Determinants of Households' Willingness to Pay for Improved Solid Waste Management in Ethiopia: The Case Study of Jimma Town

Muhdin Muhammedhussen Batu[*]
Department of Economics, Jimma University

Ermyas Admasu
Department of Governance and Development Studies, Jimma University

Fikadu Tolosa
Department of Governance and Development Studies, Jimma University

Abstract
In many developing countries solid waste management has become a serious challenge. Improper solid waste management has very high socio-economic and environmental costs that have not usually been critically considered by economic agents. Environmental quality value can usually be estimated from people's willingness to pay to improve or to restore their environment. Hence, the main objective of this study is to find out the determinants of households' willingness to pay for improved solid waste management in Ethiopia, a case study of Jimma Town. A total of 200 samples are randomly selected from four kebeles in Jimma town. The study used descriptive analysis, independent t-tests, correlation, cross tabulation and binary logistic regression. The result shows that the majority, which is 88.5 percent, of the respondents stated that they have a concern for environmental protection and safety. More than half of the respondents (56%) are not satisfied with the existing solid waste management system. Despite municipality's and private collectors' effort, solid wastes are left uncollected and found here and there in streets and communal areas. This implies that there is a desire for the improvement of solid waste management services in Jimma town. The very majority (83.5%) of the respondents are willing to pay for improved door-to-door waste collection service. The findings also revealed that households' willingness to pay for improved solid waste management is significantly affected by income of the household, possession of house and amount of waste generated by households' among other factors. Finally, the study recommends that entrepreneurs and innovators should be encouraged to develop improved schemes for waste collection and management. Regular support and monitoring should be given for the business enterprises and institutions engaged in solid waste management system.
Keywords: Environment, Solid Waste Management, Willingness to Pay, Jimma Town

1. Background of the study

Waste is produced by all sectors of the economy. Every person is a potential producer of waste. It is as old as the existence of human beings. In early times, in order to minimize the health impacts of wastes, transporting the waste out of residential places been the primary concern of authorities. After the end of the Second World War, a high rate of population and urbanization has brought an increased demand of urban and waste disposal land. In developed countries, several mechanisms of waste management have been discovered and applied. However, the condition is different in developing countries (Lindell, 2012).

Waste generation is positively related to income, i.e. increase in income rises consumption and hence waste. This implies that developed countries generate more waste as compared to developing countries. Let alone the amount, developed and developing countries are different in the composition of waste they release. The waste generated in developing countries contains a large proportion of organic materials, about three times higher than developed countries. People in developed countries consume more processed and packaged food; hence their waste contains more packaging materials than in that of developing countries (Medina, 2010).

In low income communities wastes are dumped either at the nearest vacant lot, public space, stream, river, or simply burn it in their compounds (Medina, 2010). Solid waste disposal sites turn into the sources of contamination due to the incubation and production of flies, mosquitoes, and rodents. They, in turn, are the agents of disease that affect population's health (Abul, 2010). Consequently, solid waste is one of the foremost worries of developing countries because of inappropriate planning, inadequate governance, resource constraint and managerial inefficiency (Mary and Adelayo, 2014).

As of IUCN (2009), it is always the poor who suffer from the effects of living in dirty conditions. The threat of disease from solid waste mismanagement is ever lasting. It reduces workers productivity, keeps children out of school, lowers resistance to shocks and etc. These put poor under severe financial strain and deprive opportunities to improve their standard of living. As a result, improper solid waste management has very high

economic, environmental and social costs that have not been seriously considered by economic agents.

Like the others developing countries, solid waste management is a serious confront to Ethiopia. This is mainly due to rapid urbanization and population growth. Many towns in the country lack the financial resources and institutional capacity to provide the needed municipal infrastructure for adequate solid waste management (Dagnew et al, 2012). The solid waste management in Ethiopian cities has not been carried out in a sufficient, suitable and appropriate manner. As a result, the quality of environment in cities has become more serious from time to time, and people are suffering from living in such conditions.

Jimma, like other towns of Ethiopia, is characterized by high and rapid population growth. Urbanization and high population growth are responsible for many environmental problems of which one is solid waste. Around the streets, market, commercial and residential areas, solid wastes easily appear. Despite the progress by Jimma Town to address the challenges of solid waste management, still there are unresolved problems like low coverage of solid waste management (SWM) service, absence of well designed transfer site, and problem of demarcating the final site of disposal. The report from the municipality shows that the solid waste collected by far lower than the amount of waste generated in Jimma town (Jimma City Administration, 2015).

2.   Statement of the Problem

The attempt to alleviate the problem of SWM, in Jimma and others towns of Ethiopia, requires strong commitment on the part of all concerned authorities. The government of Federal Democratic Republic of Ethiopia, as indicated in proclamation number 513/2007, realized that it is hardly possible to address the problem of environment, particularly solid waste management, without involvement of local communities. Even if solid wastes management services are the responsibilities of municipalities, the local communities should be involved in the development, implementation, and monitoring of interventions designed to improve SWM. One reason for this view is that beneficiaries' participation ensures that individuals have a say in activities that will affect their well being.

It is important to study local communities, especially households', interest to contribute for the improvement of SWM. Mary and Adelayo (2014) indicated that the progress of solid waste management has always been assessed based on the performance of the supplier or service provider. This has restricted the success of the improvement in solid waste management system due to the fact that low or no attention has been given to the demand side. However, the participation of local communities or service recipient is essential in making effective decisions and providing solutions to problems of solid waste management. With the view of that, this study aims to analyze the socio-economic determinants of household willingness to pay (WTP) for improved solid waste management in Ethiopia with focus on Jimma Town.

In this regard, various researchers in different parts of the world conducted their study to identify and analyze the determinants of households' contribution or WTP for improved solid waste management in their respective countries. Some of the most important works are: Roy et al (2013), Anjum (2013), Khattak and Amin (2013), Alhassan and Mohammed (2013), Ojo et al (2015), Ojok et al (2015), Joel et al (2014), Mary and Adelayo (2014), Adebo and Ajewole (2012), Adewuyi and Oyekale (2013), and Niringiye and Omortor (2010). In Ethiopia also there are some studies on the determinants of WTP for improved solid waste management; Dagnew et al (2013), Tewodros and Samson (2009) and Birtukan (2013). From these studies, it is controversial whether which variable has an impact on households' WTP for improvement of SWM system. As demographic, social, economic and environment factors change solid waste generation and management changes; this in turn affects the households' WTP for waste management.

Households' WTP is a dynamic concept that we need to study again and again to identify factors affecting WTP and hence draw reasonable conclusions for policy directions. Therefore, conducting study on current demographic, social, economic and environmental conditions is very indispensable. The study aimed at understanding and figuring out households' willingness to pay for improved solid waste management, considering the historic town of Jimma. In doing so, this study supplement the existing literatures on SWM, particularly those on Ethiopia.

3.   Literature Review: Determinants of Households WTP for Improved SWM

Solid waste management is one of the most critical issues the world, particularly in developing countries. This had led to the recognition of improved SWM as a central point for international environmental sustainability and development. Several studies have been conducted to analyze the demand side or households' willingness to pay for improved SWM system.

In India, Roy et al (2013) examined the WTP for sustainable solid waste management using binary probit regression. The study revealed that monthly average household expenditure, household size, average education, environmental awareness and number of working woman presented in family positively associated with the WTP for solid waste management scheme. Informal waste disposal arrangement is not significantly associated with the WTP. The study finally concluded that if solid waste management scheme is introduced,

there is a probability of success.

Anjum (2013), in Pakistan, using logistic and multiple regression, identified that willingness to pay for solid waste management is significantly affected by age, household income, education and environmental awareness. In the same way, Khattak and Amin (2013) aimed at finding out the public WTP for the treatment of environmental hazard in the form of solid waste in Pakistan. Using binomial logit model, the study found that income of household, family disease history, education and size of households as major factors which affect the household's decision regarding WTP. Mustafa et al (2014) shows that education, income, awareness, location and household size were found to be influencing WTP.

In Ghana, Alhassan and Mohammed (2013) analyzed households' demand for better solid waste disposal services using the contingent valuation method. According to the study, the most significant and influencing factors that affect WTP are the environmental safety concern of the respondent, level of satisfaction of current waste disposal services, education, household size, length of stay in the current residence, walking time to public dumpster, and sex of respondent. Addai and Danso-Abbeam (2014), in the same manner, revealed that willingness to pay for improved solid waste management is significantly related to level of education, gender, household size and age of the household head. As of Amfo-Otu et al (2012) respondents' sex, level of education, income, expenditure level, frequency of payment, frequency of collection and satisfaction with the present waste management system do not have any significant influence on the willingness of the respondents to pay for waste collection semi-rural towns of Ghana. However, variables like mode of collection, occupation and age are seen to have a significant effect on willingness to pay.

Ojo et al (2015), in Nigeria, analyzed improved household solid waste management system using multiple regressions model. The study identified that age, income, environmental awareness and household expenditure have a positive and statistically significant relationship with the willingness of households to pay for waste disposal in the area. However, household size has a negative and statistically significant relationship with households' willingness to pay. In the same country, for Mary and Adelayo (2014), the households' willingness to pay is affected by the price of service, age of the respondents, level of education and household size. Adebo and Ajewole (2012) showed that willingness-to-pay for waste disposal is significantly affected by gender, nature of primary occupation, marital status, level of education and average monthly income.

In Uganda, the study by Ojok et al (2015) examined households' willingness to pay (WTP) for improved municipal solid waste management using logit linear regression model. The determinants of WTP, according to the study, are gender, age, household size, education level, income level, marital status and migration status of household respondents. Niringiye and Omortor (2010), however, revealed that the age of the household head is negatively associated with the willingness to pay for solid waste management. Other variables (education, marital status, household size, household expenditure and weight of solid waste) are not significantly associated with the willingness to pay for improved solid waste management. The study, finally, concluded that there is little chance of success if solid waste collection service charges are introduced.

When we come to Ethiopia, some studies were conducted in this regard. According to Dagnew et al (2013), residents' WTP for improved solid waste management is significantly related to income and awareness of environmental quality, among other factors. As of Tewodros and Samson (2009), WTP is significantly affected by household income and current access to waste disposal containers. However, demographic features such as education, age, household size and gender have insignificant impact on the demand for improved services of waste collection. In the same way, Birtukan (2013) shows that households' WTP is affected by level of education, family size, number of children, length of time (years of stay), income and household work. Family size is inversely related with the probability of saying yes to the WTP. The remaining variables have a positive effect on WTP amount.

4. Methodology of the study
4.1. Site Description
Jimma is one of the largest towns in Oromia regional state, located in south western part of Ethiopia. It is the capital of Jimma Zone, one of 19 zones of Oromia regional state, the largest region in the federation of Ethiopia. Jimma has been the dominant political, economic, and historical center in south west Ethiopia. It is located at 335 KMs from Addis Ababa on the main road of Mettu – Gambella. It is situated on 7°40′N (North) latitude and 36°50′E (East) longitude. The total area of the town being the total area of land town is 4623 Hectares (Kassa, 2008). Jimma town is selected for this study at least because of two reasons: First, to the knowledge of researcher such a study has not been done in Jimma town and second, the reports from the municipality show that the current system of municipal solid waste management is inefficient.

4.2. Research Design and Methods
In this study a mixed approach is used. It helps to triangulate the consistency of the information gathered. However, the main approach is a quantitative approach, used for detail analysis of the determinants of

households' willingness to pay for solid waste management.

In order to get all the necessary information on the area under which the research is conducted, both primary and secondary sources of information is used. The primary data is mainly collected from the residents, government officials, and key informants using questionnaires and interview. Secondary data is collected from various documents. The most important secondary data sources used are; strategic plan, reports, and documents from Jimma Town municipality.

As regard to sampling techniques, in the first stage 4 out of 14 kebeles of the town were selected. According to Kothari (2006) the sample size should be determined by a researcher keeping in view the following key points: nature of units, size of the population, size of questionnaire, finance, availability of trained investigators, the conditions under which the sample is being conducted, the time available for completion of the study and etc. Based on this, in the second stage of the sampling procedure, 200 respondents were selected from households' in those four kebeles, most importantly considering prior studies, financial and time constraints.

The study used both descriptive statistical tools and inferential statistics. Correlation test and chi-square were used to check the association of variables. Independent t-tests were also applied to examine the mean differences in major socio-economic variables. In addition to these, binary logistic model was applied to identify the demographic and socio-economic determinants of households' WTP for improved SWM. The collected data through household survey entered, manipulated and analyzed using SPSS software version 20.

4.3. Model specification

The contingent valuation method (CVM) is applied in this study. It is the most commonly used method of valuing environmental qualities. In the CVM, individuals are simply asked to state their WTP for the non marketed resource through WTP surveys.

As used by Adewuyi and Oyekale (2013), Anjun (2013), Roy et al (2013), and Amfo-Otu et al (2012), to characterize households WTP for improved solid waste management in the study area, the researcher used a probability model in which the chances of WTP are linked to individual, socio-economic and demographic characteristics.

Therefore, in this study binary logit equation is defined as follows:

$$P_i = E(Y = 1/R_i) = \alpha + \beta R_i$$

WTP=f(Age, Sex, Educational level, Income, home ownership, others socio-economic variables)
Where:

Dependent variable, WTP is in binary nature (1=yes or 0=no): indicates probability of paying to the improvement of solid waste management.

Independent variable, R_i: Age of the household head, Sex of household head, Educational level, marital status, income of the household head, Assets (house owner ship), satisfaction of current SWM service, and waste generated by households.

In this study due attention is given to eight socio-economic variables. The expected relationship between dependent and independent variables used for this study are summarized as of the following table.

Table 1: Expected relationship between WTP and explanatory variables

Independent Variable: Willingness to pay			
S. No	Independent variables	Nature of Variable	Expected Sign	Remark
1	Sex	Categorical	+	Sex (female) and WTP are positively related.
2	Age (Year)	Numeric	+	
3	Marital status	Categorical	+	
4	Household Head Education	Categorical	+	Education (higher) and WTP are positively related.
5	House Ownership	Categorical	+	House ownership and WTP positively related.
6	Average Income (Monthly)	Numeric	+	
7	Solid waste per week	Numeric	+	
8	Satisfaction with current SWM	Categorical	+	Dissatisfaction with current SWM and WTP are positively related

5. Results and Discussions

5.1. Socio-Economic and Demographic Features of Respondents'

As indicated in table 2, the respondents are in their active years. All of the respondents are above 20 years. The mean (average) age of respondents is 43.06 years.

Table 2: Age of respondents' (Mean)

	Minimum	Maximum	Mean	SD
Age of the household head	24	66	43.06	8.931

Source: Survey 2016

This, therefore, shows that respondents are at critical age to know the benefits of environmental quality and hence make wise decisions about solid waste management.

Table 3: Demographic and social features

	Percent
Sex	
Male	81.5%
Female	18.5%
Marital Status	
Never Married	5.0%
Married	80%
Divorced & Widowed	15%
Family size(mean)	4.20($\pm$1.48)
Education of household head	
Read and Write	5.0%
Primary	29.0%
Secondary	34.5%
Tertiary	31.5%

Source: Survey 2016

In terms of sex, the majority of the household head are male (81.5%). Around 80 percent of household heads are married whereas 18.5 percent of them are widowed and divorced from their wives or husband for different reasons. Only 5 percent of the respondents are single. The higher proportion of the married in the study area may encourage the willingness to pay for improved solid waste management. The average family size is 4.2 persons. This number can easily show that a household consists of father, mother, a son and a daughter.

Education wise, the survey findings highlights that the literacy level is high in sampled kebeles of Jimma Town. This study assumes that a person is literate if he or she can read with understanding and write a short statement at least in one language. In this regard all respondents are literate.

Table 4: Demographic and social features

	Percent
Household head occupation	
Full time Employment	46.0%
Self Employment	47.5%
Casual and laborer	5.5%
Unemployed	0.5%
Others	0.5%
	100%

Source: Survey 2016

The considerable majorities of the respondents have jobs. Due to the fact that all respondents are literate and the very majorities are employed, they can easily pay for environmental improvement.

The average monthly income of the respondents' is ETB 4002.45 ($\pm$2962.8) ranging between ETB 600 and ETB 20,000.

Table 5: Monthly Income

	Minimum	Maximum	Mean	SD
Monthly income	600	20000	4002.45	2962.797

Source: Survey 2016

In terms of house ownership, 61.5% are living in their own houses and the remaining 38.5 % are living in rented houses. The higher the number of the house owners in the study involves many households will pay for environmental quality improvement.

www.iiste.org

Table 6: House Ownership

	Percent
House ownership	
Yes	61.5%
No	38.5%

Source: Survey 2016

5.1. Households' Attitude and Perceptions towards SWM

The survey results indicate that the majority, which is 88.5 percent, of the total respondents state that they have a concern for environmental protection and safety.

Table 7: Concern for Environment

	Percent
Concern for Environment	
Yes	88.5%
No	11.5%
Satisfaction with current SWM	
Yes	44%
No	56%

Source: Survey 2016

When we see households' satisfaction towards solid waste management in Jimma town, the majority (56%) are not satisfied with the existing service system. Despite municipality and private collectors' effort, solid wastes are left uncollected and found here and there in streets and communal areas. This implies that there is a desire for the improvement of SWM services in Jimma town. From among the respondents, 44 percent indicated that they are satisfied with the current service system but they believe that there are still so many problems that need to be considered.

Table 8: Impact of Solid Waste

	Percent
I have proper knowledge of the impact of solid waste	
Strongly Agree	2.0%
Agree	91%
Undecided	2.0%
Disagree	5%
Solid waste in Jimma Town has been increasing over the last few years.	
Strongly Agree	4.0%
Agree	66%
Undecided	21%
Disagree	9.0%
Solid waste mismanagement is the critical problem in Jimma Town	
Strongly Agree	9.0%
Agree	63%
Undecided	13%
Disagree	12%
Strongly Disagree	3.0%

Source: Survey 2016

During the survey the respondents were also asked whether they have a proper knowledge of the impact of solid waste, 93% agreed that they have a good knowledge about the consequences of mismanagement of solid waste. Close to 70 percent believe that solid waste has been increasing over the last years. In the same way, around 70 percent responded that improper solid waste management is the critical problem in Jimma Town.

Around 85 percents of the respondents believe that the government is not doing enough to deal with solid waste problem. According to key informants the reason for such complain is that the government couldn't properly expanded road and infrastructures that facilitates solid waste management.

Table 9: Government and Solid waste collection

	Percent
The government is not doing enough to deal with solid waste problem.	
Strongly Agree	16%
Agree	68%
Undecided	4.0%
Disagree	10%
Strongly Disagree	2.0%

Source: Survey 2016

Respondents have, indeed, a good awareness about the impact of environmental quality deterioration. Of all the respondents about 95 percent suggested that proper solid waste management is good for environment and it should be further promoted. In the same way, around 95 percent indicated every person should contribute to solid waste management (see table 10). This is in line with the basic idea of payment for ecosystems service (PES), which states that those who provide ecosystem services should be paid for doing so.

Table 10: Contribution to Solid waste management

	Percent
Proper SWM is good for environment and it should be further promoted.	
Strongly Agree	23%
Agree	72%
Undecided	2.0%
Disagree	3.0%
Everybody could contribute to SWM.	
Strongly Agree	35%
Agree	59%
Undecided	2.0%
Disagree	4.0%

Source: Survey 2016

5.2. Determinants of Households WTP for improved SWM
Descriptive Analysis

Respondents were asked to estimate amount of wastes they generate under normal circumstances per week in terms of garbage bag or a "50 Kg sack**"**, for all types of solid waste. On average the amount of wastes generated per household are 1.10 sacks per week. This implies that households' generate more than one sack of solid waste per week.

Table 11: Average waste generated by households

	Minimum	Maximum	Mean	SD
Solid waste produced per week	0.25	3.00	1.1088	0.59657

Source: Survey 2016

The study informed all respondents about a new system of solid waste management. This waste collection service would thus address two problems: waste would be picked up regularly from residents' house and waste would not be left around the neighborhood to create a sanitary problem. This proposal is based on the knowledge that keeping households' waste in the house for a week or longer has health implications, because it creates harmful microorganisms, rats, mosquitoes, air pollution and others. Considering this, households may be encouraged to pay for improved, timely and regular waste collection. This kind of service can only be offered if a sufficient number of households agree to pay a reasonable amount of money on a regular basis. The service can be offered by the municipal corporation or by private firms.

Based on this proposal, as shown in table below, the majority (83.5%) of the respondents considered in this study are willing to pay for improved a door-to-door waste collection service.

Table 12: WTP for improved waste collection and disposal system

	Percent
Yes	83.5
No	16.5
Total	100.0

Source: Survey 2016

The average willingness to pay is ETB 17.26, while the minimum and maximum being 0 and ETB 35, respectively. This is significantly greater than the current fee (10 ETB). It shows households have an interest to

contribute for environmental service, even more than the existing fee.

Table 13: Monthly willingness to pay

	Mean	Median	Mode	SD
Monthly WTP (in ETB)	17.261	17.500	15.0[a]	9.4604
Multiple modes exist. The smallest value is shown.				

Source: Survey 2016

Respondents close to 17 percent are not interested for the newer system of solid waste collection.

Table 14: Main reasons for "no" willingness to pay

	Percent
Don't like a private company	3%
We are poor and cannot pay	48.5%
Satisfied with existing system	18.2%
Government's responsibility to provide waste collection for free	15.15%
Service would probably not be reliable	15.15%
Total	100.0

Source: Survey 2016

***NB: The table considered those who are not willing to pay (17% of total respondents)

Correlations and Independent t-tests Analysis

This topic mainly deals with analyzing households' willingness to pay (continuous variable) in relation to major independent (exogenous variables). Accordingly, the pearson correlation test is used to see the correlation between age, income, waste generation and WTP in ETB. The result shows that households' WTP is positively and significantly associated with income of the households' and amount of waste generated by families. As indicated in the table 15, the correlation between income and WTP is moderate; it is 0.587. In the same way, correlation between waste produced and WTP is 0.554. As regard to the correlation between age of household head and WTP, the outcome shows that association between them very small or statistically insignificant.

Table 15: Correlations of major variables

		Age of the household head	Average Monthly Income	Solid waste produced per week
Maximum Monthly WTP	Pearson Correlation	.032	.587**	.554**
	Sig. (2-tailed)	.652	.000	.000
	N	200	200	200
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: Survey 2016

The study also applied the independent t-tests to check who pays more for proposed solid management system. In this case due attention is given to see the effect of sex, marital status, education, house ownership and satisfaction with current system on households' willingness to pay.

As revealed in table 16 males' WTP is significantly greater than that females'. This happens due to the fact the monthly income of the male respondents supersedes that of the females. The power of income creates difference in WTP. Joel et al (2014) also identified that that males are more willing to pay for solid waste management than the females in Kenya.

In terms of marital status, the average WTP for married (ETB 18.59) is significantly greater than others (single, divorced and widowed). This implies that family stability is a base for environmental care and willingness to pay for its protection. The independent t-tests also show that having certificates (TVET, diploma, degree) implies a high willingness to pay for improved management of solid waste. It indicates that the more people get educated the more they care for environment. This outcome is simple and logical since level of education could be related to a better understanding of the problem of solid waste.

In the same token, respondents live in their house have a significantly higher willingness to pay as compared to those who rent house. The mean WTP for house owners is ETB 20.018 while for those who rent house is ETB 12.857.

Table 16: Independent t-tests

Outcome indicator	Treatment variables	Samples	Mean	SD	t-test for Equality of Means	
WTP	Sex					
	Male	163	18.004	9.2731	t	2.359
	Female	37	13.986	9.7086	Sig.(2-tailed)	.019
	Marital Status					
	Married	160	18.592	8.955	t	4.137
	Others	40	11.938	9.665	Sig.(2-tailed)	.000
	Education (Certificate)					
	Yes	61	19.96	7.715	t	2.991
	No	139	16.077	9.928	Sig.(2-tailed)	.003
	House ownership					
	Yes	123	20.018	8.26	t	5.396
	No	77	12.857	9.637	Sig.(2-tailed)	.000
	SWM Ser. Satisfaction					
	Yes	88	18.068	11.376	t	1.022
	No	112	16.627	7.622	Sig.(2-tailed)	.309

Source: Survey 2016

The independent t-tests hold that the average willingness to pay for unsatisfied households' is almost the same to those who said they are satisfied with the current system. In other words, the amount they are willing to pay for proposed system is the same.

Cross Tabulation Analysis

The cross tabulation analysis is also used to assess the association of households willingness to pay (in binary terms, i.e. YES or NO) and dichotomous or nominal independent variables. As of table below, even if the majority of both males and females are willing to pay for improved system, males' WTP (85.3%) is higher than that of females (75.7%), despite the fact that difference is statistically insignificant.

Table 17: Cross tab analysis of Sex and WTP

		Household head sex		Total
		Male	Female	
WTP(binary)	No	14.7%	24.3%%	16.5%
	Yes	85.3%	75.7%	83.5%
Total		100.0%	100.0%	100.0%

Pearson Chi-Square		
Value: 2.017[a]	DF: 1	Asymp. Sig.(2-sided): .156

Source: Survey 2016

In relation to marital status and WTP condition, table 18 shows that being married is one factor that creates difference in paying for environmental service. The outcome shows that married households have a significantly higher willingness to pay as compared others (single and divorced), it is 87.5% and 67.5% respectively.

Table 18: Cross tab analysis of Marital Status and WTP

		Marital condition		Total
		Married	Others	
WTP(binary)	No	12.5%	32.5%	16.5%
	Yes	87.5%	67.5%	83.5%
Total		100.0%	100.0%	100.0%

Pearson Chi-Square		
Value: 9.291[a]	DF: 1	Asymp. Sig.(2-sided): .002

Source: Survey 2016

Education plays a key role in every aspect of life. The higher the education levels, the better awareness about environmental value and its protection. The cross tab analysis shows that those with certificates (TVET, diploma, degree) have a statistically significant higher WTP as compared those who "have not".

Table 19: Cross tab analysis of Education and WTP

		Certificate (Education)		Total
		Yes	No	
WTP(binary)	No	6.6%	20.9%	16.5%
	Yes	93.4%	79.1%	83.5%
Total		100.0%	100.0%	100.0%
Pearson Chi-Square				
Value: 6.298ᵃ	DF: 1	Asymp. Sig.(2-sided): .012		

Source: Survey 2016

Like independent t tests analysis, the cross tab also shows that households who own house have a higher WTP for improved solid waste management system. The chi square reveals a statistically significant difference of WTP between those who live in their house and those who rent.

Table 20: Cross tab analysis of House Ownership and WTP

		House ownership		Total
		Yes	No	
WTP (binary)	No	8.1%	29.9%	16.5%
	Yes	91.9%	70.1%	83.5%
Total		100.0%	100.0%	100.0%
Pearson Chi-Square				
Value: 16.245	DF: 1	Asymp. Sig.(2-sided): .000		

Source: Survey 2016

The association between WTP and satisfaction in the current system of waste collection and disposal was seen via cross tab analysis. The result tells that dissatisfaction of the current system implies the higher willingness to pay. That means WTP for those who satisfied (77.3%) is less than WT of those unsatisfied (88.4%). The difference is statistically significant.

Table 21: Cross tab analysis of Satisfaction and WTP

		Current Satisfaction		Total
		Yes	No	
WTP(binary)	No	22.7%	11.6%	16.5%
	Yes	77.3%	88.4%	83.5%
Total		100.0%	100.0%	100.0%
Pearson Chi-Square				
Value: 4.423	DF: 1	Asymp. Sig.(2-sided): .035		

Source: Survey 2016

Binary Logistic Regression

As mentioned earlier a binary logistic model is employed to factors affecting households' WTP for improved solid management system. In this model dependent variable, WTP, is regressed against eight independent variables. These are: sex [SEX], age [AGE], marital status [MSTATUS], income [INCOME], solid waste generation [SWGEN], house ownership [HOUSEOWN], satisfaction with current service [SAT] and education [EDU].

The classification tables show that the model correctly predicted 87.5 percent of the observations (see Appendix). As indicated in table 22 the chi-square strongly rejects the hypothesis that the model has no explanatory power.

Table 22: Omnibus Tests of Model Coefficients

	Chi-square	df	Sig.
Step	81.164	8	.000
Block	81.164	8	.000
Model	81.164	8	.000

Source: Survey 2016

Apart from these, the Hosmer and Lemeshow (H-L) test reveal the model well fitted the data, insignificant p-values indicates that the data fit the model well.

Table 23: Model Summary and Hosmer and Lemeshow Test

Step	2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
	97.983[a]	.334	.564

Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	4.136	8	.845

Source: Survey 2016

Under model summary (table 23) we see that the -2 Log Likelihood statistics is 97.983. This statistic is interpreted as the smaller the statistic the better the model. The Cox & Snell R^2 can be interpreted like R^2 in a multiple regression, but cannot reach a maximum value of 1. The Nagelkerke R^2 can reach a maximum of 1. Accordingly their value is good.

Finally before interpreting the estimates multicollinearity was checked since it reduces the accuracy of estimating the coefficient of variables. Thus the result indicates multicollinearity is not a serious problem in the data (see appendix part).

As of table 24, four variables out of eight are statistically significant and theoretically sound. These are income [INCOME], solid waste generation [SWGEN], house ownership [HOUSEOWN], and satisfaction with current system [SAT].

According the table below, income level is found to be a significant determinant of household willingness to pay. The coefficient for income is found to be positive and significant at 5 percent level of significance. As the income level increases by one unit, the odds of households' WTP increase by a factor of 1.001. This implies that when income level of household increases the probability of WTP for the improved service would be increase. This is in line with economic theory which states that SWM is a normal economic good whose demand changes in the direction of income change.

Table 24: Determinants of Households' WTP (Binary Logistic Output)

	B	S.E.	Wald	df	Sig.	Exp(B)
SEX (1)	-.707	.776	.829	1	.362	.493
AGE	-.053	.034	2.404	1	.121	.948
MSTATUS (1)	-.145	.785	.034	1	.853	.865
EDU (1)	.623	.683	.832	1	.362	1.864
INCOME	.001	.000	6.408	1	.011**	1.001
HOUSEOWN (1)	1.79	.669	7.188	1	.007**	6.003
SAT	-1.15	.539	4.551	1	.033**	.317
SWGEN	2.77	1.135	5.952	1	.015**	15.959
Constant	-.299	1.410	.045	1	.832	.742

**Statistically Significant at 5% level

Source: Survey 2016

House ownership is also one of the factors that determine households WTP for solid waste management. Being owner has a high likelihood of paying for improved solid waste management. The coefficient for the level of solid waste generation is found to be statistically significant. The higher waste generation implies the higher possibility of paying for improved management of solid waste.

The remaining variables (age, marital status, sex and education) contrary to the expectation, the coefficient for the variables was not found to be statistically significant at either of 1, 5 or 10 percent. The effect of age is statistically insignificant. In the same manner, age is found to be insignificant in Alhassan and Mohammed (2013) and Tewdros and Samson (2009).

Even if the association between marital status and WTP (in binary terms) is significant and positive, the regression outcome shows that the effect of marital status on WTP is insignificant. The good thing, however, is that the sign is as expected being married positively related to probability of willing to pay. In this regard, Addai and Danso-Abbeam (2014), Niringiye and Omortor (2010) and Mary and Adelayo (2014) stated that marital status is insignificant in determining WTP. When we see the impact of sex on probability of WTP for improved system is insignificant. This is in confirmation of the outcome obtained by Mary and Adelayo (2014) and Tewdros and Samson (2009).

The binary logistic regression output shows that respondents with higher education have no significant difference in paying to improved SWM, as compared to non-certified respondents. However, the sign is in line with expectation. Niringiye and Omortor (2010) revealed that education do not significantly influence willingness to pay for improved waste management. In Ethiopia as of Tewdros and Samson (2009), education, is found to have insignificant impact on the demand for improved services of waste collection.

6. Conclusions and Recommendations

Solid waste management is one of a serious confronts to Ethiopia, mainly due to rapid urbanization and population growth. The solid waste management in Ethiopian cities has not been carried out in a sufficient, suitable and appropriate manner. As a result, the quality of environment in cities has become more serious from time to time, and people are suffering from living in such conditions.

The survey results also indicate that the majority, which is 88.5 percent, of the total respondents state that they have a concern for environmental protection and safety. About 56% of the respondents are not satisfied with the existing solid waste management service. During the survey the respondents were also asked whether they have a proper knowledge of the impact of solid waste, 93% agreed that they have a good knowledge about the consequences of mismanagement of solid waste.

The study informed all respondents about a new system of solid waste management. Based on that around 83.5% of the respondents are willing to pay for improved a door-to-door waste collection service. The average willingness to pay is ETB 17.26. This is significantly greater than the current fee. It shows households have an interest to contribute for environmental service, even more than the existing fee.

As regard to factors affecting households WTP, both independent t-tests and cross tabulation analysis show that marital status, education and house ownership are the most important factors associated with households' WTP. Binary logistic regression was also employed to identify factors affecting households' WTP for improved solid management system. The outcome shows that four variables are found to be statistically significant. These are income [INCOME], solid waste generation [SWGEN], house ownership [HOUSEOWN], satisfaction with current service [SAT] and education [EDU].

Based on the findings the following recommendations were made to improve SWM in Jimma Town.

- ✓ Awareness creation and training should be given to the community on efficient solid waste disposal through shared efforts of all stakeholders.
- ✓ Increasing the participation of local communities in solid waste management decision making activities is necessary.
- ✓ Policy makers should consider important variables like income, education, marital status, waste generated and house ownership in designing improved SWM service.
- ✓ Entrepreneurs should be encouraged to develop improved schemes for waste collection and management.

References

[1]   Abul, S.(2010). Environmental and Health Impact of Solid Waste Disposal at Mangwaneni Dumpsite in Manzini: Swaziland. Journal of Sustainable Development in Africa (Volume 12, No.7, 2010). Issn: 1520-5509.

[2]   Addai, K.N. and Danso-Abbeam, G.(2014). Determinants of Willingness to Pay for Improved Solid Waste Management in Dunkwa-on-Offin, Ghana. Journal of Agriculture and Environmental Sciences. Vol. 3, No. 1, pp. 01–09.

[3]   Adebo, G.M. and Ajewole, O.C.(2012). Gender and the Urban Environment: Analysis of Willingness to pay for Waste Management Disposal in Ekiti-State, Nigeria. American International Journal of Contemporary Research Vol. 2 No. 5; May 2012 228.

[4]   Adewuyi, A.L and Oyekale, A.S.(2013). Contingent Valuation Analysis of Households' Willingness to Pay for Environmental Safety in Ogbomoso North and South Local Government Areas of Oyo State, Nigeria. J Hum Ecol, 44(3): 287-295.

[5]   Alhassan, M. and Mohammed, J.(2013). Households' Demand for Better Solid Waste Disposal Services: Case Study of Four Communities in the New Juaben Municipality, Ghana. Journal of Sustainable Development; Vol. 6, No. 11; 2013. Canadian Center of Science and Education ISSN 1913-9063 E-ISSN 1913-9071.

[6]   Alie W. D. (2015). Problems of Solid Waste Management in Small and Medium Enterprises. International Journal of Environmental Monitoring and Analysis, Vol. 3, No. 2, 2015, pp. 50-66. doi: 10.11648/j.ijema.20150302.14.

[7]   Altaf, M.A. (1996). Household Demand for Improved Solid Waste Management: A Case Study of Gujranwala, Pakistan. World Development, Vol. 24, No. 5, pp. 857-868, 1996.

[8]   Amfo-Otu,R.; Waife, E.D, Kwakwa. P.A., Samuel Akpah-Yeboah, S. (2012). Willingness to Pay For Solid Waste Collection In Semi-Rural Ghana: A Logit Estimation. Zenith International Journal of Multidisciplinary Research Vol.2 Issue 7, July 2012, ISSN 2231 5780 .www.zenithresearch.org.in 40.

[9]   Anjum, R.(2013). Willingness to Pay for Solid Waste Management Services: A Case Study of Islamabad. CEECC Working Paper No. 3.

[10]   Birtukan, B.W.(2013). Household Demand for Improved Solid waste Management Service in Ethiopia: the case of Bahir Dar City. Proceeding of ninth International Conference on the Ethiopian Economy

organized by the Ethiopian Economic Association. Volume II, ISBN/ISSN: 978-99944-54-24-2.

[11] Dagnew H., Alemu M., and Zenebe G.(2012). Households' Willingness to Pay for Improved Urban Waste Management in Mekelle City, Ethiopia. Environment for Development Discussion Paper Series EfD DP 12-06.

[12] FDRE Nagarit Gazeta(2007). Proclamation number 513/2007, solid waste management proclamation. Page Number 3524. Addis Ababa.

[13] Gujarati, D.N. and Sangeetha (2007). Basic Econometrics. Fourth edition. Tata Mcgraw Hill Education private limited. New Delhi.

[14] Haider, I., Haider, M., and Badami, M.G.(2013). Household Solid Waste Generation in Urban Pakistan: A Case Study of Rawalpindi. Draft working paper.

[15] Hoornweg, D and Bhada-Tata, P.(2012). What a Waste: A Global Review of Solid Waste Management.

[16] IUCN Pakistan (2009). Environmental Fiscal Reform in Abbottabad: Solid Waste Management. IUCN Pakistan, Islamabad, Pakistan. iv+20 pp.

[17] Jimma City Administration Sanitation, Beautification and Abattoir Department (2015). Progress Report

[18] Joel, S., Mark, K. and Grace, C. J.(2012). Economic Valuation of Improved Solid Waste Management in Eldoret Municipality. Journal of Emerging Trends in Economics and Management Sciences (JETEMS) 3(6): 962-970.

[19] Kassa, T. M. (2008). Household Solid Waste Generation Rate and Physical Composition Analysis in Jimma Town Ethiopia. A Thesis Submitted to the school of graduate studies of Addis Ababa University in partial fulfillment of the requirements for the Masters of Science in Environmental Science.

[20] Kirunda, M.P (2009). Public Participation in Solid Waste Management: Challenges and Prospects: A case of Kira Town Council, Uganda.

[21] Khattak, N.U. and Amin, S.(2013). Willingness to pay for the Treatment of Environmental Hazards: A Case Study of Peshawar. Asian Economic and Financial Review, 2013, 3(7):831-842.

[22] Kothari, C.R. (2006). Research methodology: methods and techniques.Second edition. New Age International private limited. New Delhi.

[23] Lindell, A.(2012). Achievement of sustainable solid waste management in developing countries: A case study of waste management in the Kavango region, Namibia. Environmental and Energy System Studies. Department of Technology and Society Lund University.

[24] Lokina R, Banga, M., Mkenda, A and Kulindwa, K.(2011). Households' Willingness to Pay for Improved Solid Waste Collection Services in Kampala City, Uganda. Working Paper Series No. 07/11

[25] Mary, O. and Adelayo, A. (2014). Household Willingness to Pay for Improved Solid Waste Management in Akinyele Local Government Area. Journal of Biology, Agriculture and Healthcare Vol.4, No.18, 2014.

[26] Medina, M. (2010). Solid Wastes, Poverty and the Environment in Developing Country Cities: Challenges and Opportunities. UNU World Institute for Development Economics Research Working Paper No. 2010/23

[27] Mustafa, U., Ahmad, I. and Haq, M.(2014). Capturing Willingness to Pay and Its Determinants for Improved Solid Waste Management. Pakistan Institute of Development Economics. Working papers, No. 110.

[28] Niringiye, A. and Dougason Omortor G.D. (2010). Determinants of Willingness to Pay for Solid Waste Management in Kampala City. Current Research Journal of Economic Theory 2(3): 119-122, 2010.

[29] Ojo, A.M, Esther Ojonugwa Ogbole, O.O., Ojo, O.A.(2015). Analysis of Improved Household Solid Waste Management System in Minna Metropolis, Niger State, Nigeria. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 15, Issue 2, 2015 PRINT ISSN 2284-7995, E-ISSN 2285-3952.

[30] Ojok, J., Koech M.K. , Tole M., Okot-Okumu J.(2013). Households' Willingness to Pay for Improved Municipal Solid Waste Management Services in Kampala, Uganda. Science Journal of Environmental Engineering Research. Volume 2013, Article ID sjeer-143, 8 Pages, 2012. doi: 10.7237/sjeer/143. http://www.sjpub.org/ sjeer.html.

[31] Roy, A.T, Deb,U. and Mazumder, R.(2013). Sustainable Urban Waste Management in Silchar Municipal Area: An Application of Contingent Valuation Method in Cachar District of Assam. International Journal of Humanities and Social Science Invention ISSN (Online): 2319 – 7722, Volume 2 Issue 1 ‖ January. 2013‖ PP.25-33 www.ijhssi.org.

[32] Tewodros T., and Samson, H.(2009). Demand for Improved Solid Waste Collection Services: A Survey in Mekelle City. Journal of The Drylands 2(1): 32-39, 2009.

[33] Tietenberg T. and Lewis L.,(2012). Environmental and Natural Resource Economics, 9th edition; Pearson Education Publishers.

[34] United Nations Environment Program (2009). Developing Integrated Solid Waste Management Plan

Training Manual, Volume 2: Assessment of Current Waste Management System and Gaps therein.

[35]   United Nations Environment Program (2009b). Developing Integrated Solid Waste Management Plan Training Manual, Volume 4: Volume 4: ISWM Plan.

[36]   Williams, R. (2013). Sustainable Solid Waste Management & the Green Economy. Key Issue Paper International Solid Waste Association.

Appendix

A- Classification table 1

Observed		Predicted		
		WTP		Percentage Correct
		No	Yes	
WTP	No	0	33	51.5
	Yes	0	167	94.6
Overall Percentage				83.5

Classification table 2

Observed		Predicted		
		WTP		Percentage Correct
		No	Yes	
WTP	No	17	16	51.5
	Yes	9	158	94.6
Overall Percentage				87.5
The cut value is .500				

B-Correlation coefficients, using the observations 1 - 200

Sex	Age	mstatbinary	certificate	income	
1.0000	-0.1735	0.6953	0.1198	-0.2202	Sex
	1.0000	-0.1322	0.0236	0.0249	Age
		1.0000	0.1683	-0.2736	mstatbinary
			1.0000	-0.0099	certificate
				1.0000	income
		houseown	weightsolid	Sersatisf	
		-0.2317	-0.1628	-0.0591	Sex
		0.4374	0.0453	0.0782	Age
		-0.2723	-0.2384	0.0101	mstatbinary
		-0.0555	-0.0614	-0.0035	certificate
		0.2899	0.6860	0.1246	income
		1.0000	0.2741	-0.0025	houseown
			1.0000	0.0538	weightsolid
				1.0000	Sersatisf