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Integrated Solid Waste Management Practice and Households 'Willingness to Pay for Improved Solid Waste Management: The Case of Addis Ababa

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Abstract

The study herein identifies the household's solid waste handling practice in Addis Ababa, their attitude towards it, and their awareness about solid waste. It also examines their willingness to pay and the associated factors. The study selected the Kolfe Keranyo sub-city, and four weredas from the sub-city were selected, which represent all types of residents: high-income, middle-income, and low-income groups. The study employed a semi-structured questionnaire and face-to-face interviews to collect data from 388 households. A contingent valuation model is selected to analyze the data. According to the findings, 65% of households are willing to pay BRL 30 for improved solid waste management services. The willingness of the households is influenced by economic variables such as direct income, other side income, and expenditure. The result indicates that the integrated solid waste management system in the city is very weak, and the institutional setup is inappropriate for supporting the system. Moreover, the finding shows a strong link between integrated solid waste components and willingness to pay. Based on the analysis, the study recommends that household awareness about solid waste management should be enhanced, their solid waste handling should be improved, a separate pay system for solid waste should be introduced, and an improved solid waste service accompanied by a new pay system and charge should be realized. Regarding the integrated solid waste management system, the institutional setup should be revised to support the system.

***Keywords**:* Integrated solid waste management, willingness to pay, *Contingent Valuation*

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Introduction

Due to a lack of appropriate planning, inadequate governance, resource constraint, and ineffective management, solid waste especially insufficient collection and improper disposal of it is a major concern for many rapidly growing cities in developing countries (Chuen-Khee and Othman, 2010; Medina, 2010). According to the United Nations Environment Programme (UNEP, 2004), solid waste generation is an increasing global environmental and public health problem. The swift expansion of urban agricultural and industrial activities, stimulated by population growth, has produced vast amounts of solid and liquid wastes that pollute the environment and destroy resources. Changing economic trends and rapid urbanization also complicate solid waste management (SWM) in developing countries. Consequently, solid waste is not only rising in quantity but also changing in composition (from less organic matter to more paper, packing materials, plastics, glass, metal, and other substances), which is exacerbated by low collection rates (Bartone and Bernstein, 1993; Medina, 2002).

Like most developing countries, the Ethiopian population is increasing, and this results in pressure on the natural resources base and urban area. The solid waste generated from different sources was indiscriminately collected without being sorted and is disposed of in the outskirts of the cities, along the drainage lines and roadsides. Thus, municipalities in the country have experienced traditional practices to collect, dispose and reuse solid waste which is not aimed at promoting public health, environmental protection, and alternative energy sources (Hailemariam and Ajeme, 2014).

This poorly managed solid waste is due to a lack of necessary materials and facilities for solid waste collection, and a lack of labor engaged in street sweeping and daily removal of solid waste. These forms of SWM practices are now becoming the major causes of environmental problems related to surface and groundwater pollution, and the decline in cities and towns' cleanness (Tsega and Reddy, 2013). Following this, the Ethiopian government passed SWM Proclamation in 2007(FDRE, 2007). Implementation of this proclamation is challenged by low levels of returns from efforts (Hailemariam and Ajeme, 2014). The necessary municipality activities to provide additional services would represent a financial burden for them and unable to coped-up with the generation of tremendous volume and complexity of SW. An option to make financially viable

for the increased solid waste management services could come from the partial coverage of the cost through the introduction of a monthly service charge. To this purpose, the raising of revenue from households is central to cost recovery of the existing operation and future upscaling of management practices (Schübeler, 1996).

In Addis Ababa City the city Administration has established Cleansing Administration Agency and Solid Waste Recycling and Disposal Project Office to improve the activities of Solid Waste Management, on the ground for the sustainable development of the city‘s Solid waste management services. But a lot remains in considering the Integrated Solid Waste Management system as being a science the integrated solid waste management mix: Reduce, Reuse, Recycle, and Recover are not fully employed; the waste –to –Energy is also at its infant stage though there are around 529 Small Scale Enterprises and 14 private sectors to actively engaged in this solid waste management. Addis Ababa Cleansing Management Agency has contracted out the door-to-door solid waste collection to MSE at a price rate of Birr 40 /m. cube and the transportation to the damping site are carried out by the agency skip loaders which costs Birr 85/m. cube. Whereas the primary and secondary waste collection from the business sector which is outsourced to private sanitation plc is carried at the price rate of Birr 70/m. cube. For these cleansing management expenditures, the Agency has levied a 20% surcharge cost on the taped water bill and a fee of Birr 48/annum during the renewal of the business permit (Addis Ababa Cleansing Agency, 2016). The gap between what the public pays and the actual expenditure made the city administration subsidize Birr 125 million was one of the critical problems because the existing cleansing management charging methodology lacks logic of collective action (Addis Ababa Cleansing Agency, 2016).

Research gaps and objective of the Study

Lack of improved waste management practices will have a global implication on social, economic, and environmental aspects and particularly in developing countries (Loboka, Shihua, et al., 2013, Hoornweg and Bhada-Tata, 2012). Establishing effective municipal solid waste management should be a priority for emerging cities, given their crucial role in protecting public health and the environment. However, in the past, most attempts by cities to improve solid waste management focused on the different technical means of collection and disposal (Altaf and Deshazo 1996; Medina, 2002). More recently, cities have begun paying more attention to enhancing municipal

systems and sustainable solid-waste service delivery, with special emphasis on involving the private sector.

No study was done that related willingness to pay with integrated solid waste management practice. Amiga (2002) has done research on the willingness to pay for improved solid waste management services, but it cannot refer to the current scenario. Tolina (2006) also did his master's thesis on willingness to pay for improved solid waste management service, but this paper was done on Adama households. In addition, most of the research previously done on this particular topic does not cover the specific area which this study covers; moreover, there are no recent studies on Addis Ababa's solid waste willingness to pay after 2015.

Therefore, the general objective of the study is to analyze the Willingness to Pay of Households for improved solid waste management in Addis Ababa city with the following specific objectives: to asses households‘ handling of solid waste, examine Challenges of integrated solid waste management system in Addis Ababa city and its link with the willingness to pay, examine households perception and attitude towards solid waste management, estimate willingness to pay for improved solid waste management and to identify factors that determine WTP for improve solid waste management.

Literature Review

At present waste continues to be disposed of on the land cover, in the intermediate zone of the ground, in the air, and in water. Most scientists, environmentalists, and waste management practitioners coincide that the disposal of waste still poses a major environmental problem. MSW for instance has the potential to contaminate our natural environment (air, water, and land), if its disposal is not correctly managed, thus affecting human health and compromising ecological conditions (W. Bidlingmaier et al., 1987).

We must comprehend the concept of value in order to quantify the worth that people place on products that either do not have a perfect market or none at all. Use value and non-use value are the two categories into which the entire (economic) value that individuals place on an environmental good are subdivided in the economics literature. The benefits people receive from actually using the good, either now or in the future, are referred to as its use value. Direct use

value, indirect use value, and option value are the three categories of use value. Living in a clean environment is a direct use derived from better waste management and prevention of some diseases, because of better waste management is indirect use. The option value is the future (expected) benefit the individual gets from living in a clean city in the future. Non-use value is divided into existence and bequest value. According to Krutilla (1967), existence value is the value people attach to environmental service not because they want to use the resource now or in the future, but because they just want to make sure the resource exists. Bequest value can be use or non-use value that one expects his/her descendants to get from the environmental amenity or service (Kartman, 1997).

Environmental valuation techniques help to estimate the value people attach to environmental amenities or services, i.e., how much better or worse off individuals are or would be as a result of a change in environmental quality. Since there are no existing markets for environmental goods, people‘s valuation for these kinds of goods will have to be derived from ―hidden or implicit markets by looking at the consumption of related private gods (Hedonic Pricing Methods, travel 9* Cost Methods, etc.,) or by constructing artificial markets where people are asked to reveal their preferences (Contingent Valuation Method (CVM)). The valuation method this study will going to use is the CVM. One reason for using CVM is its superiority over other valuation methods, which is its ability to capture, both use and non-use values. Using other valuation methods like Hedonic pricing and travel cost method will underestimate the benefits people get form improved solid waste management since they measure use values only. As Freeman (1993) noted non-use values could be larger in some cases, and, in these cases, using methods, which do not capture non-use values, will underestimate the total value.

A number of empirical studies in the area of solid waste management have used the contingent valuation method and reliable results have been found. In Ethiopia, too, some research undertaken using this method has shown CVM to be an important instrument. Alta and Deshazo (1996) disproved the conventional presumption that households give low priority to solid waste management compared to other urban services and they are unwilling to pay for it. Using the bidding game format, they concluded that 82% of the households were interested in the improved solid waste services and 80% were willing to pay. Out of those households who are interested in the service but are unwilling to pay anything for it, 84% said it is the responsibility of the

government to give that kind of service. Out of the total households who said they are not interested in the service (18% of the total) 62% said that it was the government's responsibility to collect and dispose of solid waste while 29% said that they were satisfied with the existing services. The OLS results showed that WTP for solid waste management in Gujarwala is positively and significantly correlated with disposable income, education, and property indicating that waste management is a normal economic good. The mean willingness to pay was found to be Rs. 9.80 per month, indicating a prospect for cost recovery.

Alemu (2000) used CVM to examine whether rural households in Ethiopia are willing to pay for community forestry or not. The result from this study shows that income, household size, the distance of the homestead to the plantation, the number of trees owned, and the sex of the household head are found to be significant variables explaining willingness to pay for community forestry in rural Ethiopia. Tseghabirhan (1999) made another application of CVM in rural Ethiopia. He used an open-ended format to elicit willingness to pay for irrigation water in the Tigray region from a sample of 82 randomly selected households. The regression results showed that credit at (1%) and education at (5%) are significant while age, experience in operation, and management of irrigated farming and cultivated area are not significant. The research also pointed out that if irrigation water charges are to be implemented–they should be based on socio-economic and technological factors in the area, rather than making it flat.

The reviewed literature indicates that CVM can be used in different areas when market prices are missing and CVM is a better environmental valuation method, for it can capture both use and non-use values. This literature will help this research to identify the potential socioeconomic, demographic, and factors related to the good under consideration that could help to explain the willingness to pay. Kartman (1997) addressed some methodological issues in CVM by applying it in the area of health. He measured willingness to pay for the reduction in Angina Pectores attacks- WTP for a more effective drug. For this, a sample of 402 Swedish Angens Pectoris patients was interviewed by telephone with a bidding game with an open-ended format.

Methods of the Study

In order to get all the necessary information on the area where the research was conducted, both primary and secondary sources of data were used. The main source of data is primarily gathered through a semi-structured questionnaire and face-to-face interviews from the cross-sectional sampled survey for the year 2018. As far as the secondary data is concerned, day-to-day Solid Waste Management activities from the report of the Cleansing Administration Agency (CAA), and the Reuse and Recycling Project Office (RRPO) are in cooperated in the study.

The sample size is determined based on the selected weredas population size and assuming the household's population size is five. The population size (the number of households) of the selected weredas is 46,400. Yamane (1967) helps to set the optimal sample size to be 388. The questionnaire was designed following the recommendations of the National Oceanic and Atmospheric Administration (NOAA) panel guidelines for every contingent valuation study. So, the questionnaire for this study has three main parts by borrowing the Mitchell and Carson techniques (Mitchell & Carson, 1988).

Before the actual data analysis, editing, coding, cleaning, categorization (qualitative data), and reduction were undertaken as preliminary analyses. Descriptive statistics are going to use as the data analysis tool to analyze the quantitative data. This study measures the willingness to pay (WTP) for improved solid waste management service to households in Addis Ababa. There are two broad categories of approaches to measure the willingness to pay: stated preference and revealed preference. This study aims to measure by taking demand-side information of household willingness to pay for improved service with continuous solid waste service.

Given the nature of the data, Contingent Evaluation Method and one econometric model are employed one of which is a Probit model to identify which factors are responsible for being willing or unwilling on the prior stated amount. CVM is an environmental valuation method, which uses an artificial market to measure consumer preferences by directly asking about their willingness to pay or willingness to accept change in the level of environmental goods or services. Like any other environmental and public goods, the willingness to pay the amount and whether households are willing to pay or not for improved solid waste management is expected to be affected by various factors. Some of these factors with their expected signs are defined as follows.

SR (Sex of household). This is a dummy variable taking 1 if the respondent is female; 0 otherwise. This study expects female households to be more willing to pay than men since traditionally it is the role of women to clean the house and dispose of the waste.

MSR (Marital Status of household). Whether the respondent is currently single or not is expected to influence the value the individual gives for the proposed change. MSR is a dummy variable taking 0 if the respondent is married; 1 otherwise, and it is expected to have a positive sign. This is due to the fact that married people are likely to be more responsible to keep the environment clean than single ones because married respondents are likely to have larger family sizes and hence face higher risks than those not married.

HH- (household size): this refers to the number of members of the family. This variable is expected to have a positive effect on willingness to pay. This is due to the fact that the more members or children in the household, the more willing to maintain a clean environment in the future in which children will grow with lesser risk due to a cleaner environment. Although the question regarding the family size was open-ended it is categorized into four parts for the analysis purpose. Accordingly, 0 is given to those who have 1-2 family size,1 is given to those who have a 3-5 family size, 2 is given to those households that have 6-8 family members, and 3 is given to those who have 9 and more family members.

HHSW (Households Head Sector Of work)-this is the house head sector of work which can be Private, government, self-employed, and/or Unemployed. This variable helps us to indicate which category of work sector has more willing to pay for the improved dry waste management service. It is expected here that the unemployed household category has a lesser willingness to pay for the improved service.

ER (Education status)-this variable is taken to capture the level of understanding of the respondent about the desirability of proper management of solid waste. It is hypothesized that the higher the level of education the more the respondent would understand the consequence of mishandling solid waste and the more value the individual would give in order to avoid the risk of being a victim of an unclean environment. ER is categorized into six groups here in this study 0 is for the illiterate group,1 is for those who finish primary education,2 for those who complete high

school education,3 for those who hold a diploma,4 and 5 for those who acquire a degree and those who have an education more than the first degree respectively.

IHH (Monthly Income of the Household) - this variable refers to the monthly money income of the household in terms of Birr. It includes the income of the head and all other members of the household from all sources. There is a general agreement in the environmental economics literature on the positive relationship between income and demand for improvement in environmental quality. Therefore, we expect income to affect willingness to pay and its amount positively and significantly.

HOSI (household's other source of income)-This variable shows the household's other source of income in terms of birr. The variable is expected to have a positive relationship with the willingness to pay. The higher the Income from other sources the more willing the household is to pay for improved solid waste service.

HHE (household monthly Expenditure) is the average expenditure of the household per month for household consumptions. HHE include the household's monthly expenses for food, utilities, clothes, school fee for children, and the like. This variable is expected to have a negative relationship with willingness to pay, the higher the expenses of a given household the lesser the household is willing to pay for the amount required for improved solid waste services.

TS (Time Spent in the Area)-this refers to the number of years the household has been living there. This is expected to influence willingness to pay in the positive direction, since the longer the year the household has been there, the more they would understand the problem of solid waste management of that area, and the more they are expected to pay. Although the question regarding time spent was open-ended on the questionnaire it is categorized into five parts for the analysis purpose. Accordingly, 0 is given to those who live for less than a year in the area,1 is given to those who live between 1-10 years in the area,2 is given to those who live between 1120 years in the area,3 is given to those who live between 21-30 years in the area, and 4 is given to those who live more than 31 tears in the area.

QW (Quantity of Waste Generated)-this variable stands for the quantity of waste the household generates within a week. For this the unit of measurement was used as a garbage bag usually called Madaberia (Sisal) and/or kurtu, which was common almost for all respondents during the survey.

WRD (Waste Related Disease) -this is a dummy taking 1 if any member of the household was attacked by any one of waste-related diseases such as typhoid, dysentery, influenza, trachoma, etc. in the past one year; 0 otherwise. This study hypothesizes that being a 47 victim of any of waste-related diseases would increase the willingness to pay for improvements in solid waste management.

HA (Housing Arrangement)-this variable takes 0 if the households 'house is private,1 if the house is owned by the Kebelle; 2 if the household is rented from the Federal Housing Agency, 3 if the house is rented from private owners. Those living in their own houses are expected to be more willing to pay for the improvement.

SP (Sorting Practice)-sorting practice is the household's culture of sorting the waste before disposing of it. Sorting practice is helpful to identify the household's awareness of solid wastes and integrated solid waste management. If the household has the sorting practice they will sort the waste into decomposed wastes which can be sent to composting sited, plastics and recyclable items which can be sent to recycling plants, and disposed wastes which will be sent to landfill sites. Sorting practice is a dummy variable 1 stand for those who have a sorting practice and 0 otherwise. The Variable is expected to have a positive relationship with willingness to pay since a household that has a sorting practice is expected to have adequate awareness about solid waste service which inter have a positive impact on willingness to pay.

DA (Disposal area)- This is the disposal place that the household uses to dispose of its waste. The disposal area has a crucial impact in solid waste management. Households who do not have dumping spaces are expected to be more willing to pay for improved solid waste services if the improvement is considered door-to-door services. This is a dummy variable 0 stands for no and 1 stands for yes.

DBM (Disposal Basket Material)- this state the disposal basket material made of, accordingly the waste disposal material is given values 0 is for plastic, 1 is for a material made of metal, 2 is for a material made of wood, 3 is for a material made of sisal, and 4 is for other types of materials if there any.

WRC (west reduction Culture): waste reduction culture is an advanced way of managing waste before it is produced. It is the major component of the integrated solid waste management concept. The more the reduction culture from the source the less the waste produced from a given household. Although it is very difficult to determine its correlation with the willingness to pay in our case naturally the household will be less willing to pay if it has the waste reduction culture, since the household produces less. On the opposite direction because waste reduction culture is a result of awareness; and awareness on the other hand positively related to the willingness to pay for improved service it might have a positive correlation with WTP. WRC is a dummy variable in which 0 stands for no and 1 stands for having a reduction culture at the household level.

DM (disposing Mechanism)-Disposing mechanism is the household's way of dumping the produced waste. Disposing mechanism determines the overall solid waste management service, the appropriate disposing mechanism is the efficient service. The mechanisms of the waste disposal 0 stands for those who dump in the nearby dumping area stands for those who dump by digging a hole in their compound, 2 stands for those who dump in open spaces and streets, 3 stands for those who dump in the rivers,4 stands for those who handle it to solid waste collection enterprises, and 5 stands for those who have other dumping mechanism.

SS (service satisfaction)-This is the satisfaction the households have for the current waste service provision. The higher the satisfaction the lesser they are willing to pay for additional services, and the higher they are dissatisfied with the current service the more they are willing to pay for improved solid waste management service. Accordingly, the waste service satisfaction of households is categorized into 0 stands for those who are very much satisfied with the current service,1 stands for those who are satisfied,2 stands for those who are unsatisfied, and 3 stands for those who are disappointed by the current service.

WTP (willingness to pay)-Willingness to pay is the dependent variable. The willingness to pay amount is determined by taking the preliminary survey and taking the average from the survey. Accordingly, Birr 30 for improved service is the amount to determine the willingness to pay of the households here in this study. WTP is a dummy variable, 0 stands for no and 1 stands for yes.

Findings and Discussions

Descriptive Analysis

From the survey, 53.87 percent of the household are male and 46.13 are female and a total of 388. The marital status of the household in the survey constitutes a total of 301 married and 87 singles of which the married households constitute 77.58% and 22.42% are single. Of the married 176 or 58.4% are men and 125 or 41.6 are female. Of those who are single 33 or 37.9% are male and 87 or 62.1 are female. From the survey, we expect more willingness to pay based on marital status since 77.58% are married and those who are married are expected to be responsible and are more willing to pay for the proposed solid waste service.

8.81 percent are illiterate, 19.43% are completed elementary education, 38.65% are high school complete, 15.8% are diploma graduates, 51 or 13.21% are degree graduates, and 8 or 2.07% have an educational rank above degree. From the survey government employees account for 21.65%, households who work in the private sector are 52.06%, those who run their own businesses are 10.3%, and the remaining 14.95% are unemployed.

As seen on the Pearson test, there is a statistically significant relationship between the quantity of waste and marital status. The married household produces more garbage than the single households with a significant P-value of 0.026, which is significant. 75% of unmarried or single household produces less than one bag per week while 66% of married household produce a similar amount. Only 0.023% of single households produce 3 or more garbage bags per week while 11.9% of married households produce three or more garbage bags of waste per week.

Table 1

Quantity of Waste Produced by Martial Status

Description	Marital status		
quantity of waste	married	single	Total
1 and less garbage bag	200	66	266
2 garbage bags	65	19	84
3 and more garbage bag	36	2	38
Total	301	87	388
Pearson chi2(2)	= 7.3073		Pr = 0.026

Source: - Result from Analysis

Sorting practice is expected to enhance with awareness and education, the more awareness the more the sorting practice will be. The relationship between this two in chi2 test is presented herein.

Table 2

Education and Sorting Practice

Description	Sorting Practice		
Education Rank	yes	no	Total
Illiterate	17	17	34
Elementary	21	54	75
high school	52	97	149
Diploma	26	35	61
Degree	19	32	51
above degree	3	5	8
Total	141	245	386
Pearson chi2(6) =		6.1801	Pr 0.403

Source: Result from Analysis

From the result, 50% of illiterate respondents sort the waste before disposing of it and the other 50% do not. From the elementary school level respondents 28% sort while the remaining 72% do not, from the high school level 34.89% sort the waste before they dispose of while the remaining 65.1% do not sort the waste. From the diploma, 57.37% do not sort while the remaining 42.4%

have a sorting culture, from the degree 62.74% do not sort and the rest 37.26% have sorting practice. From the above degree, 62.5% do not sort and the rest 37.5 have a waste sorting culture.

The other significant relationship with a P-value of 0.00 is the relationship between the disposal area and disposing mechanism. From those who do not have disposal areas nearby 27.21% dispose in disposal areas far from their home, 23.66% dispose of by digging a hole in their compound, the other 23.66% dispose of in open spaces and streets, 5.32% dump in the nearby river and the rest 62.73% handle their waste to waste collection micro-enterprises. Of those who have a disposal area nearby 33.65% dispose in the disposing areas nearby,2.36% dispose by digging the hole, 0 on open areas and streets, 9% dump in the river, and the rest 63,03% handle it to waste collection enterprises.

Table 3

Disposal Area and Disposing Mechanism

Description	Disposal Area			
Disposing Mechanism	no	yes	3	Total
Disposing in nearby dump area	46	71	4	121
disposing by digging	4	5	0	9
disposing in open are	4	0	2	6
disposing in nearby river	9	2	0	11
handling it to waste collectors	106	133	0	239
Total	169	211	6	386
Pearson chi2(8)	57.0441			Pr = 0.000

Source: Result from Analysis

Housing arrangement and waste-related disease is other variables that have a strong relationship found by the result. The following Pearson taste shows the relationship between these variables. As shown on the table from those whose house is privately owned 58.17% contacted waste-related disease in the previous one year, from those households who live in kebele houses 55% are contacted with waste related disease in the past one year. Of households who live in government rental houses 69% and of those who live in private rented homes only 43% have cases of waste-related disease.

Table 4

Housing Arrangement and Waste Related Disease

Description	Waste Related		
Housing arrangement	No	yes	Total
Private	87	121	208
Kebele	16	20	36
Government rental	9	20	29
Rented from Private	64	49	113
unspecified	1	1	2
Total	177	211	388
Pearson chi2(4) =	9.2574 Pr =0.05		

Source: Result from Analysis

Econometric Analysis

It is a technique for modeling and analyzing several variables when the focus is on the relationship between a dependent variable and one or more independent variables (or 'predictors'). More specifically, regression analysis helps one understand how the typical value of the dependent variable (or 'criterion variable') changes when any one of the independent variables is varied, while the other independent variables are held fixed.

From the STATA result below those variables that are significant are WRD which is the waste-related disease which is positively related to the willingness to pay t-value of 11.82 which is 99% confidence sorting practice SP with a t-value of 12.4 which is related positively to willingness with 99% confidences and/or 1% significance, the other policy variable that is positively related with the willingness to pay is HOSI or households other sources of income with a t -value of 2.86 or 99% confidence, the other variable that has a significant relationship with Willingness to Pay is households. Income or IHH with a t-value of 3.38 with 99% confidence or 1% significance. Accordingly, the regression result states that the household who contacted a disease recently are 41% more willing to pay for improved solid waste services, households who have other side income are 97% more willing to pay for improved waste services.

Table 5

Regression for The Willingness to Pay

WTP	Coef.	Std. Err.	t	P>t
SR	-0.0021836	0.032046	-0.07	0.946
MSR	0.0092816	0.039977	0.23	0.817
HH	-0.0309743	0.018152	-1.71	0.089
ER	-0.0176699	0.009601	-1.84	0.067
HHSW	-0.0001094	0.000188	-0.58	0.561
IHH	0.0000219	6.48E-06	3.38	0.001
HOSI	9.71E-06	3.36E-06	2.89	0.004
HHE	-0.0000109	6.19E-06	-1.77	0.078
TS	0.0047782	0.015316	0.31	0.755
HA	-0.0086246	0.012606	-0.68	0.494
SP	0.4444098	0.035715	12.4	0
DA	0.018602	0.028251	0.66	0.511
DBM	0.0021143	0.011741	0.18	0.857
WRC	-0.0321646	0.032103	-1	0.317
DM	-0.0166871	0.008636	-1.93	0.054
SS	-0.0103709	0.021583	-0.48	0.631
WSPI	-0.004853	0.015886	-0.31	0.76
WRD	0.4150576	0.034709	12	0
_cons	0.2217252	0.073057	3.03	0.003

Source: Result from the Analysis

As seen on the mfx table waste related has a z value of 11.82 which is significant and from those households who contacted the disease in the last one year 41.68% are willing to pay to improved solid waste from households who sort the waste before they dispose 44.39% more willing to pay birr 30 for improved service. Households who have other side income (HOSI) are 97% more willing to pay than those who do not have other side income. The income of the household (IHH) also has a significant marginal effect with 3.38 t-value or 99% confidence. Tolina (2006) also found a significant relationship between waste-related disease and willingness to pay. The

household contacted with a waste-related disease is more willing to pay for improved solid waste management and the same conclusion is reached herein in this study

Table 6

Marginal Effects after Regress

variable	dy/dx	Std. Err.	z	P>z	X
SR*	.0021836	.03205	-0.07	0.946	0.458667
MSR*	.0092816	.03998	0.23	0.816	0.221333
HH	.0309743	.01815	-1.71	0.088	1.176
ER	.0176699	.0096	-1.84	0.066	2.28267
HHSW	.0001094	.00019	-0.58	0.561	9.712
IHH	.0000219	.00001	3.38	0.001	2915.58
HOSI	9.71e-06	.00000	2.89	0.004	1870.54
HHE	.0000109	.00001	-1.77	0.077	2732.7
TS	.0047782	.01532	0.31	0.755	1.40533
HA	.0086246	.01261	-0.68	0.494	1.144
SP*	.4444098	.03571	12.44	0	0.634667
DA	.018602	.02825	0.66	0.51	0.605333
DBM	.0021143	.01174	0.18	0.857	1.504
WRC*	.0321646	.0321	-1	0.316	0.509333
DM	.0166871	.00864	-1.93	0.053	2.62933
SS	.0103709	.02158	-0.48	0.631	1.136
WSPI	-.004853	.01589	-0.31	0.76	1.32
WRD*	.4150576	.03471	11.96	0	0.549333

Source: Result from Analysis

Probit Regression

The purpose of the model is to estimate the probability that an observation with particular characteristics will fall into a specific one of the categories; moreover, classifying observations based on their predicted probabilities is a type of binary classification model. A probit model is a popular specification for an ordinal or a binary response model. As such it treats the same set of problems as logistic regression using similar techniques. The probit model, which employs a probit

link function, is most often estimated using the standard maximum likelihood procedure, such an estimation being called a probit regression

Table 7

Probit Model

WTP	Coef.	Std. Err.	z	P>z
SR	-0.0737372	0.2650055	-0.28	0.781
MSR	-0.3205013	0.3292522	-0.97	0.33
HH	-0.2947212	0.1653146	-1.78	0.075
ER	-0.171076	0.0795939	-2.15	0.032
HHSW	-0.0005735	0.001343	-0.43	0.669
IHH	0.0002453	0.0000642	3.82	0
HOSI	0.0003222	0.0000781	4.13	0
HHE	-0.0001485	0.0000585	-2.54	0.011
TS	0.0277727	0.1152911	0.24	0.81
HA	-0.0006534	0.1078548	-0.01	0.995
SP	2.241028	0.293623	7.63	0
DA	0.1547513	0.2185511	0.71	0.479
DBM	-0.0172059	0.0963094	-0.18	0.858
WRC	-0.2517623	0.2628529	-0.96	0.338
DM	-0.1810496	0.0751179	-2.41	0.016
SS	-0.2190333	0.1798089	-1.22	0.223
WSPI	0.0860624	0.1376446	0.63	0.532
WRD	2.244852	0.3076408	7.3	0
_cons	-0.8579622	0.6358266	-1.35	0.177

Source: - Result from Analysis

From the result of the STATA, waste-related disease (WRD) has a Z-value of 7.1 which is at 99% confidence and/or 1% significance which can be considered as a policy variable, the other policy variable from this test is the SP (sorting practice) which has a Z-Value of 7.63 with 99% confidence or 1% significance. HHE is also negatively related with the willingness to pay with a probit test of 2.45 with 99% confidence or 1% significance; ER which is education rank is also negatively

related with WTP with a Z- value of 2.15 with 90% confidence. The other variables that are significant to the willingness to pay are HOSI (household other side income and IHH (income of the household which are significant with a t-value of 3.96 and 3.82 respectively both with 99% confidence or 1% significance. Regarding income, the same conclusion was reached by Amiga (2002), explaining both direct income and other side income influence the willingness to pay for improved solid waste management positively. Hagos Mekonnen (2012) also reached with the same conclusion regarding the relationship between Income and willingness to pay for improved solid waste management services. Tolina (2006) also found out the a significant relationship between waste related disease and willingness to pay. Household contacted with a waste related disease is more willing to pay for improved solid waste management and the same conclusion is reached herein in this study.

Conclusion and Recommendation

In Addis Ababa integrated solid waste management is infant stage. The waste reduction culture is also very much stagnant and people lack adequate awareness regarding the benefits of waste reduction at the household level. The reusing culture is also not satisfactory or is not significant enough to make a progress in overall waste management practices. The current position of the city regarding recycling plants and recycling activity is not sufficient to make a sound effect on the overall integrated solid waste management practice of the city. The city is very much depending on the landfill system in which most of the produced solid waste is disposed on the landfill. On the other hand, the landfills at the 'Repi' or 'Queshe' site is saturated and it has creating catastrophic problems like landslide, this problem emanates from the poor practice of an integrated solid waste management system.

The institutional setup for solid waste management in the city is not appropriate to execute the integrated solid waste management tasks; this is due to the recycling and reuse tasks are accomplished by a separate institution other than the cleansing agency, this in turn creates disorganization in the sector and on integrated solid waste management system as a whole. The revenue from waste services including households and businesses is very much insignificant which only covers one-third or 60 million birrs from the total service-giving expenditure of 185 million (2016). This is due to the fact that waste service charge water tap bill which does not relate with

the amount of waste produced. In general, there is no rationale behind the current pay system and the way it is computed.

If the city Administration is improving the solid waste management services households are willing to pay much more amount than they are paying right now, in this case birr 30. As to the study, 65% of the households are willing to pay birr 30 for improved solid waste management service. Willingness to pay for improved solid waste management service is very much dependent on the household's income level in which the more the income the household the more that household is willing to pay for improved solid waste management service. Household other side income is another factor that significantly influences the household‘s willingness to pay for improved solid waste management services. If the household has other side income other that his/her main job, the more likely he is willing to pay for improved solid waste management service.

Household expense is another variable that affects the household‘s willingness to pay for improved solid waste management service. Household expenditure is negatively related with the willingness to pay. The less the expenditure the more the household is willing to pay for improved solid waste management services. Sorting Practice has also a significant effect on the household‘s willingness to pay for improved solid waste management positively. The higher the culture of sorting practice the more likely the household is willing to pay for improved solid waste management services. This is due to the fact that the sorting practice is very much related to the awareness level of the household about solid waste management, the more the household knows how to handle and/or sort solid waste the more the household is willing to pay for improved solid waste management services. This also further disclose that integrated solid waste management practice is highly related with the willingness to pay, since sorting practice is an element of ISWM and has a significant influence on willingness to pay positively. We can conclude that integrated solid waste management practice is related with the willingness to pay positively. The waste-related disease is also a variable that influence the willingness to pay of the households; households who were contacted recently with such disease are more willing to pay for improved solid waste management service.

Integrated solid waste management basis awareness should be taken at starting point for sorting, reduction, re-use, and recycling. Therefore, Addis Ababa city Administration should provide

intensive awareness creation and enhancing campaigns that elevate the knowledge and actions regarding integrated solid waste management. The institutional setup is one of the major obstacles for effective integrated solid waste management practice in the city. The cleansing Agency and recycling and reuse Project office should be administered in the same organization, therefore the activities regarding solid waste management can be handled by tracing the activities end-end. The current estimation based on a 20% rate on the tap water bill is inefficient and has also no rational. Moreover, the Agency was unable to cover its service-giving cost which in turn resulted in insufficient finance and eventually poor solid waste management Therefore a separate pay System based on willingness to pay is crucial for solid waste management services.

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