373.60 Pseudo R2 = 0.574

LR Chi2 = 967.61 Iteration Completed = 5

No. of observation = 2398 Sample = 200

The value of Pseudo R^2 is found to be 0.574 which indicates that 57.4 percent variation in the choices made by respondents is explained by the hypothesized socio-economic variables. The results show that all the socio-economic variables (except DIST) included in the model has a positive impact on the selection of improved SWM option. Out of the nine socio-economic variables, only six variables are found statistically significant. Total household monthly income (MTHIN) is found to be statistically significant at 1 percent and its coefficient has a positive sign which indicates that respondents with higher level of income have greater capacity to pay and would choose the improved SWM option more frequently. Every one unit (i.e. 1 thousand) increase in income increases the probability of selecting improved option by 0.85 units. The coefficient for education (EDUR) is positive and significant at 5 percent significance level which suggests that respondents with higher level of education would have greater awareness about the existing SWM problems and would prefer the improved plans of SWM. It means that if the people are educated above high school level then the probability of selecting an improved SWM option increases by 0.26 units. The coefficient of the household size (HSIZE) is also positive and significant at 5 percent level which means that the households with larger family size are more frequently in favour of improved SWM plans. The reason may be that the households with larger family size would generate more solid waste and support the improved plans of SWM more frequently than the households with small family size. The coefficient for the household' distance from the nearest community dustbin (DIST) is negative which indicates that the respondents whose houses are located at a larger distance from the municipality dustbin are not in favour of improved SWM plans. The result implies that every one meter increase in distance from the community dustbin decreases the probability of selecting an improved SWM plan by 0.20 units. This reflects that if the community dustbins are provided at a more frequent interval then residents will favour the improved plans of SWM. Again the coefficient for the age of the respondent (AGER) is found to be positive which is in opposite of the priori sign. The positive coefficient indicates that more aged respondents would favour the improved SWM plans more frequently. Again the coefficient for the gender of the respondent (GENR) is also positive indicating that female respondents are in more favour of improved SWM plans than the male respondents. This may be due to the reason that women are mainly responsible for kitchen works and solid waste management activities, so they are more concerned about the improved SWM plans. The coefficient for the years of residence (RYRS) is positive which indicates that the permanent residents would take the improved plans of SWM than the temporary residents. It means that every one unit increase (i.e. one year) in residence year increases the probability of selecting an improved plan of SWM by .01 units. However, the coefficient for residence year is not statistically significant. Out of the nine socio-economic variables, five are statistically significant at 5 % level and income is significant at 1 percent level. Compared to the basic CLM , the extended CLM has a high level of parameter fit. The larger the value of Pseudo Rsquare Statistic, the better is the fit of the model to the observed data. As it can be seen from the results that the extended model has a larger Pseudo Rsquare (57.4%), so its fit is also better than the basic CLM.

5.2. Estimation of Implicit Prices (Marginal Willingness to Pay)

The estimated coefficient from the basic Conditional Logit Model can be used to calculate implicit prices for the non-monetary attributes (Chuen- Khee & Oathman, 2009). Implicit prices show the marginal rates of substitution (MRS) between the monetary attribute and the non-monetary attribute under consideration. Estimation of implicit prices are made on 'ceteris paribus' basis i.e. they are estimates of respondents' WTP for additional unit of the attribute of concern , given that everything is held constant. Given the assumption of a linear-in-parameter utility function, the WTP for a certain attribute is the ratio of the attribute coefficient and the coefficient of the monetary attribute. The implicit prices for the six non-monetary attributes can be estimated using the following equation:-

$$MWTP = -\frac{\beta nma}{\beta ma} \qquad \text{------------------}(8)$$

Table 6: Estimates of Implicit Prices using the Results of basic Conditional Logit Model

Attributes	WTP in Rs.
SEG	26.51
PCMD	15.00
DWC	35.64
CTWC	30.00
CCD	6.03
DTDC	40.74

The results from table 6 reveal that the implicit prices for all the attributes are positive. This is an indication of the fact that respondents have a positive WTP for an increase in the quantity and/or quality of each attributes. The implicit price imply that respondents are willing to pay Rs. 26.51 per household per month for an improvement in the attribute SEG, Rs. 15 per household per month for an improvement in the attribute PCMD, Rs. 35.64 per household per month for an improvement in the attribute DWC, Rs. 30.00 per household per month for an improvement in the attribute CTWC, Rs. 6.03 per household per month for an improvement in the attribute CCD and Rs. 40.74 per household per month for an improvement in the attribute DTDC. It means that when an improved SWM option includes all the attributes considered in this study, viz., SEG, PCMD, DWC, CTWC and CCD then it will cost Rs.153.91 per household per month. This amount is obtained by putting the value of β coefficients and level of attributes in equation (6) . This result indicates that the households of Tinsukia municipal town are WTP significant amounts (in the form of additional municipality tax) to make provision of separation of waste, pollution control measures at the dumpsite, collection of waste on daily basis, covered community dustbins, covered trucks for waste collection and to ensure that there is door to door collection of waste.

6. CONCLUSION

The standard of solid waste management has always been evaluated on the basis of the role and performance of the service provider, without taking into account the attributes and opinions of the service receivers. However, tackling the problem of solid waste requires a concerted action of both the service provider and the service receivers, especially the households who are the primary producers of solid wastes of the town. One study has been undertaken on Tinsukia municipality (Das and Gogoi, 2013) to find out the possibility of community participation in SWM by employing contingent valuation method. But in order to assess the demand of households for alternative future resource management strategies, Choice Experiment is a better alternative. This research work will be a contribution to the growing literature on estimation of economic valuation of improved solid waste management plans using choice experiment. The Choice Modeling (CM) method has only been used in a limited number of cases to estimate the benefits of solid waste management facilities in India. However, the results of this study revealed that CM has the capacity for evaluating alternative solid waste management system characterized by a number of attributes. The results of the first conditional logit model show that households are preferring the improved SWM plan only because of its attributes. Majority of the households are willing to pay additional charges in order to implement new SWM plan in Tinsukia district of Assam. The results of the second model suggest that the socio-economic factors have been influencing the households' preferences for improved SWM plans in Tinsukia district of Assam. The results show that all the socio-economic variables (except DIST) included in the model has a positive impact on the selection of improved SWM option. Out of the nine socio-economic variables, only six variables are found statistically significant. Policy makers should take into account the information about the preference of service receivers to design appropriate solid waste management in Tinsukia.

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