DETERMINANTS OF HOUSEHOLD SOLID WASTE GENERATION AND WILLINGNESS TO PAY FOR AN IMPROVED SOLID WASTE MANAGEMENT PRACTICE IN KANDY MUNICIPAL AREA

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Introduction

This study investigates the determinants of household solid waste generation and the willingness to pay for an improved solid waste management practice in Kandy Municipal area. Municipal Solid Waste Management (MSW) is important for ensuring environmental wellbeing, human health and living standards of people living in urban areas. The recent literature shows that providing a better solid waste management system is a challenging task for any country (Kwetey, S. et. al., 2014). Services related to solid waste management are far from satisfactory in many developing countries due to their financial and social problems (Wang, H.J. *et al*, 2011). Local authorities in Sri Lanka too experience serious difficulties in addressing this problem. In 2005, the estimated average solid waste generation in Sri Lanka was 2838.46 tons/day and has been predicted to reach 1.0 kg/per cap/day by 2025.[1] According to the database of MSW in Sri Lanka (2005), per capita waste collection per day is 0.62Kg[2]. Because of this rapid increase in solid waste generation, KMC requires an effective solid waste management system. In order to implement a better solid waste management strategy relevant data and information regarding household waste generation and management practices is required.

Little systematic research has been conducted focusing on this issue in KMC. Therefore by conducting a primary survey, this study mainly expects to identify the socio economic determinants of household solid waste generation in Kandy area. It also attempts to identify the major

[1]Database of Municipal solid waste in Sri Lanka, 2005 (Ministry of environment and natural resources)
[2] Database of municipal solid waste in Sri Lanka, 2005 (Ministry of environment and natural resources)

socio economic determinants of people's average willingness to pay for an improved solid waste management service.

Methodology

This research is based on both primary data and the secondary data. A sample of 80 households in the Kandy municipality area was selected using stratified random sampling method and the relevant information was collected using a structured questionnaire and interviews. Two regression analyses were carried out to analyze the primary data. The first regression model regresses the percentage of solid waste generated by a household per day (i.e. the proportion of household waste given to the Municipal waste collection service) against household monthly income, household size, education level of the household head, extra land size within the compound of the household and distance from the center of the city. These variables were chosen based on the existing literature[3]. The percentage of waste which a household give to the municipal waste collection system per day was taken as an indicator of household waste generation since it was practically difficult to measure the total waste generated by a household. The model is shown below.

$$Ln\ W = \beta_0 + \beta_1 I_i + \beta_2 Hsize_i + \beta_3 exland_i - \beta_4 edu_i + \beta_5 distance_i + D_1 gender_i + U_i$$

Using the Contingent Valuation Method, the probability of willingness to pay was regressed against the household income, amount of property tax paid by household, amount of waste generated by H/H, distance from the center of the city, education level of the H/H head, extra land size within the compound of the household and the ownership of residency[4] as follows.

$$Z = \beta_0 + \beta_1 I_i + \beta_2 tax_i + \beta_3 waste_i - \beta_4 exland_i + \beta_5 distance_i + \beta_6 edu_i + D_1 own_i + U_i$$

Results & Discussion

According to the survey results, the average amount of solid waste generated by households per day is 1.79 kg/day. As shown in Table 1,

[3]Sankoh et al, 2012. "*A situational Assessment of Socio Economic Factors Affecting Solid Waste Generation and Composition in Freetown, Sierra Leone"*

[4] Bishop R.C. and Herberlein, T.A. 1990 "*The contingency Valuation Methods in Economic Evaluation of natural Resources*", Westview Press, pp 81-90

major Socio economic factors which determine the household solid waste generation are Household income, Household size, Education status of the H/H head and the Distance to the house from the center of the city. Gender of the household head and Extra land size of the household do not show a significant impact on waste generation. Size of the household is the most important factor which determines the household waste generation in Kandy Municipal area, and Household income also has a significant positive impact.

Table 1.Estimated results of determinants of solid waste generation in Kandy Municipal Area

lnW	**Coefficient**	**t value**	**p value**
Income (*Income)* (Total monthly income from all sources)	0.021	2.25	0.027**
Household size (*Hsize)* (Number of people in Household)	0.106	3.41	0.001***
Extra land (*Exland)* (perches)	-0.0002	-0.06	0.950
Education of the H/H head (*Edu)(binary variable)*	-0.116	-2.40	0.019**
Distance from the core of the city (*Distance)* (Km)	0.105	3.22	0.002**
Gender of the H/H head (*Gender)*	0.088	0.81	0.422

Table 2 gives the results of household willingness to pay for a better MSW management system.

In general, about 62.5% of the households are willing to pay for better management of waste while 37.5% are not willing to pay. Also percentage willing to pay is higher in the high-income groups and lower in low-income groups. The average amount of money which households are willing to pay for the waste management service is Rs93.63.

As shown Table 2, the major socio-economic factors which determine household willingness to pay are Household income, Amount of property tax paid by the household, Education level of household head, Amount of waste generated by the household and distance from the core of the city. Ownership of the residency does not have any significant impact on willingness to pay. When household income increases probability of willing to pay also increases. However marginal effect (0.0052) of

income on willingness to pay is very small. Amount of property tax paid by the household also has a significant but negative impact on willingness to pay as the increment in tax amount will reduce the peoples' motive to pay.

Table 2.Estimated results of factors influencing WTP for a better MSW management system

WTP	coefficient	Marginal effect (dy/dx)	Z value	P value
Household income (*income)*	0.0025	0.00519	2.57	0.010**
Amount of property tax (*tax)* (Rs per annum)	-0.043	-0.0089	-2.58	0.012**
Amount of waste generated by H/H (*waste)*	0.866	0.179	1.74	0.081*
Extra land area (*exland)*	-0.183	-0.038	- 2.92	0.004***
Distance from the centre of the city to the H/H premises (*distance)*	-0.555	-0.115	-1.79	0.073*
Education of H/H head (*edu)*	1.156	2.46	0.014	0.014**
Ownership of the residency (*0wn)* (Whether owned or rented house)	-1.759	-0.261	0.465	0.465

When the household head is more educated, he /she will be more aware on environmental cleanliness and willing to pay more for a better waste management system. Extra land within the housing area is negatively correlated with the household willingness to pay because when people have extra land, they dispose some amount of their waste within the housing area and are less likely to depend on municipal service.

When the average amount of waste generated by a household increases, they face problems such as waste collection, storage and disposal. As a result, they demand for municipal waste management service more. Distance from the core of the city also has a significant negative impact on households' WTP as they have more space and alternative ways to

dispose the waste rather than using the municipal collection service. The ownership of the residency is not important in determining the WTP for a better solid waste management service in Kandy area.

Conclusion

This study identifies Household income, Household size, Education status of the H/H head and the Distance to the house from the center of the city as the key determinants of both household solid waste generation and willingness to pay for the waste management services. These findings are compatible with the findings of previous empirical research conducted regarding developing countries (Baldisimo, J.M. 1988). According to the results, a majority (63%) of the households in the city are willing to pay for a better waste management service. The average amount of willingness to pay is about Rs 93.60 per month and by levying a flat rate service fee which is equal to that mean value, the Municipal Council can obtain a revenue of approximately Rs. 30,584,736/= and thereby save 15% from their recurrent expenditure. Therefore, introducing a service fee for the waste management service provided by KMC can be recommended and seems to be financially viable in providing a better waste management service.

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