

Socio-economic Determinants of Household Solid Waste Management in Kandy Municipal Area

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Introduction

Municipal Solid Waste (MSW) management is an important role of urban authorities and it is directly related with the protection of environmental wellbeing, human health and living standards of people. The recent literature shows that, the rapid increase in solid waste generation due to accelerated urban population growth, unplanned urbanization, and increasing economic activities, has become a crucial problem in all countries regardless of the development status of them (Kwetey, 2014). In fact, the services related to solid waste management are far from satisfactory level in many developing countries due to some financial and social problems (Wang, 2011).

With the current phase of rapid urbanization, relevant authorities in Sri Lanka are also experiencing serious difficulties in addressing this problem. In 2005, the estimated average solid waste generation in Sri Lanka was 2838.46 tons/day and it has increased to approximately 7,250 tons/day by 2009. In 2005, the average per capita MSW generation was 0.62 kg/cap/day and it has been predicted to reach 1.0 kg/cap/day by 2025.³ According to the database of MSW in Sri Lanka (2005), the gross weight of the solid waste, collected by the Kandy

³Database of Municipal solid waste in Sri Lanka, 2005 (Ministry of environment and natural resources)

Municipal Council (KMC) is 145.04 tons and per capita waste collection per day is 0.62kg.⁴

During the past few decades solid waste generation in Kandy area has also increased rapidly, thus KMC requires more efficient and effective solid waste management system. However, as KMC state, lack of funds is one of the major constraints for implementing such a service. To the best of our knowledge, no any systematic research has been conducted focusing this issue and consequences of not drawing attention to this problem may be aggravated in the future in many folds than it is today unless alternatives are designed to address it. Therefore by conducting a primary survey, this study mainly expects to achieve the following objectives.

Objectives

First, we identify the major socio economic factors affect to the household solid waste generation in Kandy municipal area. Secondly, we estimate the people's average amount of willingness to pay for a better municipal solid waste management system. Finally, study identifies the major socio economic factors affecting to households' willingness to pay for a better solid waste system.

Methodology

This research used both primary data collected from a household survey in Kandy Municipal area during the period from 20th September to 30th October, 2015, and the secondary data obtained from the KMC solid waste management database. A sample of 80 households from different areas in Kandy municipality was selected using stratified random sampling method and the relevant information was collected using a structured questionnaire and interviews. Household's willingness to pay

⁴ Database of municipal solid waste in Sri Lanka, 2005 (Ministry of environment and natural resources)

was measured by using Contingent Valuation Method. Two regression analyses were estimated to analyze the primary data. The first OLS regression model is used to study the percentage of solid waste generated by household per day (out of total waste generated by the households how much they give to the Municipal waste collection service) against the household income (I), household size/total number of people in the household ($Hsize$), education status of the household (edu), extra land size within the compound of the household ($exland$), distance from the center of the city ($distance$) and the gender of household head ($gender$). These variables were defined based on the previous literature⁵. The percentage of waste which a household gives 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.

$$\ln W_i = \beta_0 + \beta_1 I_i + \beta_2 Hsize_i + \beta_3 exland_i + \beta_4 edu_i + \beta_5 distance_i + \beta_6 gender + u_i$$

where u_i is the white noise random error term.

Secondly, by using Logit regression model, probability of households' Willingness to Pay (WTP) was regressed against the household income (I), Amount of property tax paid by household (tax), Amount of waste generated by H/H ($waste$), Distance from the center of the city ($distance$), Education level of the H/H head (edu), Extra land size within the compound of the household ($exland$) and the Ownership of residency (own)⁶

$$WTP = \beta_0 + \beta_1 I_i + \beta_2 tax_i + \beta_3 waste_i + \beta_4 exland_i + \beta_5 distance_i + \beta_6 edu_i + \beta_7 own + u_i$$

⁵ Sankoh et al, 2012. A situational Assessment of Socio Economic Factors Affecting Solid Waste Generation and Composition in Freetown, Sierra Leone.

⁶ Bishop R.C and Herberlein, T.A. 1990 .The contingency Valuation Methods in Economic Evaluation of natural Resources, West View Press, pp 81-90

Results and Discussion

According to the survey results, average amount of solid waste generated by households per day is 1.79 Kg. As it shows in Table 1, major socio economic factors which determine the household solid waste generation are household income, household size, education status of the house and the distance to the house from the center of the city. Gender of the household and extra land size within the house does not have any significant impact on waste generation. H/H income has a significant positive impact on household solid waste generation. However, size of the household is the most important factor which determines the H/H waste generation in Kandy Municipal area. Education status of the household also has a significant negative impact on waste generation.

Table 1: Determinants of solid waste generation

InW	Coefficient	t value	P value
<i>Income</i>	0.021	2.25	0.027**
<i>Hsize</i>	0.106	3.41	0.001***
<i>Exland</i>	-0.0002	-0.06	0.950
<i>Edu</i>	-0.116	-2.40	0.019**
<i>Distance</i>	0.105	3.22	0.002**
<i>Gender</i>	0.088	0.81	0.422

Note: *, **, *** represent the significant at 10 %, 5 % and 1 % respectively

According to the survey results, 62.5 % of the households (50 households out of 80) are willing to pay for introducing a better waste management system while only 37.5 % (30 households out of 80) are not willing to pay. The percentage of willingness 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 Rs 93.63 per month.

Table 2: Estimated results of WTP

WTP	coefficient	Marginal Effect	Z value	P value
<i>income</i>	0.0025	0.0052	2.57	0.010**
<i>tax</i>	-0.043	-0.0089	-2.58	0.012**
<i>waste</i>	0.866	0.179	1.74	0.081*
<i>exland</i>	-0.183	-0.038	-2.92	0.004***
<i>distance</i>	-0.555	-0.115	-1.79	0.073*
<i>edu</i>	1.156	0.246	0.014	0.014**
<i>own</i>	-1.759	-0.261	0.465	0.465

Note: *, **, *** represent the significant at 10%, 5% and 1% respectively

The major socio economic factors which determine the H/H willingness to pay for a better waste management system are H/H income, amount of property tax paid by the household, education level of household head, amount of waste generated by the H/H and distance from the core of the city. Ownership of the residency does not have any significant impact on willingness to pay. H/H income has a positive impact on willingness to pay which means when the 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 increase in tax amount will reduce the peoples' motivation to pay. 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 H/H willingness to pay because people dispose some amount of their waste within the housing area and less likely to depend on municipal service. When the average amount of waste generated by the household increases, they face problems such as waste collection, storage and disposal. As a result households demand for municipal waste management service is more. Distance from the core of the city also has a significant negative impact on households' WTP as they have more space and more alternative ways to dispose the waste rather than using the municipal collection

service. The ownership of the residency is not significantly important in determining the WTP for a better solid waste management service in Kandy area.

Conclusion and Policy Implications

This study identifies household income, household size, education status of the house and the distance to the house from the center of the city as the major determinants of household solid waste generation. About 62.5 % of the households in the city are willing to pay for a better waste management service while only 37.5 % households are not willing to pay for such improved service. Households' mean willingness to pay for improved solid waste management service was estimated as Rs 93.60 per month. Monthly household income, annual property tax amount paid by the household, education level of the household head, extra land area are highly significant in determining the willingness to pay whereas amount of waste generated by the house and the distance from the core of the city are weakly significant. By levying a flat rate service fee which is equal to the mean willingness to pay, municipal council can earn approximately Rs. 30,584,736/= amount of revenue annually, and thereby KMC can save 15 % from the annual recurrent expenditure. Therefore, introducing a service fee for the waste management service provided by KMC can be recommended and seems to be financially feasible in providing a better waste management service.

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