# SCHOOL OF GRADUATE STUDIES

# DETERMINANTS OF HOSEHOLDS WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT SERVICES IN GULLELE SUB CITY, ADDIS ABABA, ETHIOPIA

## BY

## DESTAW ADUGNA

**JUNE, 2022**

**ADDIS ABABA, ETHIOPIA**

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A THESIS SUBMITTED TO ST.MARY'S UNIVERSITY, SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF ARTS DEGREE IN DEVELOPMENT ECONOMICS

JUNE, 2022

ADDIS ABABA, ETHIOPIA

# DECLARATION

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of Dr. Wondimagegne Chekol (PhD). All sources of material used for the thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full toany other higher learning institutions for the purpose of earning any degree.

DESTAW ADUGNA

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| Name | Signature |

**St. Mary's University, Addis Ababa     JUNE, 2022**

# ENDORSEMENT

This thesis has been submitted to St. Mary's University, School of Graduate studies for examination with my approval as a university advisor.


**Dr. Wondimagegne Chekol (PhD)**                          _____

**Advisor**                                                          **Signature**


**St. Mary's University, Addis Ababa**                          **JUNE, 2022**

# APPROVED BY BOARD OF EXAMINERS

As members of board of examining of the final MA thesis open defense, we certify that we have read and evaluated the thesis prepared by Destaw Adugna under the title **"Determinants of Households Willingness to Pay for Improved Solid Waste Management Services in Gullele Sub City, Addis Ababa, Ethiopia".** We approved that this thesis meets the accepted standards with respect to originality and quality we recommend that to be accepted as fulfilling the thesis requirement for the Degree of Masters of Art in Development Economics

### Signed by the Examining Committee

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# ACKNOWLEDGMENT

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# LIST OF ACRONYMS & ABBREVIATIONS

**CVM**               Contingent Valuation Method

**MSWM**              Municipal Solid Waste Management

**MEF**               Ministry of Environment and Forest

**MWTP**              Maximum Willingness to Pay

**UNEP**              United Nations Environmental Program

**UNDESA**            United Nations Department of Economic and Social Affairs

**WHO**               World Health Organization

**WTA**               Willingness to Accept

**WTP**               Willingness to Pay

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# ABSTRACT

*The generation of solid waste has become an increasing environmental and public health problem everywhere in the world, particularly in developing countries like Ethiopia, Addis Ababa, solid waste management is mainly provided by the municipality and it has been measured and evaluated always based on the role and performance of the service provider (supplier of service) while demand side i.e. Willingness To Pay (WTP) of the residents is ignored. This study aimed at determining the households' willingness to pay for improved solid waste management services in Gullele sub city .Using Contingent Valuation Method, a total of 400 households were interviewed to gather information on their willingness to pay. Logistic regression model was used to determine the influence of different determinants of households' willingness to pay. Socioeconomic information showed that 205(52%) of respondents were female, 313(79.44%) married and 376(93.15%) attained a certain level of education. The majority of respondents 58.5% fall under the age group 27-49 year. As of the willingness to pay for improved solid waste management services, 352 respondents corresponding to 89.3%) answered "yes" and 42(10.7%) respondents said "no". The regression analysis revealed that at 5% significance level, Income, Awareness, Current situation, Age, House ownership and Education have positive and significance influence on the households' willingness to pay for improved solid waste management services. Household's size, variable exhibited a negative relationship and influence on the households' willingness to pay. The study showed that the main reason for not willing to pay for improved solid waste management services is lack of financial capacity, implying that households need to be financial empowered. Further studies are recommended to determine whether the expressed amount of willingness to pay if scaled to the entire urban population can cover the cost associated with solid waste management services .Further, cross subsidization among the rich and poor households should be explored to ensure full coverage of the service.*

***Key words: Willingness to Pay Improved Solid Waste Management Services, Contingent Valuation Method, Gullele Sub City.***

# CHAPTER ONE: INTRODUCTION

## 1.1. Background of the Study

According to the United Nations Environment program (UNEP, 2004), solid waste generation is an increasing global environmental and public health problem. Due to lack of appropriate planning, inadequate governance, resource constraints, and ineffective management of solid waste, especially insufficient collection and improper disposal is a major concern for many rapidly growing cities in developing countries (Chuen- Khee & Othman, 2010).

Waste management issues are coming to the forefront of the global environmental agenda at an increasing frequency, as population and consumption growth result in increasing quantities of waste (Yohanis & Genemo, 2015). The composition of different wastes has varied over time and location, with industrial development and innovation being directly linked to waste materials (Dika et al., 2019). To meet the needs of rapidly growing population, it is obvious that production has to be increased by at least the population growth rate which leads to waste production that is beyond the absorptive capacity of the environment due to the hygienic problems as a result of the negative externalities it generates (Solomon, 2007; Ghani et al., 2014, Dereje, 2021).

Proper solid waste management contributes to all three pillars of sustainable development such as environmental, economic and social by improving economic efficiency especially in resource extraction and use via waste prevent in, reuse, recovery or recycling; by reducing the budget needed for solid waste collection services, by reducing adverse impacts on health and the local as well as general environment; by delivering more attractive and pleasant human settlements and social amenity; and by creating employment opportunities especially for the poor people (Hyman, 2013; Tamiru, 2019; Dereje ,2021).

The municipality alone cannot cover this and contributions are needed from households in the town. This study examined the general features of the existing waste management, households' willingness to pay for improved solid waste management and the extent to which demographic and socioeconomic factors affect the household's willingness to pay for improved solid waste

management services in Gullele sub city by applying contingent valuation method (CVM). Payment is volume based rate (30 birr per m$^3$) (Over View Addis Ababa City Solid Waste Management System, 2010).

**Solid Waste Management Practices in Addis Ababa**

**Collection of solid waste**

The municipality spends large proportion of its budget on collection, transport, and disposal of solid waste. Solid waste collection services divided in to two sub-systems: primary and secondary. Primary collection is done by micro and small enterprises. Payment volume based rat (30 birr per m$^3$). Addis Ababa city generate solid waste of 0.4kg/c/day. Collections of solid waste service charges are collected with water consumption rate. Service charges are fixed according to the amount of water consumed in terms of ability and willingness to pay. Residential houses 20% commercial houses 42.5% of the total water consumed. (Overview of Addis Ababa city Solid Waste Management System, 2010)

**Separation, Reuse and Recycling**

Sorting of waste takes place at various levels in the waste management process. The first level of source separation is at household: plastic materials, glass, bottles, are considered as valuable and usually sorted out for reuse. Several collectors represent the second stage: Street boys, private sectors enterprises, scavengers at municipal landfills, and the korals. Recycle materials include: mental, wood, tyres, electricity products, old shoes and plastic. The municipality role in recycling is absent and mainly focuses on collection, storage, transportation and disposal of solid waste. Most of the collection of recyclable wastes in the city is performed by the informal sector. Recyclable materials are used by local plastic, shoes, and material factories. (Overview of Addis Ababa city Solid Waste Management System, 2010)

**Transport and Disposal**

Municipality transports from garbage containers (secondary collection) to the final dumping site. The highest level in the transportation system is represented by Municipality. The role of private sector on transportation of solid waste is highly limited.(Overview of Addis Ababa city Solid Waste Management System, 2010)

**Disposal of Solid Waste**

There is currently one open dumpsite where all collected waste is disposed off. It has been established 47 years ago. The site is known as "Rappi" or "Koshe" which is south west part of the city. Located 13km away from the city center. The present method of disposal is crude open dumping: hauling the wastes by truck, spreading and leveling by bulldozer and compacting by compactor or bulldozer.

The major problems associated with the disposal site are: the site is getting full, surrounding by housing areas and institutions, nuisance and health hazard for people living nearby, no leacate contaminate or treatment, no rainwater drain-off, no odor or vector control, no fence. (Overview of Addis Ababa city Solid Waste Management System, 2010)

**Best Practices on Solid Waste Management**

Decentralization of SWM services to lower tier of administration, creating employment opportunities for micro and small enterprises (Generates income for the poor),primary collection from each household is done by micro and small enterprises, efficient and equitable service charge collection system established (with water consumption rate), community participation such as (sanitation activities-campaigns, supply of dust bins, willingness to pay association – Addis Ababa clean initiative), developing transfer stations and new sanitary land fill. (Overview of Addis Ababa city Solid Waste Management System, 2010).

## 1.2. Statement of the Problem

The generation of solid waste has become an increasing environmental and public health problem everywhere in the world, particularly in developing countries like Ethiopia, Addis Ababa, solid waste management is mainly provided by the municipality and it has been measured and evaluated always based on the role and performance of the service provider (supplier of service) while demand side i.e. Willingness To Pay (WTP) of the residents is ignored (Dagnew, 2009).

Solid waste management is a universal issue affecting every single person in the world. Individuals and governments make decisions about consumption and waste management that affect the daily health, productivity, and cleanliness of communities. Poorly managed waste is contaminating the world's oceans, clogging drains and causing flooding, transmitting diseases via breeding of vectors, increasing respiratory problems through air borne particles from burning of waste, harming animals that consume waste unknowingly, and affecting economic development such as through diminished tourism (Kaza et al., 2018 ; Dereje 2021).

With limited financial resource generally shared among other basic services such as health and education, municipalities are not able to fully cover the costs of solid waste collection. One of other financing mechanism being explored by a number of counties is the user fee where waste generators pay for collection of their waste. The successful implementation of "user fee" requires the involvement of service beneficiaries even before fee setting stage in order to ensure that their expectations are reflected in the organization of waste management services. Waste collection system cannot sustain itself if the citizens are not interested or not willing to pay. In other words, if the system is designed and imposed without discussing and negotiating with users to consider their needs, it will not perform well (Sheinberg et al.,2010; Nahimana.,2021).

If solid waste collection should be full cost recovery using user charges without subsides and some user does not pay for the service, it will be difficult for the private service provider to ensure hundred percent collection coverage (serving even those who do not pay). Either the service provider will collect waste for those who pay or try to serve all users but at substandard terms (collection frequency not respected).

The purpose of this research is to determine the households' willingness to pay for solid waste collection services in Gullele sub city, Addis Ababa. Knowing the households' willingness to pay and its determinants can help the government to not only set appropriate fee for waste collection  services but also identify socio economic areas that need attention in order to improve solid waste management.

## 1.3. Objective of the Study

### 1.3.1. General Objective of the Study

The general objective of this study is to estimate the determinants of households' willingness to pay for improved solid waste management services using the contingent valuation method in Gullele sub city.

### 1.3.2. Specific Objective

- To assess the current situation of solid waste management in the town
- Identify  determinants that may affect willingness to pay of household's for improved solid waste management service;
- To Estimate mean and to total willingness to pay improved environmental quality (solid waste management services)

## 1.4. Research Question

- What is the current or existing situation of SWM service in Gulele sub city?
- What are the determinants that affect households' WTP for improved SMW service in the town?
- How much are households willing to pay for improved environmental quality (solid waste management services in the city)?

## 1.5. Significance of the Study

Conducting a study on solid waste management has an importance in terms of creating a clean, safe and healthy environment in urban areas and to improve sanitary and public health. The findings of the study will provide a lot of information for the local authority about the characteristics of the residents of the town and their estimated amount of willingness to pay in terms of monetary value for improved solid waste management. Moreover, the local authorities

can provide full SWM service by filling the budget gap through taking the WTP of residents of the town. The study can also be a guiding tool for other researchers who are interested to conduct studies on households WTP for improved SWM in other cities or towns of Ethiopia and other developing countries.

## 1.6. Scope and Limitation of the Study

The study is limited to the analysis of households' willingness to pay for improved solid waste management service of residential solid wastes only. It does not include other types of solid waste such as industrial, commercial and agricultural wastes. The sample for the study covers only household heads for five kebele of the town.  The limitation envisages are first the study was localized in only one sub city in Addis Ababa. Second the sample taken for this study (400)= households ) may not be sufficient due to financial and time limitation even though secondary data has been used as complementary.

## 1.7. Organization of the Study

The remaining part of the study is organized as follows. Chapter 2 deals with a review of related literature. Chapter 3 presents the methodology of the study chapter 4 results and discussion, chapter 5 conclusion and recommendation.

# CHAPTER TWO: REVIEW OF LITERATURES

## 2.1. Theoretical Review

### 2.1.1. Definition of Basic Terms and Concepts

**Waste**: According to Penido et al. (2009) waste is defined as movable material that is perceived erroneously to be of no further use. Once discarded, it may cause no problem, a nuisance, or a hazard. In addition, waste can generally be described as any item or material that is generated and disposed of or intended to be disposed of by a person that has custody of it (Hajkowicz,et al.,2006).

**Solid waste**: Solid waste can broadly be defined as including non-hazardous industrial, commercial and domestic refuse including household organic trash, streets weeping's, hospital and institutional garbage and construction garbage; generally, slug and human wastes are regarded as a liquid waste, a problem that is outside the scope this study. According to the Federal Democratic Republic of Ethiopia(FDRE,2007),proclamation No.513/2007solid waste management proclamation "solid waste" means anything that is neither liquid nor gas and is discarded as un wanted. This could be refuses from residential, commercial or any institutes as yard sweeping, food remains, as hand chat leftover, saw dust, piece of papers, glasses, metals, batteries, plastic, grass and vegetables, bone of animals, dead animals and other materials that cause poor environmental situation.

**Valuation**: it is the process of putting monetary values on goods and services, many of which have no easily observed market prices.

**Willingness to pay (WTP):** is the maximum sum of money the individual would be willing to pay for rather than do without an increase in some good such as an environmental amenity. This sum is the amount of money that would make the individual in different between paying for and having the improvement and for going the improvement while keeping the money to spend on other things (Freeman et al., 2014)

**Willingness to accept (WTA):** is the minimum sum of money the individual would require to forgo voluntarily an improvement that otherwise would be experienced; it is the amount thatwouldmakeapersonindifferentbetweenhavingtheimprovementandforgoing the improvement while getting extra money (Freemanetal.,2014)

### 2.1.2. Solid Waste Management in Ethiopia

The issue of waste management in Ethiopia is stated as one of the environmental rights in the country's 1995 constitution and in the solid waste management proclamation No.513/2007. Article 44 No.1 of the constitution states that all persons have the right to live in a clean and healthy environment. Moreover, article 92 No.1 states that *"Government shall endeavor to ensure that all Ethiopians live in a clean and healthy environment"* (FDRE, 1995, P.33). The solid waste management proclamation No.513 aims to protect the negative impacts of poor SWM and enhance benefits from SWM action plans by protecting active community participation. It also aims for the preparation of SWM action plans by urban local governments to enable community participation SWM. The proclamation states that urban administration should create favorable conditions to promote investment in the provision of SWM services (FDRE, 2007). The country has also ratified multilateral environmental agreements such as the 1989 Basel convention on the control of Trans boundary Movements of Hazardous Waste and their disposal, the 1998 Rotterdam convention on the prior informed consent procedure for certain Hazardous Chemicals and Pesticides in International Trade and the 2001 Stockholm convention on persistent organic pollutants waste international conventions. The common objective of the three international conventions is protecting human health and the environment from hazardous chemicals and waste (UNDESA, 2011).

The Basel convention aims to protect human health and the environment via obligating its parties to properly manage their hazardous as well as other wastes in an environmentally sound manner and reducing the movement of solid waste between countries. This international convention specifically also aims to prevent developed countries from transferring hazardous waste to less developed countries. The Rotterdam convention aims to protect human health and environment by protecting shared responsibility and cooperative efforts among parties in the international trade of certain hazardous chemicals. The aim of the Stockholm convention is protecting human

health as well as the environment from highly dangerous, long-lasting chemicals by restricting and ultimately eliminating their production, use, trade, release. and storage (UNDESA,2011).

SWM in Ethiopia is a sector that requires significant attention. The country has been working to provide adequate solid waste collection and disposal for its citizens. However, the local government in urban centers of the country face challenges and unable to manage the generated solid waste due the rapidly growing of urban population, and the absence of a coordinated national SWM policy and city-level action plan for integrated waste management policies (UNEP, 2016). Urban solid waste in Ethiopia is managed mainly by open burning and dumping. There is at least one unmanaged landfill in the major cities and towns of the country. Up to 43 percent of the waste generated is collected and disposed of in unmanaged landfills in urban areas of the country. The remaining waste is left in the streets and dumped in open spaces. The waste sector contributes 3 percent of the total greenhouse gas emissions in Ethiopia (MEF, 2015). The landfills are becoming the major source of greenhouse gas emission because they are not well developed and properly managed. Moreover, many rivers are polluted due to the generation of urban and industrial waste (UNEP, 2016).

### 2.1.3. Economic Valuation of Environmental Goods and Services

**The contingent valuation Method (CVM)**

The CVM requires that individuals express their preferences for some environmental resources or change in resource status, by answering question about hypothetical choices. The respondents to a CVM questionnaire will be asked a variety of questions about how much they would be willing to pay (WTP) to ensure a welfare gain from a change in the provision of a non-market environmental commodity; or how much they would be willing to accept (WTA) in compensation to endure a welfare loss from a reduced level of provision. A basic question for the implementation of the CVM is therefore whether WTP or WTA is the most appropriate indicator of value in a given situation.

Some believe that willingness to pay (WTP) measures would seem to be the appropriate measure for gainers from some resource allocation decision, and willingness to accept (WTA) the proper measure for losers from that same reallocation. But others have pointed out that it is often not

easy conclusively to identify gainers and losers since this judgment is itself influenced by the value's own perspective.

The choice between WTP and WTA in CVM is a little bit difficult, and though it takes us beyond the scope of this course, there are certain situations where one should be preferred over the other. Some economists believed that the two would give reasonably close estimates. For example, Willing (1976) claims that WTP and WTA measures should, in the absence of strong income effects, produce estimates of monetary value that are fairly close (within 5 %). However, since 1976 strong evidence has been accumulated which shows that, for given environmental goods, WTA is significantly greater than WTP (over 40 % divergences). In addition, WTA valuations seem to have greater variance than WTP ones, and are less accurate predictors of actual buying and selling decisions. Because of the divergence between WTP and WTA valuations, many Practitioners have taken the pragmatic decision to regard stated WTP valuations as reliable measures of true WTP and therefore to use CVM only cases in which WTP is the appropriate measure of benefit. But this raises the question as to what is the exact set of cases in which WTP is appropriate. Harris and Brown (1992) argue that WTP is in fact the appropriate measure of welfare change for a majority of situations.

**Phases in  CVM**.

*Stage 1: preparation*

There are four basic tasks in this preparation stage.

Set up a hypothetical market: individuals may be asked two basic variants

 (a) How much are you willing to pay for a welfare gain?

(b) How much are you willing to accept in compensation for a welfare loss?

ii) Define the elicitation (extracting their true WTP/WTA) method: The major alternatives are:

(a) Open ended: e.g. 'how much are you willing to pay?'

(b) Take- it-or-leave-it (dichotomous choice): e.g. are you willing to pay $X?

(c) Iterative bid: This one is a recent variant upon the dichotomous approach and is it supplements the initial question with an iterative second round (double-bound) question.

For example, if the respondent answers yes to the $X bid, then he is asked if he is willing to pay? (Or $0.5 if he answered no to the initial question).

iii. Provide information regarding:

(a) The quantity/ quality change in the provision of the good.

(b) Who will pay for the good?

(c) Who will use the good?

iv. Define the payment vehicle, for example

(a) Higher taxes

(b) Entrance fees

(c) Donation to a charitable trust

*Stage 2: Survey*

Dear reader, this stage is all about obtaining responses to the questionnaire through different types of interviews. Interview can be either on-site (face to face; users only), house to house (face to face; users and non-users) or by mail or telephone (remote; users and non-users).

*Stage 3: Calculation*

In this stage you calculate the mean WTP (WTA) from responses. In a dichotomous choice format experiment the mean is obtained by calculating the expected value of the dependent variable (WTP or WTA).

*Stage 4: Estimation*

Using econometrics, here you will find factors that affect how much people rants using econometrics, here you will find factors that affect how much people will be WTP or WTA. These could be factors like income, the number of visits, social factors such as education and other explanatory variables.

*Stage 5: Aggregation*

This is required in order to move up from mean WTP to total value. This entails decisions about, for example, moving between household and individual data, and distinguishing the relevant population.

*Stage 6: Appraisal*

This is a stage where you will assess the overall CVM as to whether it was successful or not.

**Strength and Weakness of CV Methods**

Contingent valuation has been most commonly used stated preference methods for non-market valuation and provides sufficient flexibility to enable the estimation of total economic values associated with environmental impacts (Jin et al., 2006;Dereje 2021). CV methods is also preferable to estimate values when an item cannot be easily defined in terms of attributes or characteristics

(Johnston et al.,2017). However the methods is criticized for different types of potential biases it may face during CV survey ( Tietenberg and Lewis ,2012; Dereje ,2021). The first one is strategic bias that arises when respondents provide biased answer in order to influence a particular outcome .Moreover; respondents may not be willing to respond to survey questions or to state their actual WTP for proposed project due to strategic reasons such as if there is a free-rider situation.

## 2.2. Empirical Literature

The reviewed literature indicates that CVM can be used in different areas when market prices are missing and CVM a better environmental valuation method, for it can capture both use and non-use values. In this section we review the most relevant empirical literature that can helps us to identify the potential socioeconomic, demographic and environmental factors that can explain willingness to pay for the good under consideration.Various works employed contingent Valuation method to elicit the willingness to pay for waste management service while binary and multiple regression models such as Logit used to determine how different social economic factors determines the households' willingness to pay.

Generally, all the studies show that the respondents are willing to pay a certain amount for improved services with few being reluctant to pay at different levels. A study conducted in Kampala in 2012 revealed that only 48% of the respondents are willing to pay for improved waste management. The low percentage was attributed to the fact that in 2012, waste management was a new practice and the majority of respondents considered it as the responsibility of the Government (Ojok et al., 2012), thus not willing to pay for that service.

The study by Awunyo-Vitor et al. (2013) had a "Yes response" rate of 57% in Kumasi, Ghana. On the other hand, the studies by Kassahun &Birara (2020);Nahimana (2021) in Ethiopia found that 91% and 86.3% of the households respectively are willing to contribute financially to the improvement of solid waste management conditions. Similar high percentage (95%) of willingness to pay was identified in Madurai, India where the respondents understand that improper solid waste management constitutes health issues especially for children and elderly people (Muniyandi, 2019, Nahimana 2021).

The main reasons for non-willingness to pay include the perception that it is the Government responsibility to provide waste collection services (Murad et al, 2007, Ojok et al., 2012 and Afroz and Muhamad, 2011) especially where these services used to be subsidized. There were also concerns over the quality and reliability of the service (Ezebilo, 2013; Kassahun & Birara, 2020), lack of waste management services and others found it "not necessary to pay for waste while there are other equally important issues" (Awunyo-Vitor et al., 2013).

Regarding the determinants of willingness to pay, studies have contrasting findings around the influences of age, income, education, gender, employment status, satisfaction of the service and household size on the willingness to pay.

Concerning age factor, Veronica et al., 2019 argued that age of household's head positively influences the willingness to pay. This is in line with the findings of Hamdiyah et al., (2015) and Mukarati et al., 2017), Afroz and Muhamad (2011), Nkansah and Kwabena (2015) and Mukarati et al., 2017. The reason put forward being that older people are very conscious about health and environmental issues and take mature decisions than younger ones.

The above finding however contradicts with the work of Niringiye and Omotor(2010), Dagnew et al .,(2013) , Raheel(2013) and ayenew et al., Nahimana (2021) (that showed a negative and significant effect of age on willingness to pay for solid waste management services .This is probably a result that order respondents were accustomed to free disposal of waste or government subsidized services unlike the younger people exposed to cost sharing (Niringiye and Omotor ,2010,cointreu-Levine and Coad,2000). Another reason of a negative and significant influence of age on willingness to pay put forward by Ayenew et al., (2019); Nahimana (2021) is that younger people may know and appreciate of solid waste management more than old people.

Increase in household's income is believed to positively influence the willingness to pay for solid waste management. This was confirmed by Murad et al., (2007), Afroz and Muhamad (2011), Ezebilo (2013), Akhtar et al., (2017), Kansah et al., 2015, Dagnew at al., (2012), Kassahun & Birara (2020) and Ayenew et al., (2019) ; Nahimana (2021) who found that an increase in household's income led to higher willingness to pay for waste management service. This suggests that waste management is considered as normal good as its demand increases with income (Dagnew et al., 2012). As the income increases, the household needs and values more waste management services and hence the willingness to pay for those services increases. In addition, as discussed by Kassahun & Birara (2020), Nahimana (2021)  the rise in income increases the purchasing power of the household hence making it easy to afford an additional cost. Veronica et al., (2019) however had a contradicting of a negative and significant effect of increase in income on the willingness to pay.

The study by Amfo-Out et al., 2012 and Veronica et al., 2019 Nahimana (2021), concluded that the level of education of the household head does not have any significant influence on the willingness to pay for improved solid waste management. In contrast, Hamdiyah et al., (2017); Afroz & Muhamad (2011), Ezebilo (2013); Ndau & Tilley (2018); Awunyo-Vitor et al., (2013) and Kassahun & Birara (2020) Nahimana (2021), discussed that education has a positive and significant impact on household's willingness to pay. This explains that as people get more educated they intend to understand the importance of clean environment hence more willing to pay for removal and treatment of waste.

Galgalo et al., (2019); Ayenew et al., (2019) and Kassahun & Birara (2020), Nahimana (2021) found that the household size negatively influences the willingness to pay suggesting that more children in the house will perform solid waste management activities. Kassahun & Birara (2020) also discuss that the increase in the number of household's members leads to increase in food and nonfood expenditure. Consequently, more income is needed to fulfil the minimum requirements of the household's members (Kassahun & Birara, 2020), Nahimana (2021). In this case, the willingness to pay for waste collection service will be low.

The finding of the study by Niringiye and Omotor (2010) showed that marital status has no significant effect on household's willingness to pay for waste collection services. This contradicts with Ojok et al., (2012) finding that being married has a positive and significant influence on household's willingness to pay for waste management services. This is based on the ground that married people are more mindful of the clean environment than single ones. Raheel (2013) had similar observation that married people are more likely willing to pay than unmarried people.

Other studies considered ownership of the house, satisfaction of provided services and waste quantity as other factors determining the households' willingness to pay for waste collection services. The study by Dagnew et al., (2012), Nahimana (2021) und that house ownership has a positive influence on willingness to pay for improved solid waste management. Owners of the houses are likely to pay for the removal of waste to keep their property compound clean while those who rent consider the stay as temporal and the willing to engage in additional costs is low.

Ndau and Tilley (2018) found that respondents who are satisfied with current waste management system expressed high willingness to pay that those who are unsatisfied. Amfo-Out et al., (2012) showed that satisfaction about the provided services has no significant influence on the households' willingness to pay for waste management services.

The quantity of waste may also influence the willingness of the household to pay for waste collection services. This was found by Ayenew et al., (2019) while studying about household's willingness to pay for improved solid waste management in Shashemene town of Ethiopia. Concerning the quantity of waste, Niringiye and Omotor (2010) points out that the higher the quantity of waste generated the more the household faces challenges of disposing that waste thus showing a greater willingness to pay for its removal.

Rajashekar et al., (2019) ,Nahimana (2021), assessed waste management services in Kigali and one of the findings is that only 50-60% of middle income households and 20% of low income households pay for waste collection service. The non-payment is reported to be due to tariffs, which are high for low and middle-income households.

The willingness to pay is assessed in order to know or inform of the potential price that could be given to a non-market good or service. The challenge is then to set price low enough to be affordable by users yet high enough to sustain the provision of the service (Karen and James, 2004). One of the approaches to estimate how customers' preferences would be at different prices is to ask them how much they are willing to pay for the service.

Knowing the households' willingness to pay may help the municipalities in planning for improved waste collection services. Some surveys showed that citizens are prepared to pay even more for improved service. In Bharatpur, households are willing to pay additional 10%-28% on top of what they pay for waste collection service provided at the given date and time in each week (Rajesh et al., 2019) Nahimana (2021). Another study conducted in Ghana revealed that "more than 51% of city households, regardless of the type of collection system, were generally willing to pay a higher fee for better collection services" (Oduro-Appiah at al., 2013).

## 2.3 Conceptual Framework

The conceptual framework for the study reflects the Households' willingness to pay for improved SWM in Gullele Sub City and factors which determine WTP for improved SWM service.

Figure 2.1: Conceptual framework

Independent Variable                                    Dependent Variable



- ❖ Education level
- ❖ Income
- ❖ House ownership
- ❖ Environmental awareness
- ❖ Household size
- ❖ Current situation of SWM
- ❖ Gender
- ❖ Age
- ❖ Marital status

Willingness to pay for improved solid waste management Services
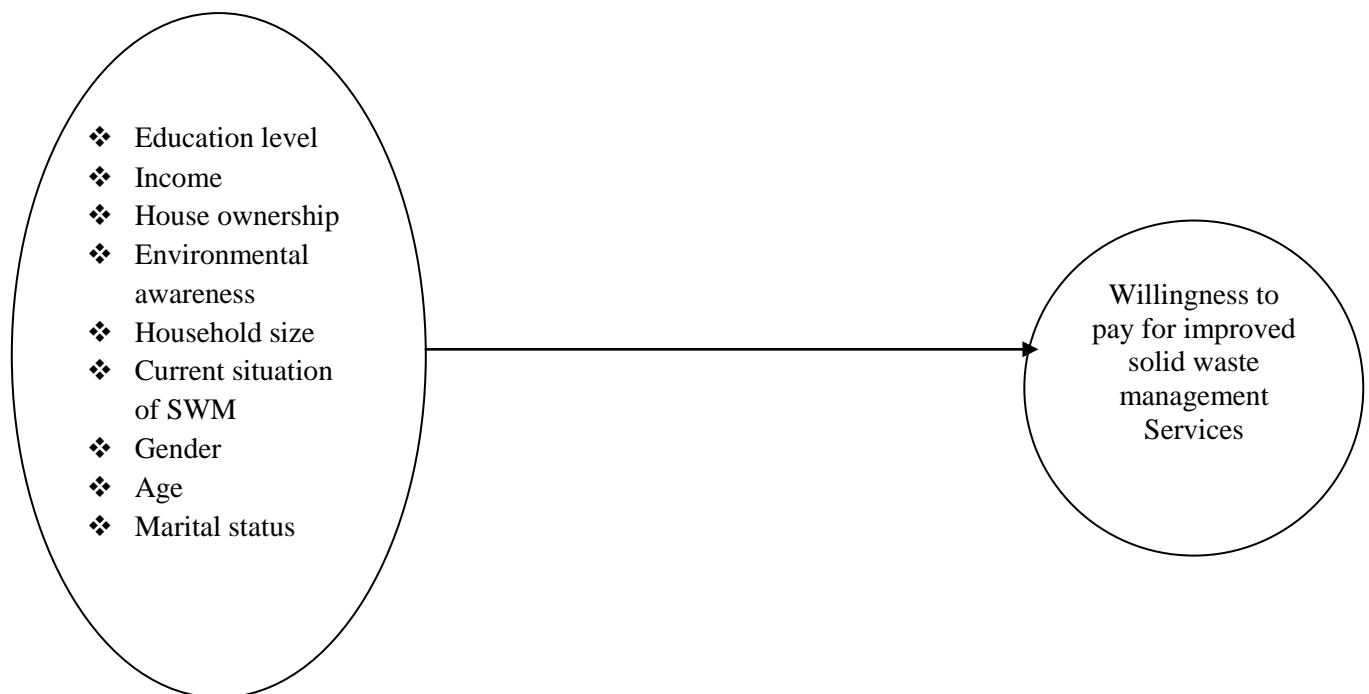
Source: **Own design and review literature**

# CHAPTER THREE: RESEARCH METHODOLOGY

## 3.1. Research design and Approach

Research design is the blue print for fulfilling research objectives and answering research questions (John Adams, et al,2007). The research design would that adopted in this study was both descriptive and explanatory research. The descriptive would be concerned with determining the frequency with which an event occurs or relationship between variables and explanatory concerned with determining the cause and effect relationship. In this study both qualitative and quantitative methods would be used simultaneously. Quantitative data would be used for any data collection technique (such as a questionnaire) or data analysis producer (such as graphs or statistics) that generate or use numerical data. In contrast, the qualitative data would be used for any data collection techniques (such as an interview) or data analysis producer (such as categorizing data) that generate or non-numerical data.

Moreover, the study would be utilized cross-sectional in the sense that all relevant data collected at a single point in time .The reason for preferring cross-sectional study is due to the vast nature of the study and limitation of time, and obtaining information from cross-section of population at a single point in time is a reasonable strategy for pursuing many researchers ( Janet ,2006)Besides, a case study would be used and aimed at understanding factors affecting willingness to pay improved for solid waste management services in Gullele sub city, Addis Ababa.

## 3.2.  Sample Size and Sample Technique

### 3.2.1. Sample Size

Based on 2007 national censuses conducted by Central Statistical Agency of Ethiopia (CSA), by 2021 the city population projected to 368,634. Sample size determination would be undertaken using a statistically proven approach developed by Tara Yamane. In order to take a sample that can be the best representative of the whole population sample size was calculated based on the

simplified formula for proportions by Yamane (1967). At 95% confidence level and precision of 0.5, the formula is given as follows:

$$n = \frac{N}{(1+N(e)2}$$

Where:

n- Signifies the sample size

N- Signifies the population under study area

e- Signifies the margin error (it could be 0.1, 0.05 or 0.01)

$$n = \frac{368,634}{(1+368,634)2} = 400$$

From the above formula 400 respondents would be determined from the population of 368,634 drawn from the five Kebele (Woreda). By using Random sampling technique 5 Kebele select out of 10 Kebele (Woreda) of Gullele sub city, Addis Ababa.

### 3.2.2. Sampling Technique

The total 400 Sample households were distributed among the kebele based on the population share each kebele from the total population.

Table 3.1: Sample Selection from Total Households of Gullele Sub City

| No. | Kebele | 2007 | | | 2021 | | | Selected Sample Size =(400×kP/TP) |
|---|---|---|---|---|---|---|---|---|
| | | Both Sex | Male | Female | Both Sex | Male | Female | |
| 1 | Kebele 19/20/21 | 29,235 | 14,045 | 15,190 | **40,271** | 19,173 | 21,098 | 99 |
| 2 | Kebele01/02 | 20,932 | 10,361 | 10,571 | **28,827** | 14,144 | 14,683 | 71 |
| 3 | Kebele 03/04/05 | 28,124 | 13,247 | 14,877 | **38,748** | 18,084 | 20,664 | 96 |
| 4 | Kebele 06 | 13,264 | 6,106 | 7,158 | **18,277** | 8,335 | 9,942 | 45 |
| 5 | Kebele 10/18 | 26,123 | 14,131 | 11,992 | **35,946** | 19,290 | 16,656 | 89 |
| | **Total** | **117,678** | **57,890** | **59,788** | **162,069** | **79,026** | **83,043** | 100 |

Source: Ethiopian Central Statistical Agency and own calculation

The survey for study would be conducted from March to May, 2022; using a direct face to face interview method .This method is selected from survey techniques due to its capacity to generate the highest quality WTP data (Alberini and Cooper, 2000, Dereje, 2021).

This study would also conduct a pilot survey from 20 randomly selected households living 5 kebele based on the population. The pilot survey was conducted in order to determine five initial bids or Starting point prices using open-ended question, to determine the payment vehicle for the CV scenario, and to revise the final question before the main survey is conducted. Based on the results of the survey, the five initial bids or starting point prices using open-ended question, to determine the payment vehicle for the CV scenario, and to revise the final questionnaire before the main survey is conducted. Based on the results of the survey, the five initial bids are ETB10, ETB50, ETB 100 and ETB150. Out of the 20 respondents, 75 percent (15) of the total respondents were willing to pay for improved USWM.

Finally, the actual or main survey would be conducted by dividing the randomly selected respondents from each kebele in to five groups based on the starting point price. All respondents from each kebele have equal chance to get the five initial bids. A total of 80 questionnaires for every five initial bids distributed for the five kebele.

**Table 3.2: Questionnaire Distribution Based on Initial Bid**

| No. | Kebele | Sample size | Distributions of questionnaire based on Initial Bid | | | | |
|---|---|---|---|---|---|---|---|
| | | | 10 | 30 | 80 | 100 | 150 |
| 1 | Kebele 19/20/21 | 99 | 20 | 20 | 20 | 20 | 19 |
| 2 | Kebele 01/02 | 71 | 14 | 15 | 14 | 14 | 14 |
| 3 | Kebele 03/04/05 | 96 | 20 | 19 | 19 | 19 | 19 |
| 4 | Kebele 06 | 45 | 9 | 9 | 9 | 9 | 9 |
| 5 | Kebele 10/18 | 89 | 17 | 17 | 18 | 18 | 19 |
| | Total | 400 | 80 | 80 | 80 | 80 | 80 |

## 3.3. Data Type and Sources

Both primary and secondary data would be used in this research. The primary data would be collected from 400 respondents of the household from five Kebele in Gullele sub city, Addis Ababa. And also secondary data is also as important as the primary data would be used from secondary sources. The secondary sources of data would be used different books, research papers (both published and non-published), internet sources, and articles from different magazines.

## 3.4. Method of Data Collection

Both primary and secondary data would be collected to make a complete research document. In the primary data collection, in-depth interview, and naturalistic observations would be used to collect a first-hand data on the nature of municipal waste management in Gullele sub city. Secondary data would be gathered from reading reviews of various literatures written on municipal waste management and its predicaments, browsing internet sources and newspapers and going through published and unpublished reports.

## 3.5. Data Analysis Technique

The study would be used both descriptive methods of data analysis by using SPSS and econometrics methods of data analysis by using STATA. In this section the researcher would be employed both of qualitative and quantitative methods of analysis. The qualitative method of analysis would be applied for the data that were collected via interview and focus group discussion. Quantitative way of analysis would also apply for the data which will be collected from households through structured questionnaire. The binary logit model was chosen and used because the dependent variable has two categories (willingness to pay, or not). It is the most common type of logistic regression and it often simply referred as logistic regression (Agresti and Finlay, 2009).

### 3.5.1. Econometric model Specification

In this, the households were asked at first whether he/she is willing to pay or not for improved service. This was analyzed with binary logit model**.**

**The binary logit model:** In this study, the household willingness to pay question was a dichotomous choice, i.e. 'yes'/ 'no' thus a binary logit model( Greene 2003) can be applied in the analysis of factors associated with respondent willingness to pay for improved residential waste management.

The probability P that the respondent will give a 'yes' response, i.e. willing to pay is given as follows:

$$p[yes] = \frac{1}{1+e^{-\beta x}} \qquad (1)$$

Where $\beta$= is a vector of parameters to be estimated and

   X = is a vector off the respondent attributes.

The probability that the respondent will give a 'no' response, i.e. not willing to pay is given as flows:

$$p(0) = 1 - p(yes) \qquad (2)$$

$$p(no) = \frac{1}{1+e^{\beta x}} \qquad (3)$$

Manipulation of (2) and (3), gives

$$1 - p(yes) = \frac{1}{1 + e^{\beta x}}$$

$$\frac{p(yes)}{1-p(yes)} = e^{\beta x} \qquad (4)$$

Where $e^{\beta x}$ = is the ratio of the probability of a 'yes' to the probability of a 'no' response.

The logarithm of the odds ratio is given as follows:

$$In\left[\frac{p(yes)}{1-p(yes)}\right] = \beta x$$

$$WTP_{wm=}\beta_0 + \beta x_1 + \cdots + \beta_n x_n + \varepsilon \qquad (5)$$

$WTP_{wm=}$ willingness to pay for improves waste management

$\beta_1$ = is the coefficient associated with the price x 1, and

$\beta_n$ = a vector of regression coefficients associated with other attributes of the respondent $x_n$

$\varepsilon$ = is the error term which is logistically distributed.

To find out the probability of households' WTP for improved waste collection service, the parameters from the logit model cannot be used to interpret effects of each of the explanatory variable as the model is nonlinear. In this case, marginal effects are calculated to find the relative magnitude of effects of each of the explanatory variables. The effects of the *j*th explanatory variable can be summarized as below:

$$\frac{1}{n} = \Sigma_{i=1}^{n} \partial p\left(\frac{yi-1}{\partial xi}\right) = \beta_j \frac{1}{n} \Sigma_{i=1}^{1} f(x_i'\beta), j = 2, \ldots\ldots., k. \qquad (6)$$

i.e., the mean marginal effects over the sample of n individuals the maximum likelihood method was used to estimate the parameters of the multiple logistic response function. The log-likelihood function is a follows:

$$Log\ L(\beta) = \sum_{i=1}^{n} yp\ (x_i'\beta) - \sum_{i=1}^{n} log\ [1 + e\ (x_i'\beta) \qquad (7)$$

However, the logit model provides information only about respondents' decision to pay or to not pay for the improved SWM service, but not on the maximum amount of money they are willing to pay (Padi, A.; Addor, J.A.; Nunfam, V.F. (2015).

$$\text{MeanWTP} = \frac{1}{n}\sum_{i=1}^{n} y_i \qquad (8)$$

Where n = is the sample size and each y is a reported WTP amount

### 3.5.2. Variables for the Model

The dependent variable would be used for the econometric model in this study is households willingness to pay (WTP) for improved solid waste management service and households maximum willingness to pay (MWTP) for improved solid waste management, respectively. The selection of explanatory variables for the binary Logit models would be based on theoretical considerations and previous studies, i.e., significant variables would be used in other studies on household's willingness to pay for improved solid waste management. The description of variables would be used in this study is presented in Table 3.3 below.

**Table 3.3: Description of Explanatory Variables**

| Variables | Description | Unit of measurement |
|---|---|---|
| Income | Monthly household expenditure | Ethiopian Birr (ETB) |
| Environmental awareness | Awareness of the respondent about the impacts of poorly managed solid waste on the environment | 1 = yes<br>0= No |
| Willingness to pay | Dummy variable | 1= Yes<br>0 = No |
| Current situation of SWM | Households perception on current solid waste management | 1 = Good<br>0 = bad |
| Age | Age of the household head | Years |
| Education | The level of education attained by the household head | 0=Illiterate<br>1=primary up to preparatory<br>2= Diploma<br>3=Degree<br>4=postgraduate |
| Household size | Number of adults and children feeding from the same source | Number of individuals |
| House ownership | The ownership of the house the household live in | 1=owned<br>0= Rented |
| Marital status | The marital status of the household head such as married, unmarried | 1 = married<br>0= unmarried |
| Collection of frequency | Categorical which takes 0 if no 1,if once a week,2 if twice a week | 0= no<br>1=once<br>2=twice |
| Health effect of improper waste | Weather improper solid waste generated Affect households making members unable To engage in productive works due to sickness | 1= yes<br>0= no |

**Income:** This variable refers to the total monthly income (total expenditure used as proxy) of households in Ethiopian Birr (EB). Many studies found that income is positively and significantly related to households WTP for improved SWM (Endalew & Tassie, 2018;

selamawit; 2018; Alhassan; 2017; Dereje; 2020).In this study income is one of the major determinants of households WTP for improved SWM in Gullele sub city.

**Awareness:** Awareness of households about the impacts of poorly managed solid waste on environment has a significant effect on the respondent' WTP for improved SWM service. Theoretical, .households with higher awareness about the impacts unsound solid waste disposal on the environment tend to provide positive and higher WTP values .As in other studies in the literature ,households' awareness about the impact of poorly managed solid waste is expected to affect positively their WTP for improved SAWM services (Tamru 2019 ;Dagnew et al .,2013. Dereje; 2020).

**Current situation of SWM:** This variable refers to the perception that the household head has on how the solid waste is managed in the area .It is Assumed that households who perceive solid waste management as well as are less willing to pay for the improved services . Thus, this study assumes that there is a negative relationship between the current situation of solid waste management and WTP for households who perceive solid waste management. (Dagnew et al., 2013)

**Age:** This variable refers to the age of the household head in number of years; Studies conducted on households WTP for improved SWM found that age of households affects the willingness to pay significantly. Hence, this study expects the age of household head to affect positively the household's WTP for improved SWM as other studies in the literature (Alhassan et al., 2017; Selamawit. 2019; Dereje, 2020)

**House ownership:** This variable refers to whether the household live in owned or rented house. Respondents that own a house are expected to care more foe their homes that those who live in rented house .Hence, the household will be more willing to pay for better SWM as compared to a household that lives in a rented house (Banga et al .,2011; Dagnew et al.,2013). This study expects the positive relationship between house ownership and WTP variables .Thus, those people who owned their own house will be more willing to pay for improved SWM than people who live in rented house.

**Education:**   This variable refers to the level of education the household head attained on formal education .Educated people better understand the impacts of improper solid waste management on the environment and are more willing to pay for improved solid waste management service. Thus, the level of education of a household head is expected to affect positively households WTP for improved SWM as in other similar studies in the literature (Alhassan et al., 2017; Banga et al., 2011; Dereje 2020).

**Household Size:**   This variable refers to the total number adults and children currently living in the house and feeding from the sane source. When the number of individuals in a household increases, the amount of solid waste generated will rise and thus the household head will be more willing to pay for improved SWM services (Tesfa ,2019;Bhattarai,2015 ;Dereje ,2020).Therefore ,household size is expected positively to affect households WTP in this study.

**Marital Status: -** This variable refers marital status of the households head categorized under married and married and other than married such as unmarried. Married households generate more amount of solid waste and thus, are more willing to pay for improved SWM as compared to those household heads who are unmarried, (Dagnew et al., 2013; Alhassen et al.,2017.

This variable refers to the marital status of the household head categorized under married and other than married such as unmarried, divorced and widowed. Married households generate more amount of solid waste and thus, are more willing to pay for improved SWM as compared to those household heads who are unmarried, divorced or widowed (Dagnew et al., 2013; Alhassan et al., 201; Tamru, 2019). Therefore, this study expects the positive relationship between marital status and WTP of households

Health effect :- This variables refers to whether improper solid waste generated affect households daily life via making members unable to engage in productive works due to sickness or not . It is expected that households whose members are unable to engage in productive works due to sickness caused by improper solid waste generated are more willing to pay for improved solid waste management services. Thus, this study expects a positive relationship between health effect and WTP

# CHAPTER FOUR: RESULTS AND DISCUSSION

## 4.1. Descriptive Analysis

The 400 questionnaires used in the survey were distributed to the randomly selected respondents based on the four initial bids. Out of the total 400 distributed questionnaires, 394 questionnaires were successfully completed. Six questionnaires were not successfully completed and excluded from the analysis part making the response rate 98.5%.

### 4.1.1. Demographic and Socioeconomic Characteristics of Respondents

The survey results showed that 189(48%) and 205(52%) of the total respondents were male and female, respectively. The marital status of respondents revealed that 313 (79.44%) of the respondents are married. The other remaining 81 (20.56%), are unmarried respectively. The house ownership status of the respondents showed that 359(91.12%) have their own house and 35(8.88%) percent have rented from others (Table 4.1)

**Table 4.1: Respondent's Characteristics: Summary of Categorical Variables**

| Variables | No. | Percent |
|---|---|---|
| Sex | | |
| Male | 189 | 48 |
| Female | 205 | 52 |
| **Marital Status** | | |
| Unmarried | 81 | 20.56 |
| Married | 313 | 79.44 |
| **House Ownership** | | |
| Own | 359 | 91.12 |
| Rented | 35 | 8.88 |

Source: Field Survey 2022

The educational attainment of the respondent showed 27 (6.85%), 114(28.93%), 150(38.07%) and 909(22.84%) and 13 (3.30%) have illiterate, Primary -preparatory, Diploma, Degree and Postgraduate, respectively.

Figure 4.1: Education
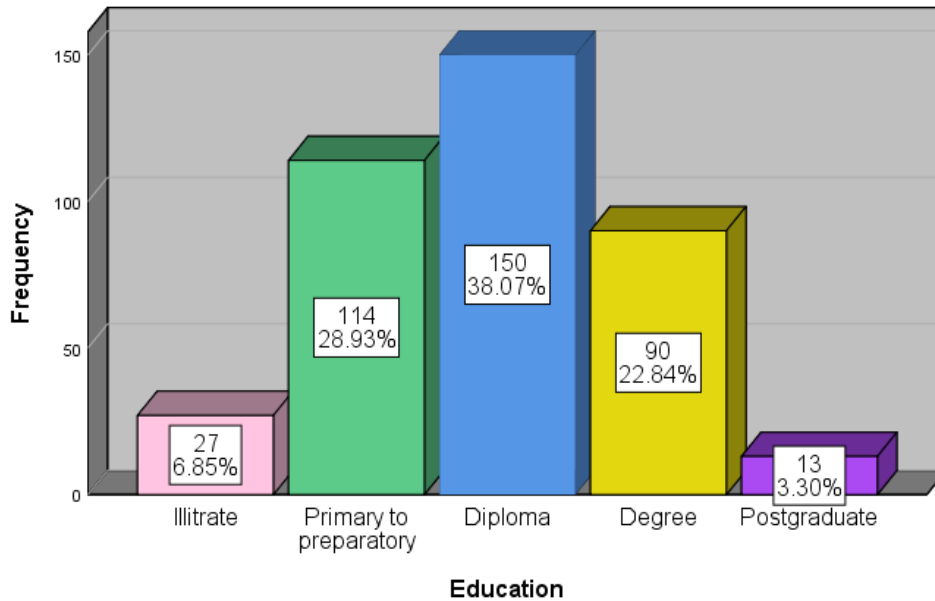


Source:  Field survey 2022

The survey result in table 6 below reveals that the average total monthly income of the household is 7496.95 ETB with a minimum and maximum of 1800 ETB and 15000 ETB respectively. The average age of the respondents is minimum of 21 years and maximum of 70 years. The household size is a minimum of 1 and maximum of 5 members.

**Table 4.2:Respondents characteristics; Summary of continuous variables**

| Variables | Minimum | Maximum |
|---|---|---|
| Income | 1800 | 15000 |
| Age | 21 | 70 |
| Household size | 1 | 5 |

Source: Field Survey 2022

**4.1.2. Households' Response for current Situation of SWM in Gullele sub city**

The result in table 4.3 below shows that about 343 (87.06%) and 51(12.94%) of respondents evaluated that the current situation of solid waste management as good and bad respectively

**Table 4.3: Household response to question about SWM and evaluation of current SWM in Sub city (394)**

| Current situation of the SWM | No. | Percent |
|---|---|---|
| Yes | 343 | 87.06 |
| No | 51 | 12.94 |

Source: Field Survey 2022

**4.1.3. Households Response for Impact of Unsound Solid Waste Management**

Among respondents who were asked about the environmental impacts of unsound solid waste 354(89.85%) were aware of the impacts of unsound solid waste disposal in the town and 40(10.15) were not awareness .Respondents were also asked whether they thought that unsound waste disposal affect the health of members or not .As a result, 380(96.45%) of households thought the unsound solid waste disposal affects the health of members in the family 380 (table 4.4).

**Table 4.4: Response of households' awareness on impacts of unsound SWM on environment (n=394)**

| Environmental Awareness | No. | Percent |
|---|---|---|
| Yes | 354 | 89.85 |
| No | 40 | 10.5 |
| **Health concern among members** | | |
| Yes | 380 | 96.45 |
| No | 14 | 3.55 |

Source: Field Survey 2022

Table 4.5 shows the majority which is about  10(2.5%) ,302 (76.6%) ,34(8.5%), 16(4.06%) , 24 (6.09%),8(2.03%), ) of the total respondents practiced open air burning ,solid waste collectors take it, throw in an open space (on the street),dispose in nearby river, throw in drainage ,other( burying ,use as compost etc )respectively.

The results of the survey showed that 280(71.06%) and 94(23.85%) of the total respondents said the municipality and the households' are responsible for the solid waste management in the town, respectively. The remaining 20(5.07%) of the total respondents said both the municipality and the households are responsible for management of solid waste in the town (table 4.5).

**Table 4.5: Households response for methods of disposal and responsible body for SWM in the town**

| Methods of disposal | No. | Percent |
|---|---|---|
| Open air burning | 10 | 2.5 |
| Solid waste collectors take it | 302 | 76.6 |
| Throw in an open space ( on the street) | 34 | 8.5 |
| Dispose in nearby river | 16 | 4.06 |
| Throw in to drainage | 24 | 6.09 |
| Other(burying, use as compost | 8 | 2.03 |
| **Responsible body for SWM** | | |
| Households | 94 | 23.85 |
| Municipality | 280 | 71.06 |
| Both | 20 | 5.07 |

 Source: Field Survey 2022

Among the respondents who received solid waste service, 8(2.03%), 63 (15.99%) and 323 (81.98%) get the service once, irregularly and twice per week respectively.

Figure 4.2: Collection of Frequency per Week
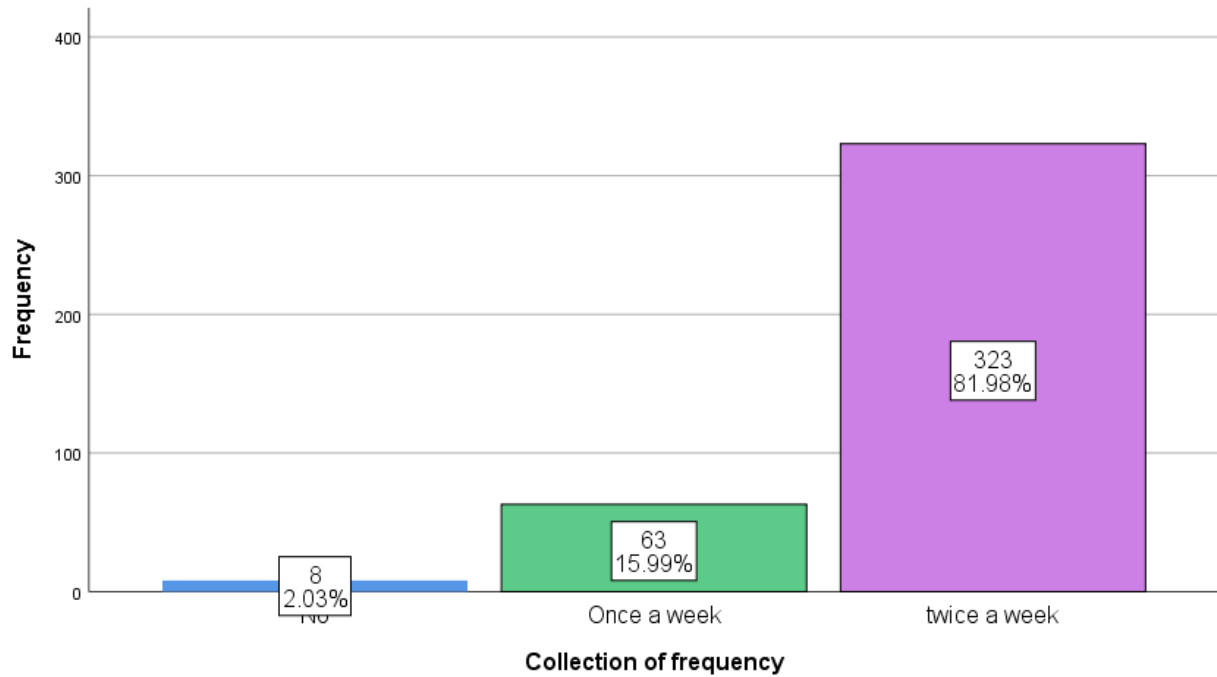


Source: Field Survey 2022

**4.1.4. Households Willingness to pay for Improved SWM in Gullele Sub city**

Based on the results of the study, about 352 (89.3%) of the total respondents were willing to pay for improved solid waste management in the town. However, the remaining 42(10.7%) of respondents were not willing to pay for the proposed project. The respondents were asked reasons for their willingness to pay or not for improved solid waste management in order to know whether they clearly understood the scenario or not. The unwilling 42 respondents were also asked their reasons for not willing to pay for the proposed scheme from the given list alternatives.

Figure 4.3: Households willingness to pay for improved solid waste management
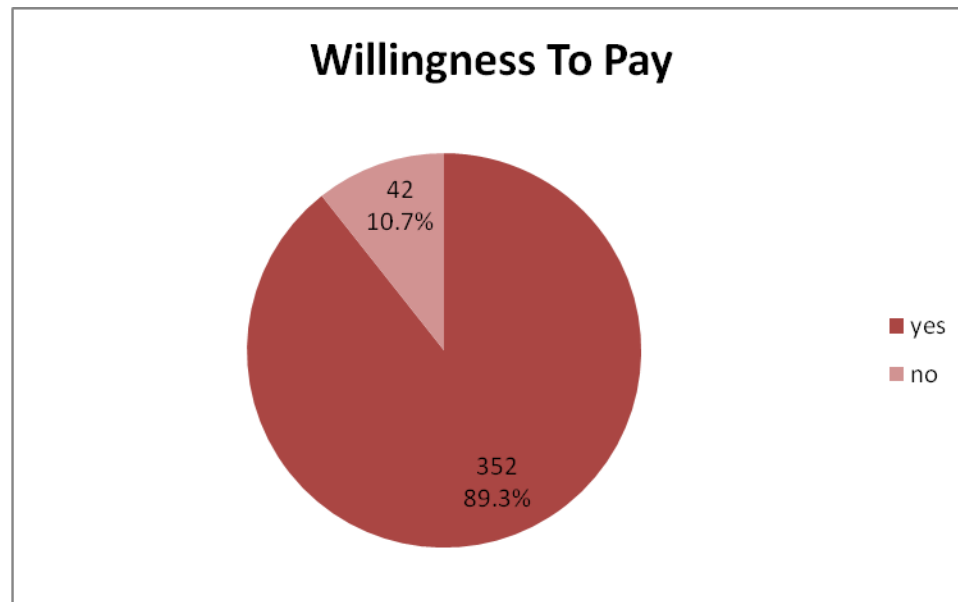


Source: Field Survey 2022

Table 4.6 below shows the WTP responses of households for the double-bounded value elicitation format. The results revealed that the number of "yes-yes" responses for the initial and follow-up bids decreases as the value of initial bids increases. In a well-developed cv survey, the number of "yes " answers should decline as the bid amount increases (CARSON, 2000). Furthermore, the proportion of "yes-yes " answering pattern decreases as the bid amount is increased. The proportion of "no-no "answers increase as the bid amounts on the WTP question is increased. At initial bid amount of ETB 10, there no "no-no " response, implying that all the households who are willing to pay something are willing to pay at least ETB 10 (half) for solid waste management services. At the highest initial bid of 150 ETB, 3.35 percent answered " no-no " response. The remaining answering patterns, " yes-no " and " no-yes " responses indicate the respondents' willingness to pay lies between the initial bid amount and the increased and decreased bid amounts, respectively. Therefore, this result can be interpreted as a sign of the internal validity of the CVM answers, confirming the selection of an efficient bid design (Banga et al., 2011(Table 4.6)

**Table 4.6: Respondents Willingness to pay response for the initial and follow up bids**

| Initial Bid In ETB | Follow-up Bid in ETB | Response | | | | Total |
|---|---|---|---|---|---|---|
| | | Yes-Yes | Yes-No | No-Yes | No-No | |
| 10 | 10 ±5 | 39(11.07) | 16 (4.47) | 5(1.39) | - | 60(16.93%) |
| 30 | 30±15 | 20 (5.58) | 24 (6.7) | 8(2.23) | 4(1.11) | 56(15.62%) |
| 80 | 80±40 | 15 (4.18) | 48 (13.4) | 22(6.14) | 6(1.67) | 91(25.39%) |
| 100 | 100±50 | 6 (1.67) | 21 (5.86) | 41(11.45) | 8(2.23) | 76(21.21%) |
| 150 | 150±75 | 5 (1.4) | 16 (4.46) | 36 (10.05) | 12(3.35) | 69(19.26%) |
| **Total** | | **85 (24.14%)** | **125(34.91%)** | **112(31.28%)** | **30(8.38%)** | **352(100%)** |

Source: Own Survey, 2022

## 4.2. Econometric Analysis

### 4.2.1. Determinants of Household's willingness to pay for improved solid waste management

**The binary logistic regression analysis** was used to find out the factors influencing the households' willingness to pay for solid waste collection on Gullele sub city. All variables were used in the model as they were found to b statistically significant correlated.

### 4.2.2. Overall model fit and test result

In this study, the considered level of significance is 0.05. "If the "prob>chi$^2$ " or p-value is greater than 0.05, the chi-square is statistically significant and the null hypothesis is true. This means that the independent variables do not influence the dependent variable. If the "prob >chi$^2$" or p-value is less than 0.05, the chi-square is statistically significant and the null hypothesis is rejected. In this case, independent variables have influence on the dependent variable.

**Table 4.7: Overall model fit and test result**

| Binary Logistic regression | Number of observation | = | 394 |
|---|---|---|---|
| | LR chi2 (7) = | | 203.08 |
| | Prob > chi$^2$ = | | 0.0000 |
| Log likelihood = -32.162181 | Pseudo R$^2$ = | | 0.7594 |

Source: Survey 2022

The results of fitness test presented in table 4.7 above show that p-value is less than 0.05 indicating that the model is statistically significant. In other words, the independent variables (Income, Awareness, Current situation, Age, House ownership, Households size, Education) taken altogether correctly predict the regression model. The value Pseudo R2 of 0.7594 indicates 76% of the valuation of willingness to pay is caused by independent variables and the remaining 24% is due to other factors not considered in the model.

**Table 4.8: Binary Logistic regression model of factors determining households' Willingness to pay**

| Variables in the Equation | Coef | odds ratio | std.Err | z | p>\|z\| | [95 conf. Interval] | |
|---|---|---|---|---|---|---|---|
| Income | .0003479 | .9996522 | .0001706 | -2.04 | 0.042** | .09993178 | 0.9999866 |
| Awareness | 2.165909 | 8.722523 | 8.279264 | 2.28 | 0.022** | 1.357365 | 56.05154 |
| Current situation | 1.776306 | 5.907993 | 4.688968 | 2.24 | 0.025** | 1.247013 | 27.99039 |
| Age | 0.0901697 | 1.09436 | .0466518 | 2.23 | 0.034** | 1.00664 | 1.189724 |
| House ownership | 4.89192 | 1.33.2091 | 153.2231 | 4.25 | 0.000*** | 13.97794 | 1269.476 |
| Households size | -1.120513 | 3.066426 | 1.543406 | 2.23 | 0.026 ** | 1.143411 | 8.223614 |
| Education | .9037406 | 2.460021 | 1.037041 | 2.15 | 0.031** | 1.083772 | 5.623947 |
| -cons | -9.20526 | .000105 | -2.288548 | -4.02 | 0.000 | -13.69073 | -4.719789 |

***,**,** represents the level of significance at one, five and ten percent, respectively.

Source: Survey 2022

The result of the regression presented in table 4.8 shows at 5% significance level income, awareness, current situation SWM, age, households size, education and at 1% significance level house ownership, were found to be statistically significant meaning that they influence the willingness of the household to pay for solid waste collection services.

**Income:** Another determinant that has positive impact on the amount of WTP is income and it is significant at 5 percent. This is consistent with economic theory that explain income is positively related in general and the same with environmental demand. This also indicates that environmental good is a normal good since its demand increase with income.

**Environmental awareness:** This variable has a positive relationship and it is significant at 5 percent. More awareness about the environment means respondents know the benefit of the environment and it is likely to have more environmental demand.

**Current Situations of SWM:** The coefficient is a positive sign and is statistically significant at 5%. Positive and significant influence of Current Situations of SWM on the willingness to pay insinuates that people understand the importance of proper waste management and seek to live in healthy and clean environmental conditions, hence more willing to pay for solid waste collection services.

**Age**: The age coefficient has a positive sign (0.0901697) and is statistically significant. This literally means that, holding other  factors constant, an increase of one year in age causes the probability of willingness to pay to increase by 0.0901697 times. This implies that as people grow older their willingness to pay for waste collection services increases. This confirms the finding of the study conducted by veronica al., 2019 in Cameroon.

As people get older, they become conscious about the health issues associated with unclean environment, they are anxious of getting sick easily due to their advancing age. Also, in most cases, old people have secure income and stable life and find it easy to incur additional cost therefore they are more willing to pay for waste collection services than young people.

**House ownership:** This dummy has a significant impact 1% and positive relation with WTP which means households with their own house have more WTP for improved solid waste management system than those living rented houses. This may because of those people living in a rented house considers their residential area as temporary or may be due to the current condition in the city that only hues owners are paying for sanitation.

**Household size:** It was assumed that a larger household with members aware of the importance of waste management would be willing to pay for solid collection. However the results showed a negative and significant impact of household size on willingness to pay. At 5% level, the coefficient for household size variable was found to be -1.120513   with p-value of   0.026

Ezebo(2013), Raheel (2013) and kassahun & Birara (2020) had similar finding that an increase in household size reduce the household willingness to pay  for waste management services. This is partly due to the fact that the household's members may decide to share home chores including the removal of waste but also as the members of the household to incur additional cost such associated with solid waste collection services (Raheel, 2013).

**Education:** As expected, the coefficient of education the level variable shows a positive and significant relationship between respondent education level and willingness to pay. It was observed that an additional year to education level increases the households 'willingness to pay for waste collection ser4vices by .9037406 times keeping other factors unchanged. The odd ratio indicates that educated people are willing to pay almost 3 times (2.460021) more than people with no from education. This corroborates the findings of Nkansah et al., 2015; Zerbock (2003); Haymdiyah et al., (2017); Kassahun & Birara (2020);Afroz & Muhamad (2011); Ezebilo(2013) and Ndau & Tilley (2018).

Positive and significant influence of education level on the willingness to pay insinuates that educated people understand the importance of proper waste management and seek to live in healthy and clean environmental conditions, hence more willing to pay for solid waste collection services. Moreover, higher education level is generally linked to higher possibilities of getting a well-paying job with reliable income.

**Table 4.9: Total WTP of Households**

| Sample number of Households | Households with invalid Response | | Households with valid Response | Mean WTP per month (in ETB) | Total WTP per month (ETB) |
|---|---|---|---|---|---|
| | Protest Response | Outliers | | | |
| 400 | 6[a] | 42[b] | 352[c] | 10 | 3,940.00 [d] |
| 400 | 6 | 42 | 352 | 80 | 31,520.00[e] |

Source: Own calculation

Out of a total observation (394), 6(1.52%) are protest zero. The protest response out of the total households number; i.e., 400 times 0.015 gives the number of households who are expected to have protest responses (6 households).

Out of a total observation (394), 42(10.65%) are outlier. The number of households with outliers measures out of the total number; i.e., 400 times 0.1065 gives the number of the household who are expected to be an outlier (42 households). The difference between total household number (400) and households who have invalid response; 6 protest zero and 42 outliers is households with valid response (352).

[d]Total WTP from mean maximum WTP

[e]Total WTP from mean of double-bounded WTP

# CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

## 5.1. Conclusion

The generation of solid waste has become an increasing environmental and public health problem everywhere in the world, particularly in developing countries like Ethiopia, Addis Ababa, solid waste management is mainly provided by the municipality and it has been measured and evaluated always based on the role and performance of the service provider (supplier of service) while demand side i.e. Willingness To Pay (WTP) of the residents is ignored.

The general objective of this study is to estimate the factor affecting of household's willingness to pay for improved solid waste management services using the contingent valuation method in Gullele sub city. The study used CVM in order to estimate households WTP using double-bounded followed by open-ended value elicitation formats. The sample households were selected from the five kebeles in the town using a stratified random sampling technique. Based on the household or population number of the town, the study selected 99, 71, 96, 45, 89 households from Gullele sub city Kebele 19/20/21, Kebele01/02, Kebele 03/04/05, Kebele 06, Kebele 10/18, respectively. Out of the total 400 sample households, 394 households successfully completed the face-to-face interview. Out of the total 352 respondents that were questioned on their willingness to pay to improve solid waste management, about 89.3% the households had positive willing to pay values for improvement in solid waste management starting from 10 birr per month while the rest, 42(10.7%), were not willing to pay. The percentage of positive WTP values was compatible with the findings of the previous studies in many parts of the developing world including Ethiopia. This tells us that if more firms that are private are involved in the provision of an improved solid waste management service large number of residents might be willing to pay for service.

The study used the CVM to elicit households' willingness to pay for improved solid waste management in Gullele sub city. A logit regression model was then estimated to investigate the factors influencing households' willingness to pay. The logit model shows that the WTP amount is affected by various socioeconomic factors. Based on the findings of the study , it can be concluded that Income, Awareness, Current situation ,Age , Households size, Education and of

the respondents were significant factors in influencing people's willingness to pay improved SWM services in Gullele sub city at 5% statistically significance and House ownership at 1% statistically significance.

Addis Ababa municipality should take the imitative of establishing sanitary landfills, and encourage establishment of private service provider (solid waste contractors) to improve the solid waste collection in the city by increasing trucks and collection frequency per week. The study recommends that entrepreneurs and innovators should be encouraged to develop improved schemes for waste collection and management.

## 5.2. Recommendation

- The municipality of the town work hard to provide residential solid waste management services on regular basis to change unfavorable conditions of the current situation of solid waste management in suitable way.

- Education was found to positively influence willingness to pay. Public sensitization programs should continue and be strengthened in order to raise awareness on solid waste management and its importance.

- Sustainable solid management considers waste disposal at dumpsite or landfill as the last option. However, the study observed that it is the predominant choice of household for disposal of collection waste. The government should put much effort in sensitizing population about waste recycling and encourage private sector to engage in activities aiming for resources recovery. This will not only create jobs for locals but also will save the land that would rather be used for waste disposal.

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## Appendix 1

### Table 8: Logistic regression model of determinants of households Willingness to pay

| Variables in the Equation | Coef | odds ratio | std.Err | z | p>|z| | [95 conf. Interval] | |
|---|---|---|---|---|---|---|---|
| Income | .0003479 | .9996522 | .0001706 | -2.04 | 0.042** | .09993178 | 0.9999866 |
| Awareness | 2.165909 | 8.722523 | 8.279264 | 2.28 | 0.022** | 1.357365 | 56.05154 |
| Current situation | 1.776306 | 5.907993 | 4.688968 | 2.24 | 0.025** | 1.247013 | 27.99039 |
| Age | 0.0901697 | 1.09436 | .0466518 | 2.23 | 0.034** | 1.00664 | 1.189724 |
| House ownership | 4.89192 | 1.33.2091 | 153.2231 | 4.25 | 0.000*** | 13.97794 | 1269.476 |
| Households size | -1.120513 | 3.066426 | 1.543406 | 2.23 | 0.026 ** | 1.143411 | 8.223614 |
| Education | .9037406 | 2.460021 | 1.037041 | 2.15 | 0.031** | 1.083772 | 5.623947 |
| -cons | -9.20526 | .000105 | -2.288548 | -4.02 | 0.000 | -13.69073 | -4.719789 |

# Appendix 2

Questionnaires for Addis Ababa, Gullele the study is limited to the analysis of households' willingness to pay for improved solid waste management service of residential solid wastes only

**Topic: Determinants of Households Willingness to Pay Improved Solid Waste Management Services; in the case of Addis Ababa Gullelle sub city.**

Dear Respondent.

As part of my study program, I am investigating the above topic. I am humbly requesting your input in answering the questions here by filling in the gaps using numbers and other guidelines are given. Will like to assure you that all the information you will give will remain confidential and only useful for this research.

I thank you.

Yours, Destaw Adugna

**Section 1: Questions about Current Situation of Solid Waste Management and (knowledge) Awareness of Respondents**

1. How do you dispose the solid waste of your household?
A. Private disposal well
B. Open air burning
C. Throw it on an open space or on the street
D. Dispose in nearby river
E. Throw into drainage
F. Solid waste collectors take it
G. Others, specify _____

2.  If your answer for question numbers 1, is G, who provides you this service?

    A. town municipality B. Private C. Others, specify _____

3.  Do you get solid waste collection service in your area? A. Yes B. No
4.  If "Yes" how often do you get the service per week?_____
5.  Do you pay for the solid waste collection service? A. Yes B. No
6.  If "Yes" how much do you pay for the service per month? ____ETB
7.  Are you satisfied with the current solid waste collection service? A. Yes       B. No
8.  Who is mainly responsible in managing solid waste services in your household?
A.      Females                C. Children
B.      Males                  D. Others specify
9.  How do you evaluate the current situation of solid waste management in the town?
A.      good        B. bad
10. What environmental and health problem (impact) will the current unsound solid waste disposal (disposal on open space) do you think create? _____
11. Who is responsible for the proper management of solid waste in the town in your view?

    A. The municipality        B. the household       C. Other, specify _____

12. Do you think that the unsound solid waste disposal is damaging members of your household's health? A. Yes                           B. No
13. If "Yes", have your household members suffered any one of the following disease due to solid waste?

| | Diseases | Mark(x) |
|---|---|---|
| 1 | Common cold | |
| 2 | Asthma | |
| 3 | Typhoid fever | |
| 4 | Diarrhea | |
| 5 | Cholera | |
| 6 | Other | |

14. Does the improper solid waste generated affect your household's daily life via making the members unable to engage in productive works, school or elsewhere due to sickness?

    A. Yes                      B. No

**Section two: Impacts of Solid Waste on the Environment, Human Health, and Economy**

15) Do you think that the MSW is creating environmental problems such as water pollution and air pollution due to open burning and uncontrolled dumping of solid waste?

    A) Yes                      B) No

16) Do you think that the MSW is damaging members of the household's health?

    A) Yes                      B) No

    If "Yes" go to question 17

17) Have your household members will be suffered any one of the following diseases due to MSW? Tick the type of disease.

|      | Diseases       | Tick( √ ) |
| ---- | -------------- | --------- |
| i.   | Common cold    |           |
| ii.  | Asthma         |           |
| iii. | Typhoid fever  |           |
| iv.  | Malaria        |           |
| v.   | Diarrhea       |           |
| vi.  | Cholera        |           |

18) Does the MSW generated affect your household's daily life via making the members unable to engage in productive works, school or elsewhere due to sickness?

    A) Yes                      B) No

19) Have you will be incurred a cost to your household members in order to get medical treatment from health stations?

        A) Yes                     B) No

20) How many days on average a household member becomes unable to engage in his or her own work per month during illness?

**Section 3: WTP Questions**

Considering the benefits that might accrue to your household and the town:

21. Would your househoilod be willing to pay in support of the scheme?

  Yes (go to 22) ---------

   No (go to 24) --------

22. Would you willingness to pay----Birr per month for the improvement in SWM?

Yes ------------- No--------------

23. What is the maximum amount your household would be WTP in support of the new SWM scheme? --------birr monthly.

24. If your answer for 21 is no why is your household not WTP in support of the scheme?

    a) We cannot pay due to lack of income.

    b) We don't have faith in the proposed services.

    c) The improvement in SWM is not important and priority the city

**Section four: factor affecting of WTP Questions**

25) Gender

        A) Male                  B) Female

26) Age........................... years

27)  Marital Status

A.   married
B.   Unmarried

28) Educational Level

    A. illiterate    C. Diploma, D. Degree

    B. Primary -preparatory, E. Postgraduate

29)  Average income per month …… ETB

30)  House ownership status

    A. Owned           B. Rented

Thank you very much for your cooperation as well as contribution to this survey