DETERMINANTS OF HOUSEHOLD WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT IN KIGALI-RWANDA.

Dr. SIBOMANA ERIC

ABSTRACT

In our everyday activities, generation of solid wastes are inevitable. Solid wastes are generated from different sources such as residential or household, industrial, institutional, commercial, agriculture, municipal, processing and construction activities, etc. Kigali, capital of the Republic of Rwanda, is expanding at very alarming rate in terms of infrastructures, economic activities and population. This leads to increased household solid waste, which accounts for more than half of total solid wastes. Therefore, this study attempts to study the main factors which influence the household willingness to pay for improved solid waste management in Kigali by using a sample of 220 households. Descriptive statistics and logistic regression analysis were used in this paper. The results revealed that household willingness to pat for improved solid waste management influenced by, education, income and years of staying of respondents in the study area.

Keywords: Solid Waste, Willingness to Pay, Household.

Lecturer and Head of Management Science Department, KIM University

1. Introduction

In several rapidly growing cities in developing countries solid waste is a major source of concern due to lack of appropriate planning, inadequate governance, resource constraint and ineffective solid waste management. In our everyday activities, generation of solid waste is inevitable.

Household solid waste is a type of municipal solid waste (MSW) and consists mainly of plastics, paper, glass, metals, organics, wood and others. These wastes must be predisposed appropriately to assist in keeping environmental quality and human health, as well as to preserve natural resources (Daskalopoulos et al., 1998; Lin et al., 2008). Household solid waste has both direct and indirect effects on environment and human welfare. Direct effects range from the damage of materials and loss of aesthetic importance to the impairment of human health, thus creating significant socioeconomic impacts. Indirect effects are mainly long-term effects, which range from changes in ecosystem structure and behaviour to the climate change, which in turn affects socio-economic status and the sustainability of the region (Woodwell, 1970, Munn et al., 1977, and Basnet, 1993).

In addition, household waste generally is known as residential or domestic wastes, which are made up of wastes that are consequences of household activities. According to the Centre for Africa Settlement Studies and Development (1998), household waste includes unwanted materials from activities such as food preparation, sweeping, cleaning, fuel burning and gardening. Obsolete materials like appliances, clothing and furnishing as well as used packaging and unwanted reading materials, and sometimes, faecal materials form a part of household waste.

Generation of solid waste in Kigali

The table below shows the classification of solid waste according to their sources. It is clearly shown that, households are generating more solid waste because more than half of wastes generated in Kigali are from households. Generation of solid waste generally depends on many factors. Some of these factors are production and trade behaviour, size of household, income, life style, level of industrialization, educational level of the population, etc.

High-income groups consume more than lower income groups which lead to higher waste generation by the higher income group. The World Bank report in 1999 showed that

the greater the economic prosperity and the higher the percentage of urban population, the greater will be the amount of solid waste generation. The generation sources of solid waste in Kigali are: households, market and public places, hotels and restaurants, commercial areas, offices, industrial healthcare centres and construction site.
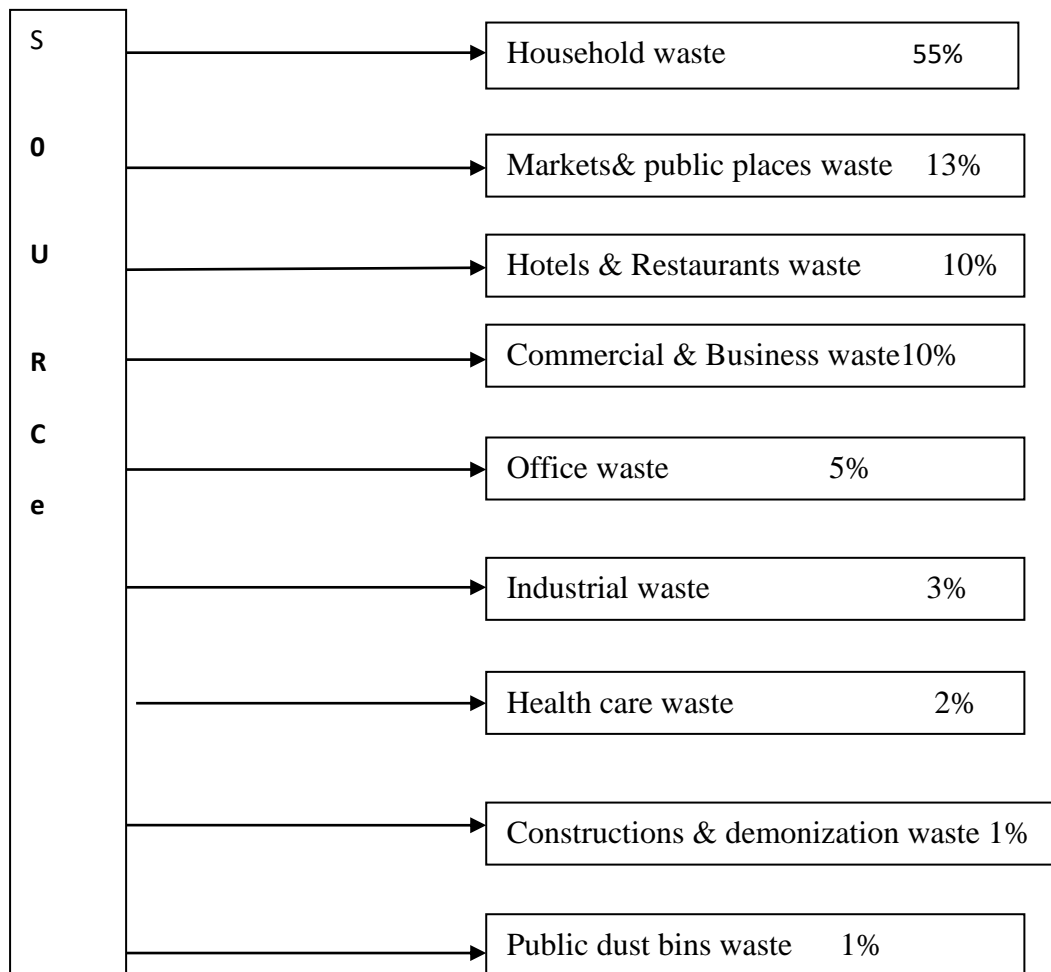
SOURCE	
→	Household waste 55%
→	Markets& public places waste 13%
→	Hotels & Restaurants waste 10%
→	Commercial & Business waste10%
→	Office waste 5%
→	Industrial waste 3%
→	Health care waste 2%
→	Constructions & demonization waste 1%
→	Public dust bins waste 1%

Figure : Generation of solid waste in Kigali, Rwanda

Source: Adapted from REMA 2010

2. Review of Literature:

Niringiye and Douglason (2010) examined the determinants of willingness to pay for solid waste management in Kampala City. A multi-stage random sampling technique was employed to select one hundred eight two households from the study area. A dichotomous choice contingent valuation technique was used to elicit household's willingness to pay for improvement in management of solid waste. They used also a logistic equation model to establish the determinants of willingness to pay for solid waste management. The households are willing to pay for improved waste management but it is not directly influenced by

education level, marital status, quantity of waste generated, household size and household expenditure. Age of the respondents alone was significantly related to the willingness to pay for the service. The study suggests creating awareness on negative side of mismanagement of solid waste.

Adebaju and Salimon (2013) studied household willingness to pay for improved solid waste management in Osun State, Nigeria. It shows that the idea of paying solid waste management service is not new and that is why majority of respondents were willing to pay for alternative waste service added to the current one. Gender, education and household expenditure were found to be positively related to willingness to pay for solid waste management. The study suggest that facilities should be provided to the investors dealing in solid waste management to make prices affordable for solid waste management service

Anjum (2013) had made a study on willingness to pay for solid waste management services: A case study of Islamabad, Pakistan. In this participative study, the logit regression showed that 65.4 per cent of the respondents were willing to pay for the proposed service (scenario), through which the environmental situation of region can be improved. The estimated mean willingness to pay for solid waste management is Rs 298.15 (USD 3.4) per household per month. The determinants like age, services availability and household size of respondents showed a negative relationship, while other variable like education, environmental awareness and income of the respondents showed positive relationship with willingness to pay for solid waste management. The study suggested that the service on solid waste management should be provided and the participation of the community is of prime importance for improvement of environmental situation in that region.

3. Statement of the Problem:

The capital city of Rwanda, Kigali, is challenged by industrial trends and urbanisation that increase the size of population. As a negative side effect of these changes, the generation of household solid wastes also increase which harm the environment as well as human health, if they are not treated in good manner.

As it has been shown that household waste accounts for more than half of Kigali City wastes, this shows that household waste needs more attention so that it can be efficiently managed. Cooperation among government authorities and companies/cooperatives in charge of sanitation and solid waste management as well as population is an important aspect to the management of household wastes. Therefore, this thesis makes an attempt to study the household willingness to pay for improved solid waste management in Kigali.

4. Objectives:

1. To study socio demographic factors of respondents in the study area.

2. To identify the factors determining the willingness to pay for improved solid waste management in the study area.

5. Research Design:

The logistic regression provides the inferential statistics, and is applied in the analysis of this study because of its simplicity and uniqueness with constrained predicted probabilities. The logit linear model is based on the cumulative probability function and is uni and multivariate technique, which allows estimating the probability that an event will occur or not through prediction of binary dependent outcome from a set of independent variables (Roopa, 2000). The logit model used in this study has also been used in previous studies such as Hanemann (1989), Yusuf et al. (2005), Adepoju and Omonona (2009). In addition, this model was selected because of its ability to deal with the dichotomous dependent variables.

The logit regression model is established below

$$P_i = E(Y = 1/X_i) = \frac{1}{1 + e^{-(\beta_o + \beta_{1i})}}$$

Where: Pi = probability that Y=1

Y= dependent variables, Xi= stet of independent variables, β0=the intercept which is constant, β1= the coefficient of the price that households are willing to pay for improved solid waste management.

The coefficient estimates obtained from the identification of the factors influencing household willingness to pay for solid waste management were then used to calculate the mean willingness to pay for improved solid waste management and it is used as given by Hanemann(1989).

$$MeanWTP = 1 * \ln \frac{1 + (\exp \beta_0)}{/\beta_1/}$$

Where β0, β1 are the absolute coefficient estimates from the logistic regression and the mean for improved solid waste management. To identify the factors influencing household

willingness to pay for solid waste management, the household responses to the willingness to pay question was regressed against the prices the household is willing to pay and other socio economic characteristic of the household. The regression logit model is specified as:

$$Y = \frac{1}{1 + \exp^z}$$

Where Y= responses of household WTP which is either 1 for Yes and 0 for No

$$Z = \beta_0 + \beta_1 X_1 + ... + \beta_n X_n + E$$

Where β_0: is a constant and Z: summation of the explanatory variables multiplied by their coefficient.

$\beta_1...... \beta_n$ are coefficient of explanatory variables and $X_1.....X_n$ are explanatory variables.

6. Results and Discussions:

Table 6. 1.

Socio-economic Characteristics Distribution of the Respondents

Gender	Area of Residence		Total
	Unplanned	planned	
Male	85 (77.3)	101 (91.8)	186 (84.5)
Female	25 (22.7)	09 (8.2)	34 (15.5)
Age group			
Up to 29	19 (17.3)	12 (10.9)	31 (14.1)
30-39	26 (23.6)	40 (36.4)	66 (30.0)
40-49	22 (20.0)	28 (25,5)	50 (22.7)
50-59	15 (13.6)	10 (9.1)	25 (11.4)
Above59	28 (25.5)	20 (18.2)	48 (21.8)
Religion			
Christian	110 (100)	98 (89.1)	
Muslim	0	12	

		(0.0)	(10.9)	
Education				
Primary	17 (15.5)	14 (12.8)	31 (14.1)	
Secondary	48 (43.6)	25 (22.7)	73 (33.2)	
Tertiary	45 (40.9)	71 (64.5)	116 (52.7)	
Occupation				
Government	35 (31.8)	33 (30.0)	68 (30.9)	
Private	75 (68.2)	77 (70.0)	152 (69.1)	
Family type				
Nuclear	107 (97.7)	106 (96.4)	213 (96.8)	
Joint	3 (2.7)	4 (3.6)	7 (3.2)	
Size of family				
Below 5	15 (13.6)	06 (5.5)	21 (9.5)	
5 to 7	44 (40.0)	55 (50.0)	99 (45.0)	
Above7	51 (46.4)	49 (44.5)	100 (45.5)	
Income (RWF)				
Up to 150000	05 (4.5)	00 (0.0)	05 (2.3)	
150001-300000	59 (53.6)	26 (23.6)	85 (38.6)	
Above 300000	46 (41.8)	84 (76.4)	130 (59.1)	

Source: Computed 2019

Note: Figures in parentheses are percentages to Colum total

In the above table 6.1, majority of the respondents 84.5 per cent are male and 15.5 per cent of the respondents are female in the study area. This means that majority of household-heads are males in this study area. The general view in Rwanda is that, male is one who propose the female for the formulation of the family. This is the reason for the domination of male in the study area. In life, various age groups of people influence decisions and behaviour. That is, how people view things is depending on their age. In this study, respondents are classified into five age groups. The first group corresponds to those who are below 30 years, while the second group consists of the respondents who are in 30 to 39 years. The third group is for people in 40 to 49 years, fourth group is in the 50 to 59 years and finally the 60 and above age group. The table shows that 14.1 per cent of the respondents are below 30 years, whereas 30 per cent of the respondents belong to the 30 to 39 age group. Also 22.7 per cent of the respondents are between 40and 49 years, whilst 11.4 per cent of the respondents are in the age group of 50 to 59 years. 21.8 per cent of the respondents are above 59 years, it is shown that second category has more respondents. The belief of respondents can be seen in different religions such as Christians Muslims and other believers. 94.5 per cent of the respondents are Christians and 5.5 per cent of the respondents are Muslims. None was found to belong to religions other than Christian and Islam in the study area. The educational level in this research is classified into four levels: the first level is primary education, second level is secondary education and third level is tertiary education. 14.1 per cent of the respondents had primary education only, 33.2 per cent of the respondents had secondary education and 52.7 per cent of the respondents had tertiary education. It is clearly shown that a huge number of the respondents had tertiary level of education followed by secondary education and finally the lower number of the respondents has primary education level only. For the occupation of the respondents, 30.9 per cent of the respondents were participating in government jobs, whereas the remaining 69.1 per cent of the respondents were in the private activities for earning money for their livelihood. 96.8 per cent of the respondents are staying in nuclear type of family, whereas the remaining 3.2 per cent of the respondents are staying in joint family in the research area. This shows that majority of families are living in nuclear life. The table also shows that number of members within the household in this paper is divided into three categories. The first category is the household with membership less than 5, the second category is in 5 to 7 members within the household and the last category corresponds to the above 7 members in the household. Again 9.5 per cent of the respondents were having below five members in the household, 45 per cent of the respondents have four to seven members in the household. The third category constitutes 45.5

per cent respondents that has more than seven members in the household. It shows that in this study area both second and third category has more family members.Finally the monthly income of the respondents in this paper is grouped into three groups. The first group captures the respondents with income up to 150000 RWF, and the second group consists of those earning between 150001 RWF and 300000 RWF. The third group represents persons who earn above 300000 RWF. Table 5-12 in this research shows that 2.3 per cent of the respondents belong to the first group; 38.6 and 59.1 per cent of the respondents belong to the second and third income groups respectively

1.2. Logit Regression results of the factors influencing willingness to pay for improved solid waste management service

Variables	Coefficients	Standard error	significant
Age	-0.299	0.145	0.040**
Education	1.117	0.283	0.000*
Income	0.08	0.46	0.000*
Years of Staying	0.146	0.063	0.021**
Household size	0.012	0.303	0.970
Area of residence	0.651	0.432	0.131
House type	-2.145	0.486	0.000*
Bid	-0.001	0.001	0.050**
Constant	-0.499	1.645	0.762

Source: Computed, 2019

*Significant at 1%, ** Significant at 5%,

Chi square: 130.285, Log Likelihood: 170.596, R square: 0.627

The table presents the factors that determine the willingness to pay for improved solid waste management service in the study area. The results showed that three variables are significant at 1 per cent level. These variables are education, income and house type. The other three variables are significant at 5 per cent level and they are age, years of staying and the bid amount.

The result indicates that educational level is positively related to the willingness to pay for improved solid waste management service. This means that as the household education increases, the willingness to pay for improved solid waste management service also increases. This result is similar to the work of Addai and Danso (2014), Niringiye and

Douglason (2010). The educated people are aware of the issues of environmental degradation. In this connection, the households wish to participate in the activities which give the better environment.

Household income and willingness to pay have a positive relationship and significant at 1 per cent. This implies that as household income increases, the household is willing to contribute to the improved solid waste management service. It shows that if household income increased by 1 RWF, the willingness to pay also increases by 0.08 points in the study area. This positive relationship between income and willingness to pay is in conformity with the work of Pham and Nguyen (2017).

The house type has a negative effect on the willingness to pay. The household type means owing or renting house. This shows that willingness to pay for improved solid waste management among those who are renting houses is lower compared those who own houses. Renting a house reduces the likelihood of willingness pay by 2.145 point. These results are due to the fact that less number of households are not having their own house. This result is different from Muhdin et al. (2016) results, where they found that ownership of house positively influences willingness to pay.

The age of the respondents also has a negative impact on the willingness to pay for improved solid waste management. This means that as household head's age increased the willingness to pay decreased, as the probability of household paying for improved solid waste management is -0.299. This may be because the old people are less interested in investing in environmental services. Others also are of the view that the period of old people to leave this planet is closer. This result is same as that from the work of Yusuf and Salimonu (2007).

The number of years a resident has stayed in the area has a positive impact on the household willingness to pay for solid waste management. This means that as one year is added to the staying period, the willingness to pay for improved solid waste management will increased by 0.146. It is because once you are staying in the place for long time you wish to keep it like your own place and you want to have it very cleaned. Awunyo-Victor et al. (2013) reported the same result.

The results also show that increased price for improved solid waste management is negatively affecting willingness to pay. This means that if the price increased, the number of households willing to pay decreased.

7. Conclusion:

Kigali City is one cleanest city in Africa and is expanding at very alarming rate in terms of infrastructure, population and solid waste generation. This can lead to intractable

environmental problem and quality if proper care is not taken. In our everyday life, we make so many activities which generate waste

In the analysis of collected data, the research shows that willingness to pay for improved household solid waste management is influenced by education of the respondent, income of the respondent and years of staying in the study area and this paper suggested that Government could come up to subsidise the private companies dealing with sanitation and collecting solid waste and should again concentrate on the awareness and campaigns about the consequences of solid waste mishandling.

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