

ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
DEPARTMENT OF ECONOMICS



**HOUSEHOLD WILLINGNESS TO PAY FOR IMPROVED SOILD
WASTE MANAGEMENT IN ADDIS ABABA: THE CASE OF KOLFE
KERANIYO SUB CITY**

(A Thesis Submitted to the Department of Economics in Partial Fulfillment of the
Requirements for the Degree of Master of Science in Resources and Environment
Economics)

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College of Business and Economics
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ADDIS ABABA UNIVERSITY
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This is to certify that the thesis prepared by Getahun Seid Yimer, entitled: *“Households’ Willingness to Pay for Improved SWM in Addis Ababa, Kolfe Keraniyo Sub City”* and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Economics complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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LIST OF ACRONYMS

AASWM	Addis Ababa Solid Waste Management
AAWS	Addis Ababa Water and Sewerage
CV	Contingent Valuation
CVM	Contingent Valuation Measurement
FDRE	Federal Democratic Republic of Ethiopia
RGDP	Real Gross Domestic Product
IDA	International Development Association
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MWTP	Maximum Willingness to Pay
OECD	Organization for Economic Co-operation and Development
SW	Solid Waste
SWM	Solid Waste Management
UN	United Nation
UNDESA	United Nation Department of Economic and Social Affairs
UNEP	United Nations Environment Program
USWM	Urban Solid Waste Management
WB	World Bank
WTA	Willingness to Accept
WTP	Willingness to Pay

ABSTRACT

Designing improved solid waste collection service in Addis Ababa city is vital for to improve the quality of life and welfare of the residents. However, households in all sub cities are dissatisfied with the current solid waste collection and the budget gap prevents enhanced solid waste collection service. It is necessary to create an improved solid waste collection system in order to satisfy households and reduce budget gaps in solid waste collection service. This study contributes by introducing an alternative collection service so as to improve solid waste management and to fill the budget gap of the city. This study was undertaken to investigate households' willingness for new and improved solid waste management in Kolfe Keraniyo Sub-City, Addis Ababa. The study used both cross-sectional survey design and quantitative approach. It also used both secondary and primary data sources. The primary data was collected via questionnaire. Stratified and simple random sampling techniques were applied. The Tobit model was applied to analyze the factors influencing households' willingness to pay decisions for improved solid waste management in Addis Ababa, particularly in Kolfe Keraniyo Sub-City. The results show that households' willingness to pay for new improved solid waste management in Kolfe Keraniyo Sub-City is significantly influenced by household income, size and age. The result also confirmed that education and number of household members have job were related with households' willingness to pay. Furthermore, households were on average willingness to pay Birr 31.1 million per month and Birr 373.2 million per year. Among others, the study suggests that in order to fix the price for the improved urban household solid waste collection service the municipality could use mean and maximum willingness to pay fee to charge on every low-income and every high-income households, respectively. So that the municipal agency will improve households' solid waste collection service and narrow the budget gap.

Key words: Household, Solid Waste Collection, Wiliness to Pay and Kolfe Keraniyo Sub-City

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Problem of waste management is multi-faceted which affects multiple facets of society and the economy. It is seen as a starting point for addressing other global issues, including health, consumption, poverty reduction, food, climate change, resource protection, and sustainable development. Waste management is leading most vital utility services for the community in 21st century, predominantly in urban areas (GWMO, UNEP, 2015).

This because growing population in urban sites makes the generation of all modes of solid waste surpasses the capacity of effective disposition and collection (UNSAID, 2006). According to Kaza et al. (2018) solid waste amount generated increase when economic development and the pace of urbanization become higher. The urban waste amount in unindustrialized countries is growing rapidly due to increasing living standards and migration of rural population to urban areas (Wilson et al., 2015).

In 2016, global waste is about 2 billion tons. It is also expected to reach to 2.59 billion by 2030 and further 3.4 billion tons in 2050 where the highest increase predictable to be generated in sub-Saharan Africa. With speedy population growth as well as urbanization, municipal generation of waste in the world is estimated to reach 1.2 kgs per person to 1.42 kgs per person by 2025 (WB/IBRD/IDA, 2019). This poses severe threat to people health and causes numerous environmental challenges in urban places of developing countries including Ethiopia.

Proper solid waste management contributes to all three sustainable development pillars such as environmental, economic and social (Hyman, 2013). Further, Ahmad et al., (2011) indicated that well-organized solid waste management (SWM) plays a pivotal importance to enhance environmental superiority via increased amenity values. Moreover, effective waste collection service is a principal step to reduce pollution and to improve public health while improperly managed wastes adversely affect economic development through diminishing tourism (Kaza et al., 2018). Further, inadequate municipal SWM results in reduced the

quality of environment in urban zones (Wilson and Velis, 2014). Consequently, to provide favorable urban environment for urban dwellers SWM services must be in place (Muhdin et al., 2016).

In order to manage properly the solid waste (SW), Ethiopian government had issued SWM proclamation in 2007. The objective was to increase the entire capacities to halt the likely adverse impacts whereas creating socially and economically beneficial assets out of solid waste by supporting community participation. According to Central Statistical Authority (2007) projected that the urban population is to nearly triple from 15.2 million in 2012 to 42.3 million in 2037, growing at 3.8 percent a year. This recapitulate that the central challenge for the Ethiopian Government is to make sure that cities are attractive places in which to work and live while fostering urbanization.

As in many towns and cities in the developing world, Ethiopian cities struggle to manage solid waste which is often dumped into open areas and endangering both public health and environmental wellbeing. Addis Ababa is the capital city of Ethiopia seat of the African Union and the United Nations Economic Commissions for Africa and it is also the city government with eleven sub-cities. According to Addis Ababa Solid Waste Management (AASWM) The city SWM service is challenged by low service coverage, very low customer satisfaction, high operational cost, and poor quality of services as well as lack of environmentally sound, efficient and effective system (AASWM, 2019).

In city of Addis Ababa, the yearly waste collection is estimated more than 200,000 tones and the largest share of sources of waste generated comes from % households, Presently, collection of SW in the Addis Ababa is handled by the city municipal. It is financed by a mandatory waste management fee raised from whole registered Addis Ababa businesses and households based on their water consumption (AASBPDA, 2008).

Despite this mechanism put in place to cope with problems, still the matter of solid waste management far from being resolved in Addis Ababa. Accordingly, addressing the problems of SWM is essential for economic development of low-income countries in general and urban centers in particular. Because if solid waste is appropriately used, it can be a valuable resource, but if it is not successfully controlled, it leads to serious opposing influences on the pursuit for sustainable development of the countries.

Therefore, this research study is aimed at examining households' willingness to pay (WTP) for new improved municipal SWM in Kolfe Keraniyo Sub-City, Addis Ababa.

1.2. Statement of the Problem

Ethiopian ten-years development plan lays a long-term vision of making Ethiopia an “African Beacon of Prosperity” by 2030. Among others, environment and climate change constitute some of the focus areas of the plan. In the next ten years, the plan targets to ensure sustainable development by developing, maintaining and protecting the country's natural environment and healthy ecosystem interactions ((Ethiopian Ten-year Plan, 2021-2030).

In Ethiopia, 25% of urban population are living in Addis Ababa which reveals that the city is rapidly growing cities in Africa. Its economy is mounting by 14% annually and this creates pressure on the municipality to manage solid waste (WB, 2015). The city generated 0.4kg/day per capita waste and about 550 ton/day. From this, households account for 76% of the waste generated which is the largest share (AASWM, 2019).

According to the information received from Addis Ababa Waste and Sewage Authority (AAWSA), in 2019/20 the authority collected Birr 95 million for SWM services. In 2019/20, the City Administration of Addis Ababa subsidized Birr 120 million for SWM agency to facilitate the SWM service. In this fiscal year, AASWM agency required Birr 600 million budgets to handle the SWM services of the city. Thus, the budget gap stands at Birr 385 million and this creates burden for the agency to search other sources. Furthermore, the preliminary interview with an expert at AASWM agency indicated that households in all sub cities are unsatisfied with the existing solid waste collection workers because the workers do not maintain the schedule all the time and collect in irregular time even if they paid the collection service charges with water bill.

This reflects that urban solid waste management is expensive that requires an allocation of adequate municipal budget though fee imposed by the municipality on residents of the town for SWM service. This requires the willingness and participation of households to fill the budget gap and thereby obtain an improved SWM service in the city. Alongside, the households in are dissatisfied with current solid waste collection service of the city.

Therefore, this study is designed to improve SW collection service of the city, which is vital for the planning process of improved solid waste management system. As one alternative option, it is relevant to introduce an alternative SWM collection service fee system other than the existing collection system. However, households' WTP for introducing an alternative collection service of solid waste is in question until it is proved by research and their WTP depends on a number of factors

Concurrently, undertaking research on pollution issue, SWM is a topical issue in Ethiopian economy (Ethiopian ten-year plan, 2021-2030) so that, it is appropriate to do research on this timely issue. On top of these, there is lack of adequate empirical evidence on the issues concerning to households' WTP for improved SWM particularity undertaken in Kolfe Keraniyo Sub-City. This study intends to add to the existing literature to households' WTP for SWM service in Kolfe Keraniyo Sub-City.

1.3. Research Questions

This study focused to answer the following basic research questions.

- I. What is the existing condition of SWM practices in Kolfe Keraniyo Sub-City, Addis Ababa?
- II. How much average and maximum amount of money that households are WTP for new and improved SWM service in Kolfe Keraniyo Sub-City?
- III. What are factors that influence households' WTP for improved SWM in Kolfe Keraniyo Sub City?

1.4. Objectives of the Study

1.4.1. General Objective

The main objective of this study was to analyze households' WTP for new improved SWM in Kolfe Keraniyo Sub-City.

1.4.2. Specific Objectives

The study has the following specific objectives;

- I. To examine the existing condition of SWM practices in Kolfe Keraniyo Sub-City.

- II. To identify factors that influence households' WTP for improved SWM in Kolfe Keraniyo Sub-City.
- III. To show the mean and maximum amount of fees households are WTP for better SWM service in Kolfe Keraniyo Sub-City.

1.5. Significance of the Study

The study gives vital information for Kolfe Keraniyo Sub-City managements about the present-day situation of the town and households' WTP in terms of monetary value for improved SWM service. Moreover, this study offers an alternative insights or options for Addis Ababa SWM Agency managements to fill the budget gap. Furthermore, the study's result can serve as spring board for other researchers who are interested to study in connection with households' WTP and SWM service in other cities.

1.6. Scope of the Study

The study is confined to investigating households' WTP for new proposed improved SWM in Kolfe Keraniyo Sub City, Addis Ababa. Methodologically, the study employed Tobit model using primary data from survey on households from Kolfe Keraniyo Sub-City conducted using structured questionnaire (CVM). This study not concerned with other sorts of solid waste sources such as institutions, commercial establishments, factories, hotels, and street sweeping.

1.7. Organization of the Study

The rest of the chapters are organized as follows; chapter two provides theoretical foundation of the study through exploring the arguments of different theoretical perspectives and empirical evidences followed by summary of research gaps. Thereafter, third chapter presents the methodology of the study. Also, chapter four focuses on the results and analysis and discusses the findings. Finally, chapter five presents conclusions and policy recommendations.

CHAPTER TWO

LITERATURE REVIEW

This chapter pinpoints an overview of literatures that are connected to the research study problem and it introduces literature like concepts of SWM and factors of household willingness to pay. It also includes empirical studies done so far.

2.1. Theoretical Review

2.1.1. Theory of Welfare Change

Welfare and Economic Change Welfare is, in simple terms, the level of well-being of a group. It is sometimes thought of as the aggregate of utility (individual well-being). Whenever there is an economic change in society, there is usually and associated change in welfare. The two most common forms of economic change are; the opening or closing of a market (i.e. A new good is invented or a current good cease to exist. Second, there is a change in the relative price of a good. (i.e. it is now cheaper or more expensive relative to other goods). Whenever an economic change occurs an individual moves from one equilibrium point to another equilibrium point. This means that they move from one indifference curve to another indifference curve. The change in well-being is measured by the difference in utility.

However, utility is an unobservable number; therefore, economists attempt to convert the change into some index that can be observed, such as money. The idea being that any economic change can be off-set by a lump-sum transfer of money. If the transfer amount is known, then its size can be interpreted as being proportional to the magnitude of the welfare change. There are three measures that are used to measure welfare change: Consumer surplus (CS), Compensating Variation (CV) and Equivalent Variation (EV).

Consider two alternative states of the world. In the first state (or status quo), the consumer faces prices p^0 and has income m^0 . In the second state the consumer faces prices p^j and has income m^j . The utility maximizing consumer will obtain utility level $\psi(m^0, p^0)$ in the initial state and utility level $\psi(m^j, p^j)$ in state j. Here $\psi(p, m)$ is the indirect utility function yielding the maximal level of utility with prices p and income m. If all we care about is which state is

optimal, this measure is sufficient. Utility is an ordinal measure so the consumer is better or worse off as $\psi(p^j, m^j)$ is greater than or less than $\psi(p^0, m^0)$. The difficulty with using this ordinal measure is that it allows no comparisons across individuals and gives no indication of the strength of preference for $\{p^0, m^0\}$ versus $\{p^j, m^j\}$.

2.1.1.1. Compensating Variation

Compensating variation (CV) measures the net revenue of a planner who must compensate the consumer for a price change after it occurs, bringing her back to the utility level $\psi(m^0, p^0)$. Compensating variation would be negative if the planner would have to pay the consumer a positive level of compensation because the price change makes her worse off. Compensating Variation is defined implicitly by

$$CV = c(\psi(m^j, p^j), p^j) - c(\psi(m^0, p^0), p^j) = m^j - c(\psi(m^0, p^0), p^j)$$

If there is no change in income between the initial price and income pair and the subsequent one, we can also write CV as follows given that $c(\psi(m, p^j), p^j) = c(\psi(m, p^0), p^0)$

$$\begin{aligned} CV &= c(\psi(m, p^j), p^j) - c(\psi(m, p^0), p^j) \\ &= c(\psi(m, p^0), p^0) - c(\psi(m, p^0), p^j) \end{aligned}$$

Compensating variation is negative of the amount of money the consumer would be just willing to accept from the planner to allow the price change to take place. Compensating variation measures the difference in attaining the initial utility level at the initial and subsequent prices. Compensation takes place after the price and income change, so that compensating variation uses the after-change prices.

2.1.1.2. Equivalent Variation

Equivalent variation (EV) is defined as the amount of money paid to an individual with base prices and income that leads to the same satisfaction as that generated by a price and income change.

$$EV = c(\psi(m^j, p^j), p^0) - c(\psi(m^0, p^0), p^0) = c(\psi(m^j, p^j), p^0) - m^0 \dots\dots\dots(11)$$

If there is no change in income between the initial price and income pair and the subsequent one, we can also write EV as follows given that $c(\psi(m^j, p^j), p^j) = c(\psi(m^0, p^0), p^0)$

$$EV=c(\psi (m^j, p^j), p^o) - c(\psi (m^o, p^o), p^o)$$

$$=c(\psi (m, p^j), p^o) - c(\psi (m, p^j), p^j)$$

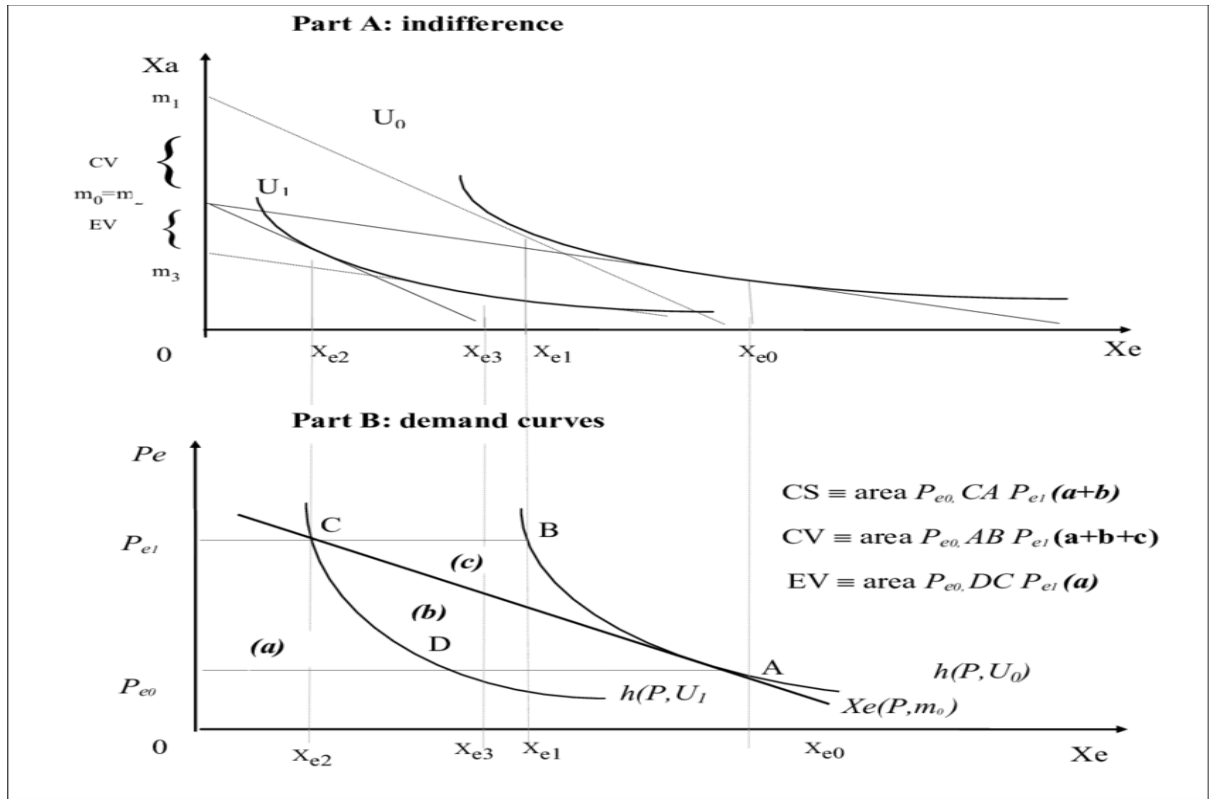
In equation 11, $c(u,p)$ is the cost or expenditure function, $\psi(m, p)$ is the indirect utility function, p^0 is the initial price vector, p^j is any other price vector, m^0 is initial income and m^j is subsequent income. Equivalent variation is the amount of money one has to give to a consumer so that she could attain the utility level possible with the new prices and income while facing base prices and only having base income. Equivalent variation can be thought of as the amount of money the consumer would accept in lieu of the price change. Equivalent variation measures the difference in attaining the initial utility level at the initial and subsequent prices. Equivalent variation is negative if the price and income change would make the consumer worse off.

2.1.1.3. Consumer Surplus

The concept of consumer surplus was developed in 1844 to measure the social benefits of public goods such as national highways, canals, and bridges. It has been an important tool in the field of welfare economics and the formulation of tax policies by governments.

In general, a consumer surplus happens when the price consumers pay for a product or service is less than the price, they're willing to pay. It's based on the economic theory of marginal utility, which is the additional satisfaction a consumer gains from one more unit of a good or service. Consumer surplus always increases as the price of a good falls and decreases as the price of a good rises.

Figure 1: Form of Welfare Chane Measure



2.1.2. Solid Waste Management Concept

During the twentieth century, rapid urbanization virtually transformed the world into populations of cities and towns facing similar environmental problems (Smith, 2010). Cities pose a challenge to the environment due of the growing volume and complexity of waste produced. Solid waste generation has become a growing environmental and public health issue around the world, predominantly in developing countries (UNEP, 2013).

The issue of solid, liquid, and hazardous waste management in Africa has arisen due the continent's rapid urbanization. The speedy growth of towns, populations, and metropolitan areas is a significant part of urbanization. As a result, collecting and handling solid waste in this time has turn into a significant challenge for countries with densely populated populations, resulting in significant waste production (Zerbock, 2003).

Solid wastes products that have little value to the individual. Names like Garbage, trash, and refuse are all synonyms for solid waste and are usually used interchangeably (Zhu et al., 2008). Industrial and commercial waste, municipal trash, sewage sludge, wastes from

agricultural and animal husbandry operations and other related practices, demolition wastes, and mining residues are all examples of solid wastes (UN, 1997, p. 69).

As described SWM Proclamation No. 513/2007, SWM refers the gathering, transporting, storing, recycling or dumping solid waste into the disposal site. The primary goal of SWM is to verify that the world is healthy and safe for humans by properly disposing of waste.

Municipal solid waste (MSW), also known as urban solid waste, is a form of solid waste whose meaning varies depending on the country and academic field. Household waste, commerce and trade waste, office buildings, organizations and small businesses waste, garden waste, litter container contents, market cleansing and street sweepings waste are all included in MSW. However, municipal drainage networks and treatment waste, and municipal building as well as demolition waste, are not included in MSW (OECD, 2008).

In Ethiopia, municipalities were primarily responsible for SWM services, resulting in insufficient service provision as evidenced by a lack of proper collection, weak sanitary facilities, poor planning and coordination. An influx of people moving to urban areas exacerbates these issues (Edmealem, 2013).

2.1.3. Solid Waste Management Processes

The key elements in SWM process include: waste generation, storage, collection, processing and recovery, transfer and transport and final disposal.

Waste generation: refers to any activity in which items are marked as no longer useful and are either discarded or collected for removal (Momoh and Oladebeye, 2010).

Storage: Tchobanoglous et al. (1977) define storage as the process of storing solid waste until it is collected. This may be a skip or dustbins, and it should not be thrown away carelessly. They say that storage is the most important factor due to aesthetic considerations.

Collection: The element of collection involves not only the assembling of solid waste, but also the transportation of waste to the place where collection truck is available (Tchobanoglous & Kreith, 2002). Bins and also containers are frequently used in Ethiopia, where they are placed at strategic locations and then transported by trucks.

Transfer and transport: it involve two steps: (1) transfer of solid wastes from the smaller assortment vehicle to the larger transport instrumentation and (2) then the solid waste transport to the final disposal place (Tchobanoglous and Kreith, 2002).

Processing and recovery: The components of processing and recovery, include all the abilities, equipment, and facilities used to improve the performance of another well-designed elements as well as to recover materials that are useful from solid wastes (Tchobanoglous et al., 1977). Separation operations created to extract useful resources from mixed solid wastes shipped to handover stations or SW recycling plants during the recovery process. As a result, it is considered that the solid waste collected contains certain useful objects and services, which are removed during the recovery stage.

Disposal: is the final stage of SWM where it is dump at a landfill site or any other designated place.

2.1.4. Problems of SWM in Developing Countries

The problem of SW generation is wide thought to be increasing across the planet because of enhanced population, enhanced industry and enhanced urbanization (UNEP,1994). Developing countries, on the opposite hand, face totally different SWM problems and composition than developed countries (Zerbok, 2003).

In their discussions, Zebrok (2003) as well as Zurbrugg and Schertenieib (2002) covered a wide range of issues in the arena of SWM. According to them, issues in SWM can be clarified by insufficient service coverage, organizational inefficiencies, ineffective hazardous waste management, and low recycling activity utilization. Ogawa (2002) however, grouped problems SWM into economic, technical, institutional financial and social constraints.

SWM in urban places of emerging countries have is given a little urgency, according to Ogawa (1997). As a result, governments allocate relatively little funding to the SWM sector, and resource mobilization programs are insufficient, resulting in low levels of public health as well as environmental service provision.

This is especially serious issue that the taxation system of the government is underdeveloped. Users in low-income areas find it difficult to pay for such SWM costs,

although that insufficient financial infrastructure can be funded by user collection services (Puopiel, 2010). Due to this, many scholars have indicated scarcity of funds is the chief problem in controlling SWM (Cointreau, 2001 and Majale, 2011).

Technical constraints, according to Ogawa (1997), are includes insufficient human resources at local and national stages and also lack of technical expertise required for SWM planning and activity, especially in most developing countries.

Local governments in developing countries import technology from developed countries, according to Zurbrugg (2002) and Majale (2011). This has a significant effect on the imported technology's service and maintenance. This is because the developing countries' lack of technical experience in terms of how to operate and sustain imported technology.

Another aspect that contributes to the inefficiency of imported technology is that it is usually built to function in areas with different geographical characteristics than where it is used. Also, Ogawa (2002) noted inadequate of grand plans for SWM at local and nationwide levels as well as low priority for research and development activities have aggravated the problems of SWM.

According to Ogawa (1997), SWM is normally handled various national agencies. However, Ogawa (2002) went on to say that in developing countries, cooperation between the various bodies responsible for SWM is lacking, as are different legislations regulating SWM that are clearly fractured.

According to Zurbrugg (2002), organizational inefficiencies of solid waste systems, such as insufficient institutional management capability and inadequate technologies, are also a concern for successful solid waste management implementation in developing countries. Both emerging and developed countries face social challenges in aspect of SWM. In developed countries, however, the issues are more complicated. "Social status of SWM staff is usually ranked low," according to Ogawa (2002), "a condition that can be clarified by people's negative perceptions of work that requires the handling of unnecessary material.

Where there is insufficient sanitation infrastructure, human excreta may mix with municipal SW, adding to the complexity of the characteristics. Uncollected waste can stop drainage systems and creating suitable environment for malaria diseases (UN Habitat, 2010).

According to Majale (2011) in developing countries there is an existence of low degree of assembling of solid waste which has led to people adapting waste disposal methods such as burning and open dumping. These initiatives are often linked to environmental health issues such as respiratory diseases caused by smoke from burning waste, contamination of the atmosphere (solid, ground & surface water and air) and other environmental health issues.

2.1.5. Solid Waste Management in Ethiopia

In Ethiopia's 1995 constitution and the SWM proclamation No.513/2007, waste management is listed the foremost country's environmental rights. All people have the right to live in a safe and healthy climate, according to Article 44 No.1 of the constitution. Furthermore, article 92 No.1 of the Constitution specifies “the government of Ethiopia shall endeavor to safeguard that wholly Ethiopians living in a safe and healthy environment” (FDRE, 1995).

By encouraging active community engagement, the SWM proclamation No. 513 seeks to mitigate the detrimental effects of bad SWM while also enhancing the benefits of SWM. Its intentions for urban local governments to develop SWM action plans to encourage community engagement in SWM. According to the proclamation, local governments should establish favorable conditions to encourage investment in the provision of SWM services (FDRE, 2007). This international convention specifically also aims to prevent developed countries from transferring hazardous waste to less developed countries.

The country has also ratified multilateral environmental agreements. In 1989, the country approved Basel Convention which conveys Control of Transboundary Hazardous Wastes Movements and their Disposal. Secondly, in 1998, FDRE accepted Rotterdam Convention which concerned on certain unsafe Chemicals & Pesticide in International Trade. The next conventions in 2001 named Stockholm Convention that was emphasis on Organic Pollutants waste international conventions.

The common objective of the three international conventions is defending human health as well as environment from both harmful chemical compounds and wastes. The Basel Convention has an objective to keep human health and then the environment via obligating its parties to properly manage hazardous as well as other wastes in a way that capable of

reducing environmental damage and reducing the movement of hazardous and solid waste between countries (UNDESA, 2011).

The Rotterdam convention aims to safeguard environment & human health by promoting collective responsibility in addition cooperative efforts amongst parties in global trade of some hazardous chemicals. The purpose of Stockholm Convention was protecting environment & human health from highly hazardous, long-lasting chemicals by limiting and ultimately removing their use, storage, production, release and trade (UNDESA, 2011).

SWM is a sector in Ethiopia that needs a lot of focus. The nation has working to guarantee its residents have access to appropriate collection solid waste and disposal. However, due to the increasingly increasing population of urban and inadequate coherent national SWM policy and a city-level action plan for integrated waste management policies, local governments in the country's urban centers face challenges and are unable to handle the created solid waste (UNEP, 2016).

In Ethiopia, open burning also dumping are the primary methods of managing urban solid waste. Every country's major cities and towns, there is at least one unmanaged landfill. Up to 43% of SW in urban areas around the country is gathered and disposed in unmanaged landfills. The leftover waste is dumped in open fields and left on the streets. The waste sector contributes 3% of the total greenhouse gas emissions in Ethiopia (MEF, 2015). Since they are not well planned and maintained, landfills are becoming a significant source of greenhouse gas emissions. Furthermore, several rivers have been contaminated because of production of urban and industrial waste (UNEP, 2016).

2.1.6. Economic Estimate of Environmental Goods/Services

Economic valuation is the process of assigning monetary prices to non-marketed products and services. If a product contributes to human well-being and the service too, it has economic benefit. A non-marketed product or service's beneficial contribution to an individual's well-being, alternatively, is measured by whether it satisfies his or her preferences (Pearce & zdemiroglu, 2002).

The number of non-use and use values able to use to calculate the overall economic value of these goods and services (Pearce & zdemiroglu, 2002; Lee et al., 2010). Use values reflects

that the values associated with the depletion of resources or the usage of environmental characteristic by individuals (Lee et al., 2010; Gunatilake, 2003). Direct, indirect, and choice use values are the three types of use values.

There are two categories of environmental valuation strategies employed to estimate economic worth of non-marketed goods/services: these are stated preference and revealed preference. The revealed preference methods are categorized into travel expense, hedonic property, hedonic pay, and averting behavior and are based on real or observed behavior of individuals as revealed in the market. Proxy economies are needed to value non-marketed products and services in revealed preference.

Respondents are asked to assign importance to environmental or non-marketed products/services in carefully designed surveys using specified preference methods, which are rooted on hypothetical market. Option trials, contingent ranking, paired comparisons, and contingent rating are examples of contingent valuation and choice modeling techniques (Mendelsohn & Olmstead, 2009; Pearce & Özdemiroglu, 2002 and Bolt et al., 2005).

The methods of revealed preference and stated preference each have their own set of benefits and drawbacks. To calculate use values, both the revealed preference and SP methods can be used. Unlike revealed preference, SP approaches like contingent valuation and option modeling are the most commonly used methods for determining non-use value. In reverse, revealed preference, cannot be applied to calculate non-use values. When there is no proxy market for valuing non-marketed products and services, stated preference is the only alternative (Pearce & zdemiroglu, 2002; Hanemann, 1994; Perman et al., 2003).

While in stated preference, unlike RP, it is possible to evaluate the factors that underpin a given environmental valuation (Pearce & zdemiroglu, 2002). The option among choice modeling (CM) and contingent valuation (CV) techniques such as choice experiments (CEs), according to Johnston et al. (2017), is nuanced and should be focused on respondent expectations of the change being valued, the decision objective being considered, and the type of information required.

When deciding between CVs and CEs, three key factors should be taken into account: First, how will the shift in value impact basic features of the item or the item as a whole, and what are the decision-makers' knowledge requirements? Second, do respondents consider value

the shift in terms of individual characteristics or as a whole? Third, how does the information demonstration format influence respondents' understanding of the item to be valued? (Johnston et al., 2017).

Option modeling techniques, which are preferred and applicable when different characteristics or attributes of a good/service must be valued (Pearce & zdemiroglu, 2002), may avoid the response difficulties that CV encounters. Where an object cannot be easily explained in terms of attributes or characteristics, the CV approach is preferred to estimate values. It has been widely used for the valuation of non-marketed products and services (Johnston et al., 2017).

2.1.7. Contingent Valuation Method

The idea of CV appears to have started in 1947, when Ciriacy-Wantrup suggested using surveys to ask people to state economic values for products that aren't exchanged in markets, such as public goods (Jacobsson & Dragun, 1996). Davis, using surveys concept valued public goods, which was performed the first known empirical CV analysis in 1961. (Mitchell & Carson, 1989). In the Maine forests, he used a CV questionnaire to measure the value of outdoor recreation (Davis, 1963).

CV employs survey methods to determine the value of products and services that never sold in markets with no prices. This approach entails asking a randomly chosen sample from the population if they are WTP or support a clearly specified change in the provision of a good or service, or whether they are ready to oppose the change (Bolt et al., 2005). In-person interviews, mailed questionnaires and telephone interviews are the three main forms of survey administration. Each form of survey has advantages and disadvantages.

In spite of that face-to-face surveys are more costly than other types of surveys, SP practitioners favor them because of benefits such as higher response rates, the ability to use visual aids, and the interviewer's ability to inspire and respond to the respondent's questions (Pearce & zdemiroglu, 2002; Gunatilake, 2003). Payment card, bidding game, open-ended, and single-bounded or double-bounded dichotomous option are the four most commonly used value elicitation formats in CVM.

The open-ended approach is the oldest and most widely used method and hence respondents are requested to indicate their WTP for product/service being valued. Respondents are questioned to indicate the WTP sum that is shown on the card with a visual help in the payment card case. As a result, respondents mark the sums they are WTP with a tick and cross the amounts they are not WTP.

Another value elicitation format is the bidding game, in which participants were asked to show their WTP iteratively until a yes answer changes into a no answer and vice versa. In the dichotomous or discrete option format, randomly assigned prices for the non-marketed good/service in question are allocated to each respondent, and then each respondent gives a yes/no reply for the stated WTP sum in single-bounded format, and the respondents of the survey are also asked higher or lower bids in double-bounded format (Bolt et al., 2005; Gunatilake, 2003).

Surveys using CVM, according to Carson and Hanemann (2005), are divided into six parts. The first segment is an overview section that discusses the study's general subject and sponsor. The second segment includes questions about respondents' previous experience and attitudes toward the good or service. The third section covers the presentation of the CV scenario, including the study's goals, how the project or study will be executed and paid for, and what will happen if the current study is not implemented.

Questions regarding the respondent's WTP or willing to accept (WTA) for the good or service are asked in the fourth segment. The fifth segment focuses on questions that can be employed to assess how well respondents comprehended the situation. Finally, in the sixth segment, demographic questions were raised. The design of a CV study can be broken down into four stages. The first phase is setting up a hypothetical demand for a non-marketed product/service. The second footstep is to gather bids through a diversified survey method, including mailed questionnaires, telephone interviews, and face-to-face interviews.

The third phase is to present the findings, such as average WTP or WTA, and the factors which affect WTA or WTP. The final step is to examine CVM exercise, which involves determining how effective the application of CV has been (Bolt et al., 2005).

During the CV survey, respondents can offer biased answers. During the CV survey, various types of possible biases can arise (Tietenberg & Lewis, 2012; Hussen, 2004). The first is

strategic bias, which occurs when respondents provide biased responses in order to affect a specific outcome. Furthermore, respondents may be unable to answer survey questions or state their actual WTP. Additionally, respondents may be hesitant to answer survey questions or state their actual WTP for new proposed project for strategic reasons, such as a free-rider scenario.

If respondents believe the proposed project will be introduced and they want to profit from it by assuming others will pay, they will understate their true WTP for the non-marketed product or service in question. This is known as the free-rider issue. The second is information bias, which occurs when respondents are compelled to value non-marketed products or services for which they have little to no knowledge or experience.

The amount and quality of information given to respondents, and the way the questions are worded, have an effect on their WTP for the product/service in question. The third bias happens when respondents' WTP answer is influenced by the method of evaluating the initial bids. The fourth is hypothetical bias, which occurs when the hypothetical market is not well-designed, resulting in a disparity between hypothetical responses and real payments.

Respondents were required to understate or overstate their accurate WTP due to the incorrect payment vehicle range. The fifth prejudice is difference between WTP & WTA. In the case of WTA reimbursement and WTP for a non-marketed product or service in question, respondents state a higher and lower monetary value.

2.2. Factor Affecting Willingness to Pay

In Nigeria, Ojo et al (2015) used a multiple regressions model to examine how to improve household solid waste management. Their study found that household expenditure, age, environmental awareness, and income are positively and significantly related with households' WTP for waste disposal in the region, according to the report. However, the size of household is a negatively and significantly related with households' willingness to pay (WTP).

Ojok et al., (2015) used a logit linear model to analyze households' will WTP for improved municipal SWM in Uganda. Sexes, marital status, age, household size, migration status of

household, income level and education level respondents are all determinants of WTP, according to the report.

Bhattarai (2015) examined households' WTP in Banepa Municipality, Nepal, in order to boost SWM. To elicit WTP, the researchers used a cross-sectional sample of 220 randomly selected households and single-bounded dichotomous CVM. According to the study's findings, 51 percent of households receive SW collection service, and 83 percent of all respondents of study are willing to take action to boost SWM with mean WTP of USD 1.69 household/month and Nepalese Rupees 160 (USD 1.63) median WTP. Logit model also applied analyze the factors which impacts household WTP. According to the regression results, the respondent's age, household size, level of education, and monthly household income all have positive and important effects on the households' WTP for new improved SWM. While the respondent's gender and current waste collection service had a negative and substantial impact on WTP for new improved SWM.

Muhammed et al. (2016) investigate factors which influence households' WTP for new improved SWM in Ethiopia, Jimma Town as a case study. The study applied inferential and descriptive analysis. The majority of respondents (88.5%) expressed concern about environmental protection and safety, according to the results. Fifty-six percent of respondents were dissatisfied with the current SWM scheme. The majority number of respondents (83.5%) is WTP more for better door-to-door waste collection. Further, the findings showed that, among other things, household income, house ownership, and waste amount produced by households all have a major impact on households' WTP for new improved SWM.

In the Tamale municipal part in Ghana's northern province, Alhassan et al. (2017) investigated households' WTP for new improved SWM service. CVM was used to distinguish households' WTP from 120 respondents chosen via a three-stage sampling process. To elicit respondents' WTP, open-ended and iterative or bidding games value elicitation formats were used. In order to perform a survey, this study used a direct face-to-face interview. Ordered probit model used to investigate determinants of household WTP in order to enhance SWM service in the study field. According to the study's results, approximately 76.7 percent of respondents were WTP between GHS 2 and GHS 25 per

month for enhanced SWM service. The gender, age, marital status, income, and household education were positively related and have important effect on WTP.

Maskey and Singh (2017) researched households' WTP in Nepal's Gorkha municipality in order to enhance waste collection operation. CVM was employed to elicit WTP from 401 households selected by using sampling-stratified technique. This survey was undertaken using a face-to-face interview process, with value elicitation-open-ended format applied to elicit the MWTP. The study used the logit and Tobit regression models in their research. The study's results showed that 61% of respondents were WTP more for new improved SW collection facilities, with an average monthly WTP of Nepalese Rupee 73.38 (0.72 USD). Monthly household income, household head education, environmental awareness, and collection of waste facility all had a positively and significantly impact households' WTP for new better collection of waste facility, according to the logit regression results. Tobit model showed that wages, environmental awareness, and collection of waste service were significant and positively affect households WTP.

Birara and Kassahun (2018) conducted a study in Bahir Dar, Ethiopia, on urban households' demand for improved SWM service. This study used a double-bounded CVM accompanied by an open-ended query to evoke the households' WTP for new better SWM services. Focus group discussions, Face-to-face interviews and main informant interviews were also used to gather information from 350 households chosen using a multi-stage random sampling methodology. The determinants of households' WTP were investigated using ordered probit regression model in order to enhance SWM services. According to the study's results, 86.3 percent of respondents were able to pay for new improved SWM facilities, with WTP of monthly average ETB 13. In addition, the model revealed that the household head's educational level, monthly income, getting to SWM service, disease outbreaks, the number of children, and the waste amount produced per week all had a positive and important impact on households' WTP. However, household gender had a negative and substantial impact on WTP, while female- household heads are able to pay more than male-headed households.

In Nairobi, Kenya, Ndunda and Muia (2018) conducted a report on household WTP for enhanced SWM to minimize air pollution. WTP was elicited from a cross-sectional survey

of 114 households in the Dandora dumpsite areas of Dandora, Babadogo, Kariobangi North, and Korogocho using CVM and face-to-face interviews. In order to boost SWM in the Dandora dumpsite, the researchers used a double-bounded model to investigate the determinants of households' WTP. According to the study's findings the most of respondents (78.95 percent) was WTP for better SWM, with an average WTP of Kenyan Shilling 237 per month (USD 2.8). The results obtained from double-bounded model revealed that WTP of household was positively and significantly influenced by education, household size, and income. Furthermore, the household head's gender had a negative and important influence on WTP for better SWM, suggesting that households led by female have less possibility to pay than male-headed households.

Getachewa and Fufa (2018) conducted study in Ambo town on the factors influencing households' WTP for new improved SWM services. To calculate the average WTP and define factors influencing households' WTP decisions, probit model was used. The households average monthly WTP is Birr 29.55, according to the data. The probit model also revealed that solid waste amount produced, household perceptions of SWM head, monthly income, marital status, educational level and sex of household have significant factors in determining a WTP. Moreover, Tobit model was employed to analyze factors which affect the amount of money that households are able to spend. According to the model's findings, solid waste amount produced, household perception, family size, total income and educational level are all significant variables in explaining the MWTP.

Tamru (2019) conducted a study to assess Dilla residents' WTP for enhanced municipal solid waste management. To evaluate the factors that affect a household's WTP, the researchers used both Tobit and probit models. According to the report's findings, the city has a serious MSWM problem. The probit regression and tobit regression models displayed that income of household and respondents' perception on the impact of poorly controlled solid waste have positive and substantial effects on households' WTP and households' WTP response for initial bids. The respondents' age and also satisfaction with the present system variables have major positive and negative effects on the households' WTP response to the initial bids respectively. The solid wastes amounts produced by households, household strategy, and period variables all have a positive and necessary impact on household MWTP.

For a household, the mean WTP values acquired from double-bounded and open-ended value elicitation formats are nearly ETB 12.36 & ETB 10.7 each month.

A household WTP for new improved SWM in Sub City of Gulelle, Addis Ababa was investigated by Dika et al., (2019). To evoke households' WTP for new proposed improvement in SWM service, the researcher used the contingent valuation approach (CVM). A logistic model applied to examine the data from the CVM survey. The study's findings showed that the greatest numbers of households were aware of improper SW disposal and its problems, and that they were (78%) WTP for the wastes they produced. Furthermore, we discovered that a large majority of respondents (76%) were eager to endorse potential improvements in residential SWM. Furthermore, the monthly minimum of ETB 5 and maximum of ETB 100 with average monthly WTP is ETB 21. Finally, the logit regression analysis findings revealed. Finally, logit regression analysis displayed that sex and household size had an important impact at 1% and 5% respectively.

Ayenew et al., (2019) looked into urban population WTP for new better SWM in Shashemene town. The household's WTP was examined for new improved SWM by Double Bounded-Dichotomous Choice technique. Logistic regression model was employed in the analysis. According to the econometric results the total and average WTP of double bound elicitation technique were 16 USD//year per household & 590,473.22 USD/year, respectively. While the total and mean WTP obtained from the open-ended elicitation method was 14 USD/year and 524,306.8 USD/year. When using method of double bound elicitation, the mean annual WTP for SWM was higher than when using the open-ended elicitation method. The age, size, income, education, and solid waste amount produced by households, and the bid value, were all important factors in improving SWM.

2.3. Summary of Research Gaps

In this regard, many studies were conducted on households' WTP and SWM in Ethiopia using different methods and area focus. Study by Woretaw et al., (2017) examined households' WTP for better-quality SWM interventions in Debre Tabor town applying choice experiment method. Birara and Kassahun (2018) conducted a study on urban WTP for better SWM in Bahir Dar. Study by Getachew and Fufab (2018) examined households' WTP for better SWM facility in Ambo Town. Muhammed et al., (2016) investigate factors

influencing households' WTP for better SWM in Jimma town. Ayenew et al., (2019) looked into the willingness of urban population to pay for better SWM in Shashemene town. Tamru (2019) conducted a study to assess Dilla residents' WTP for enhanced municipal SWM.

In relation to household's WTP and SWM service in Addis Ababa city, different studies were conducted using different methods and area focus. Aklilu (2002) examined the extent of SWM problem and households' WTP in connection with SWM services in Addis Ababa. Also, Solomon (2007) identified households' WTP for SWM in Yekka Sub City. Likewise, Seleshi (2007) investigated households' WTP for better SWM in common building residences in Addis Ababa. Further, Dika et al., (2019) investigated households' WTP for better SWM in Sub-city of Gulelle, Addis Ababa.

This reflects that existence of inadequate recent empirical evidences on households' WTP and SWM centering on Addis Ababa city even though the problem of SWM is still unresolved. Concurrently, there is lack of adequate empirical evidence on the issues concerning to households' WTP for improved SWM particularity undertaken in Kolfe Keraniyo Sub-City. This study intends to add to the existing literature to households' WTP for SWM service in Kolfe Keraniyo Sub-City, Addis Ababa city.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Description of the Study Area

Kolfe Keranio sub-city, which is the focus of the study, is one of the eleven sub-cities of Addis Ababa, the capital of Ethiopia. Kolfe Keranio sub-city is located in the western part of the city between 8° 57' 00'' North and 9° 05' 24'' North latitude and between 38° 39' 36'' East and 38° 43' 12'' East longitude. It is about 9.6 kms away from the center of the city and the total area of Kolfe Keranio sub-city is estimated to be 6400 hectares. Kolfe Keranio, also spelled Kolfe Keraneo.

It has an estimated 546, 219 population and from this 220,859 are males and 235,360 are females. It consists of 15 Weredas. Kolfe Keranio sub-city was selected as an area of this study because it is the most populous Sub-City among other Sub-Cities of Addis Ababa. It is also the sub-city where the problem of solid waste management is prevalent

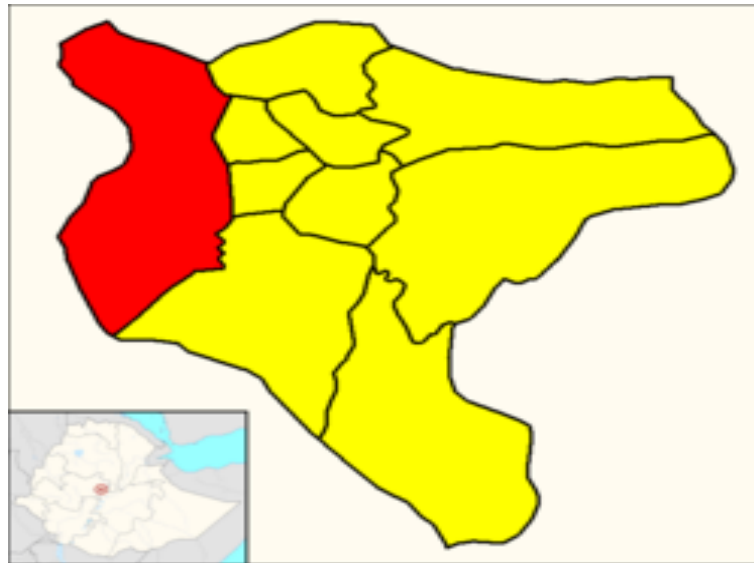


Figure 2: Kolfe Keranio Sub City, Addis Ababa

3.2. Research Design

The research applied cross sectional survey design where data collection was confined to a single time period for each household head. This because, the study used population-based surveys to show the existing condition of SWM practices as well as to portray the socio-demographic factors in connection with households' WTP in the context of Kolfe Keraniyo Sub-City. A cross-sectional survey design, according to Creswell (2005), collects data in order to form inferences about the population of universe at certain point in time.

3.3. Research Approach

To achieve the aforementioned objective this research employed quantitative research approach. According to Creswell (2005), quantitative research approach useful for developing the cause-effect relationship between variables that yield statistical data. Hence, in this study quantitative method applied to identify significant determinates of households' WTP for new proposed SWM service in Kolfe Keraniyo Sub-City, Addis Ababa.

3.4. Data Sources and Types

In this study both secondary and primary data sources were employed. Primary data collected via questionnaires that were administered to heads of the households. Moreover, the study also used contingent valuation method (CVM) to examine household's WTP for the new proposed improvement in SWM service. Furthermore, the researcher employed secondary data such as relevant journal articles and research findings to elaborate this research finding.

3.5. Target Population and Sampling Size

Currently, Addis Ababa city has 11 sub cities. Based on the 2007 National Census Data (2017/18), Kolfe Keraniyo Administration is the most populous Sub-City among other Sub-Cities. It has a total population of 546,219 and from this 220,859 are males and 235,360 are females. It consists of 15 Weredas.

Since it is challenging to gather data from whole households of the Sub-City, the study used sample data. In this regard, Saunders et al. (2003) justified that sample size ensures an

appropriate representation of the defined target population. Based on Kothari (2004), the formula to determine the sample size (n) of finite population is given as;

$$n = \frac{Z^2 \cdot p \cdot q \cdot N}{e^2 (N-1) + z^2 \cdot p \cdot q}$$

Remarking that N represents the total number of populations in the sub city of Kolfe Keraniyo, n represents sample size, Z represents standardized normal at 95% confidence interval equal to 1.96, p represents the sample proportion, P represents 0.5, q represents 1-p and e represents allowable error (0.05). Therefore, the calculation of the sample size is shown below.

$$n = \frac{(1.96)^2 (0.5) (0.5) 546,219}{(0.05)^2 (546,219-1) + (1.96)^2 (0.5) (0.5)}$$

$$n = \frac{524,588.7276}{1,366.5054}$$

$$n = 383.8907 \approx 384$$

As a result, based on the formula this study needs a sample of 384.

3.6. Sampling Technique

There are several sorts of sampling techniques to select real representative of population of the study. The Sub-City comprises 15 Weredas. So as to make homogenous for primary data collection purposes the researcher taken these 15 Weredas as strata. Then, from these Weredas, eight (8) Weredas were randomly selected to gather data from the households.

Then, simple random sampling was applied to select sampled households from each of selected Wereda or stratum. Moreover, the researcher allocated equally the needed sample size for each of the selected Weredas due to lack of accurate and compiled data on the number of household head at each Weredas in the Sub-City.

3.7. Data Collection Methods and Procedure

In this study, the researcher gathered the required data from households in the selected Weredas via structured interview questionnaire. The study employed contingent valuation techniques (CVM) to produce a precise analysis on a households' decision whether or not WTP for new and improved SWM service. The method was chosen because it allows for easy data collection, very simple to comprehend and interpret.

The fundamental principle concern to use this data collection method is that people have preferences for environmental goods and services and these preferences are hidden, but can be translated in monetary units. As a result, the WTP values were elicited using CVM. During the interview, respondents were freely to answer the open-ended questions while indicating the WTP for the new and improved SWM service. Despite its shortcomings, as opposed to other environmental valuation, CVM was used in this study because of its ability to capture use and non-use values.

In view of this, the questionnaire organized based on the study objectives and it comprises four sections. The first section of the survey questionnaire portrayed the existing situation of SWM service in Kolfe Keraniyo Sub City. The second part revealed the valuation scenario for new and improved urban household SWM service. The third section includes CVM linked with WTP questions for the given scenario. Lastly, the final part of the CVM contained the general demographic information of the sampled respondents.

To collect the data from the respondents' four enumerators were participated. The enumerators were also selected based on their familiarity with the selected survey areas. The researcher supervised the daily activities of the data collection and provided feedback to the enumerators on daily basis.

Furthermore, after the study data were gathered the study performed data coding, entry, editing and cleaning activities then after STATA version 12 was applied for processing and analyzing of the results. Finally, various empirical evidences were also triangulated to support the primary data results.

3.8. Contingent Valuation Scenario

The ultimate intention of this survey is to provide an effective SWM service for the residents of the city to create a clean environment. Hence, the main hypothetical market scenario that was described to the respondents in order to help them to elicit their WTP for new and improved SWM service in Kolfe Keraniyo Sub-City expressed as follows

Currently, SW collection workers employed by Addis Ababa solid waste agency are collecting solid waste generated from all household's door-to door twice a week. And you are paying for the waste collection service a monthly fee with water bill.

Suppose a decision is made to provide new improved urban SWM service especially SW collection service for the residents of Addis Ababa city. The municipal agency will prepare different official plastic bags for collection attached with density (kgs) and seated price. Then the municipal agency provides the official plastic bags to the SW collection workers to use for household door-to-door SW collection.

At the time of door-to-door collection, the workers take the household's bin garbage and transfer into official plastic bags. This enable them to know the density (kgs) and price. Then, the households will be obligated to pay for SW collection service as per the generation density which will be indicated in the official plastic bag.

At household level, the project is designed to avoid infrequent coming of collection workers and to maintain the schedule all the time. Besides, it also helps the municipal to minimize budget insufficiency. For instance, the municipality has allocated Birr 600,000 million for collection service in 2013 E.C (2020/21) fiscal year. In the same year, AA Water & Sewage Authority collected service fee of Birr 95 million. Besides, Addis Ababa town administration subsidized Birr 120 million for Addis Ababa SWM agency. Thus, the budget gap becomes Birr 385 million and this creates burden for the agency in looking for other sources of finance.

Therefore, this needs the involvement of residents of the city in newly designed SW collection service. If attention is not given to the management of SW amount generated in the city, poorly managed SW collection will continue to create negative impacts on the environment, economy and human health.

Dear respondents, this form of service will be delivered in a sufficient way if you agree to share costs related to urban SWM with the municipality agency, and if you are WTP the seated monetary values per solid waste density whenever the collection is made. Hence, every household will pay different urban SWM service fee.

3.9. Methods of Data Analyses

The study carried out descriptive as well as inferential analysis with the aid of STATA 12 software. As a result, the study applied frequency, minimum, maximum, percentage and mean. The data received from CVM survey was investigated by using econometric model. Tobit model was employed to identify variables which influence households' WTP for new improved SWM service. Finally, very important assumptions of Tobit model were used to distinguish the applicability of the model.

3.10. Model Specification

The Tobit model or censored regression was first suggested by James Tobin in 1958. All negative values in this model are mapped to zeros (Verbeek, 2004). This model is an extension of a probit model that expresses the observed response y_i as an underlying latent or unobserved variable y_i^* that meet the assumptions of classical linear regression model (Gujarati, 2003 and Wooldridge, 2012). This model applied to analyze factors which influence WTP of households' using the response of the respondents via structured questionnaire.

In this case, dependent variable or WTP is not fully observed as well as censored at zero values and hence ordinary least squares is unable to be applied, and hence the researcher applied a Tobit model for the observed MWTP: The standard tobit model can be formulated as follows.

$$MWTP_i^* = \beta_0 + \beta x_i + \varepsilon \sim N(0,1)$$

$$MWTP_i = MWTP_i^* \text{ if } MWTP_i^* > 0$$

$$MWTP_i = 0 \text{ if } MWTP_i^* \leq 0$$

Then the Tobit model employed in this study is specified as follows:

$$MWTP = \beta_0 + \beta x_i + \varepsilon \sim N(0,1)$$

$$MWTP = \beta_0 + \beta_1 GEN + \beta_2 AGE + \beta_3 EDU + \beta_4 HHS + \beta_5 INC + \beta_6 SWG + \beta_7 FC + \varepsilon$$

Where: MWTP: Maximum Willingness to Pay

GEN: Gender

AGE: Age

EDU: Education

HHS: Household Size

INC: Income

SWG: Solid Waste Generation

FC: Frequency of Collection

β_0 : Constant,

β_1 β_7 : Coefficients of the independent variables,

ε_i is error the term.

3.11. Description of Variables and Measurements

3.11.1. Dependent Variable

Households' WTP response for new improved SWM is used as dependent variable.

3.11.2. Independent Variables

In this study area, different factors can affect households' WTP for new improved SWM services. Accordingly, explanatory variables were used for Tobit model selected based on significant variables used in other studies conducted on households' WTP for improved SWM. Accordingly, Table 3.1 summarizes the variables description and unit of measurement of the explanatory variables.

Table 3.1: Definition of Variables, Measurements and Expected Sign of the independent Variables used in the Tobit model

Variable	Variable description	Unit of Measurement	Expected sign
Gender	household head-gender	1 if male 0, otherwise (female)	+
Age	Household head age	Number of years	+
Education level	Educational attainment of household head	0=Illiterate 1=Primary school (grade 1-8) 2= Secondary school 3= Certificate to College diploma 4=Degree and above	+
Household size	Total number of members living in a single household	Number of individuals within the households	-
Income	Household total average monthly income.	1=Birr0-3,000 2=Birr 3,001-6,000 3=Birr 6,001-9,000 4=Birr 9,001-11,000 5=Above 11,000	+
Solid waste generation	Solid waste amount generated by the household	Solid waste in sacks (50 kg) /month	+
Frequency of collections	Frequency of solid waste workers collection service	Numbers week or weeks	+

3.12. Validity and Reliability Test

In this study, content validity was applied by consulting Advisor and experts. In order to improve the instrument, the research advisor and these experts looked at every question in the questionnaire and forwarded comments to ascertain that the questions can answer research objectives.

3.13. Ethical Consideration

Participation of respondents was strictly on voluntary basis. Participant respondents are fully notified about the intension of the study. Actions were taken to ensure the freedom and each individual participating in the study was treated with respect. In addition, participants were notified that the information they provide shall be kept confidential and not disclosed to anyone else without their consent.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

This chapter contains results and discussion of data analysis. The findings of this research hold key headings: Response rate, Socio-economic information, Descriptive analysis and Tobit model analysis are presented below.

4.1. Response Rate

From the total questionnaires distributed (384), 362 were appropriately returned with the rate of 94.3%. Based on this response rate (94.3%) the next analysis was carried out.

4.2. Respondent's Socio-Economic Information

This section sought to present the respondents relevant profile information related to gender, education, age, family size, number of job holder, and monthly income.

Table 4. 1: Respondents' By Gender

Variable	Description	Frequency	Percentage
Gender	Male	220	60.8%
	Female	142	39.2%
Total		362	100%
Income	0-3000 Birr	104	28.8%
	3001-6000 Birr	75	20.7%
	6001-9000 Birr	80	22.1%
	9001-11000 Birr	74	20.4%
	above 11000 Birr	29	8.0%
Total		362	100%
Education	Illiterate	18	5.0%
	Primary school	30	8.3%
	High school	67	18.4%
	College diploma	123	34.0%
	BA/BSC degree	124	34.3%
	MA and above	-	-
Total		362	100%

Source: Survey Data, 2021

From the data presented in table 4.1, most of the respondents of this study were male 220 (60.8%) and the remaining respondents were female 142(39.2%). This specified that the greatest participants of this study were male household heads.

As described in the table 4.1, most of the participants (28.8%) have an income of Birr 0-3,000.00 per month which is followed by Birr 6,000.00-9,000.00 (22.1%), Birr 3,001.00-6,000.00 (20.7%) and Birr 9,001-11,000.00 (20.4%). The remaining respondents 29(8%) had an income of Birr above 11,000.00 per monthly. This implies that most of the respondents have good income so that they can afford a considerable fee for new proposed SW collection service.

In aspect of the educational status of the respondents, the highest of those respond 124(34.3%) had undergraduate degree. The remaining 34%, 18.5%, 8.3% and 5% attained college diploma, high school, primary school and illiterate, respectively. This implies that they can have good knowledge on the negative and positive impact of improper solid waste management on their health and environment.

Table 4. 2: Summary of Continuous Variables

Variable Description	Minimum	Maximum	Average
Age	38	75	54
Family Size	1	5	2.59
Job Holder	1	5	2.65

Source: Survey Data, 2021

Concerning the age of participants, average of the sampled respondent’s age is 54 years, minimum of 38 years old and a maximum of 75 years old. As it can be observed from the above table 4.2, the minimum and maximum number of household’s family members having a job is 1 and 5, respectively. Likewise, average workers number per household that generate income is 2.65. Further, in aspect of household size, the average household family number is 2.59 with a minimum and maximum number of household’s family members are 1 and 5, respectively.

4.3. Households Response for Current Situation of MSWM

This section sought to illustrate the existing conditions of household SWM and their response which are presented subsequently.

Table 4. 3: Households' solid waste composition

Waste Type	Frequency	Percent (%)
Wet	51	14.1
Hazardous	-	0%
Dry	311	85.9
Electronic	-	0%
Biomedical	-	0%
Total	362	100%

Source: Survey Data, 2021

Table 4.3 shows the most important solid waste compositions coming out from your household. As indicated representing in the table-2, 311(85.9%) of this study participants discharge dry waste followed by wet waste which accounted about 51(14.1%). This implies that the mass of this study participants discharges dry type of solid waste.

Table 4. 4: Solid Waste Generation-Sacks (50kgs)/Month

Minimum	Mean	Maximum
1.00	3.08	5.00

Source: Survey Data, 2021

The next question which was forwarded to the respondents was to state how many sacks (50kgs) of solid garbage is produced from their home within a month. Consequently, the survey result indicated in the table 4.4 reveals that the average solid waste produced per month by households is 3.08 sacks with a minimum of 1 sack and maximum of 5 sacks.

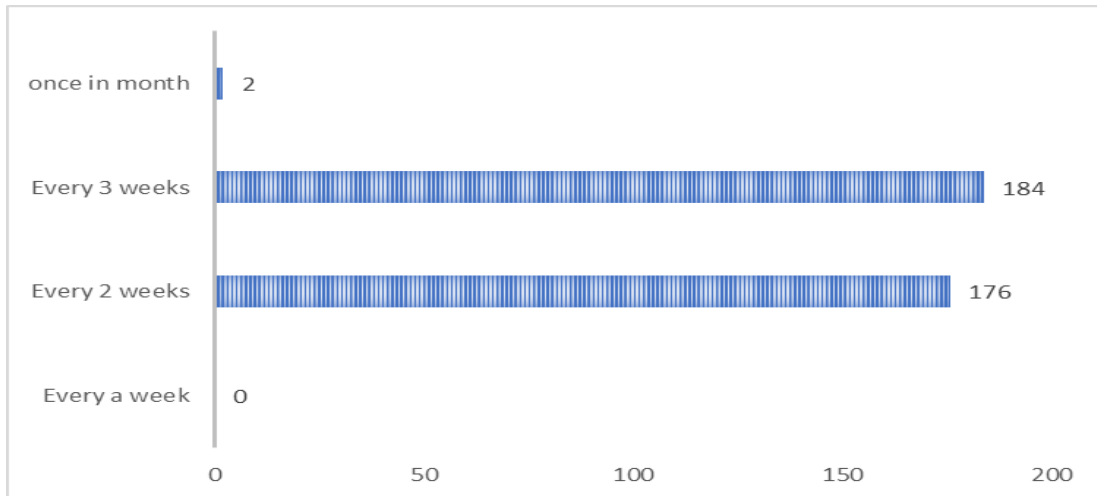
Table 4. 5: Current solid waste problem

Level of Problem	Frequency	Percent (%)
Very serious	246	68%
Serious	116	32%
Not serious	-	-
Do not know	-	-
Total	362	100%

Source: Survey Data, 2021

Households were also enquired to mention the current SWM problem in Kolfe Keraniyo Sub-City as very serious, serious, not serious and do not know. The finding in the table 4.5 discloses that 246(68%) and 116(32%) of the total respondents reflects that the existing SWM problem in Kolfe Keraniyo Sub-City is very serious and serious respectively. In general, this result implies that SW generated from households of Addis Ababa, Kolfe Keraniyo Sub-City still cause serious problem.

Figure 3: Frequency of Getting SW Collection Service



As indicated in the figure-2, respondents were questioned regarding the frequency of getting door-to-door SW collection service, the largest number of the participants 184(50.8%) said that the SW collection workers collect the household solid wastes once a week. However, 176(48.6%) and 2(0.6%) of the respondents replied that SW collection service collect household solid wastes twice a week and once in month respectively. This implies that most

of households do not obtain door-to door SW collection service twice a week and hence the SW collection workers are not punctual in keeping their schedule.

Figure 4: Satisfaction of SW Collection Service

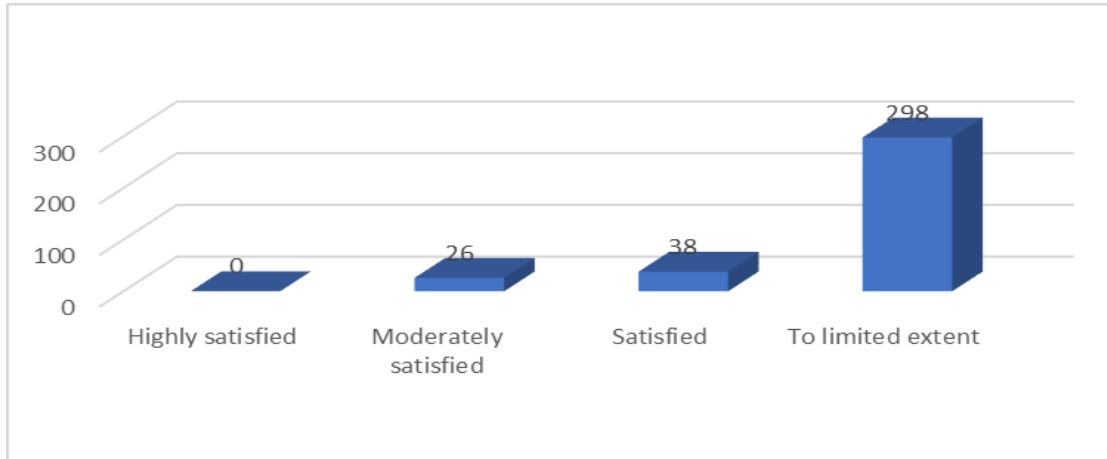
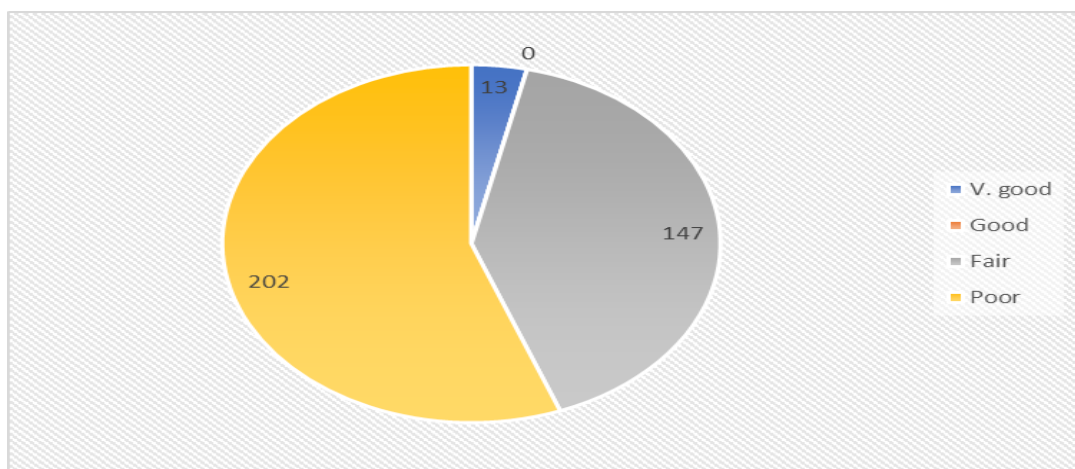


Figure-3 presents the responses on the current SW collection service extent in the Kolfe Keraniyo Sub-City administration. In this aspect, the highest proportion of respondents 298(82.3%) were satisfied to the limited extent on the existing SW collection service while 38(10.5%) of sampled households were satisfied and further, 26(7.2%) respondents were moderately satisfied. This implies that the greatest numbers of the sample households are not adequately satisfied on the existing door-to-door SW collection service.

Figure 5: Efforts of Managing Households Solid Waste



As depicted in the figure-4, most of the respondents 202(55.8%) disclosed that the controlling of households' solid waste in Kolfe Keraniyo Sub-City is poor while 147(40.6%)

sampled households showed fair. The remaining 13(3.6%) of the households were very appreciate the SWM system of the Sub-City. This implies that a notable number of the households ascertained that the efforts made so far by administration of the Kolfe Keraniyo Sub-City to control households' solid waste are somehow unsatisfactory.

4.4. Households' WTP for New Improved USWM Service

In this section the researcher discussed the households' reflection towards the new project which center in improving proper collection service of solid waste for the residents of Addis Ababa city, taking Kolfe Keraniyo Sub-City as a case study. Accordingly, the views of this study participant households concerning this issue are discussed in next sections.

4.4.1. Households' Willingness to Support the Project

Respondents were asked about households' readiness to support this new SW collection system.

Table 4. 6: Household Willingness to Support

Description	Frequency	Percent
Not support the project	7	1.9
Support the project	355	98.1
Total	362	100

Survey Data, 2021

As indicated in table 4.6, 355(98.1) of the sample respondents were willing to support the expected new improved household SW collection service project: to use municipal official plastic bags for door-to-door SW collection services.

4.4.2. Households' WTP for the Project

Households in this study were requested to give their opinions in connection with WTP which helps to improve the existing SW collection service of the city.

Table 4. 7: Willingness to Pay

Description	Frequency	Percent
Willing to Pay	355	98.1%
Unwilling to Pay	7	1.9%
Total	362	100%

Survey Data, 2021

Accordingly, from the entire respondents 355(98.1%) are WTP some money (even a very small amount) for this new SW collection service project while 7(1.9%) are unwilling to pay for this new project. This implies that the very greatest numbers of sample household are willing to pay for the implementation this new SW collection project.

In line with this, the participants were questioned to state the reasons they WTP for this SWM project Their response showed that majority of the respondents, 198(54.7%) were to get an improved SW collection service, 70(19.3%) were to lessen the negative impacts, 32(8.8%) were to make the city suitable for life, 34(9.4%) were to make the city suitable for life and hoping to get better SWM service and others represented by 28(7.8%).

4.4.3. Maximum Willingness to Pay

Pertaining to household’s WTP for the new proposed SWM project the response of the households’ is presented in the table below.

Table 4. 8: Maximum Households’ WTP

Minimum	Median	Mean	Maximum
Birr 0.00	Birr 20	Birr 24	Birr 50

Survey Data, 2021

As indicated in the table above 4.8, the average amounts each household WTP for new and improved collection service which hold 50 kgs solid wastes is Birr 24.00, minimum of zero Birr, maximum of Birr 50.00 and median of Birr 20.

According to CSA, Population Projection (2013) Addis Ababa city has total population of 3,352,000. The researcher tried to gather the whole number of household head at Addis Ababa and at Kolfe Keraniyo Sub-city but the officers did not have genuine data.

In order to calculate the estimated total amount of all households living in Addis Ababa expected to pay, the researcher assumed that a given household in Addis Ababa is likely to hold average family members of 2.59, which is study’s average number of household’s family. Consequently, the researcher assumed 1,294,208 household heads probably live in Addis Ababa.

Therefore, by multiplying this mean WTP (Birr 24) by all number of households, the monthly and yearly total amount WTP is estimated at Birr 31.1 million and Birr 373.2 million, respectively. Besides, the total amount all Addis Ababa city households are expected to pay using the mid WTP (Birr 20) is estimated at Birr 25.8 million per month and Birr 309.6 million per year.

4.5. Post-Estimation Results

The diagnostic tests are carried out to ensure whether the assumptions required for Tobit model is violated or not. Accordingly, the fundamental assumptions of Tobit model such as specification test, multicollinearity, normality and heteroscedasticity are shown in *appendix section*.

In order to check the appropriateness of the model the researcher used ‘Linktest’ for joint model specification. The result disclosed that the probability of ‘hatsq’ is 0.215 which is greater than 5% significant level which is good for model specification error. Hence, this reveals that the Tobit model is appropriate. As specified in the appendix, the result showed that p-value of the SK test exceeds 5% significant level. As a result, it can be concluded that the Tobit model has no severe problems with normality assumption.

The existence of multicollinearity within the model is detected by using Variance Inflation Factor. As noted by Gujarati (2004), rule of thumb suggested that problem of multicollinearity occurred if VIF exceeds 10. As revealed in table 4.13, the value result of mean variance inflation factor for all independent variable 3.39 which is less than 10. This shows that absence of multicollinearity problem and hence all independent variable can be considered in the model estimation.

4.6. Tobit Model Estimation Result

This study applied Tobit model to identify determinates of household WTP for new improved SWM services in Kolfe Keraniyo Sub-City. In this model dependent variable, WTP is regressed against eight independent variables: Sex of the household, income of household, Education of household, Age of household, Frequency of SW collection service, Number of household’s member having job, Household size, solid waste amount generated.

However, in this study, two variables such as education and income are stated in categorical variable form so that it is difficult to consider in Tobit model estimation. This because variables to be considered in the Tobit model estimation they should be continuous. So, the researcher changed the above two categorical variables into continuous variables just by giving numbers for each level of the group.

Table 4. 9: Tobit Model Regression Result

Dependent Variable: WTP			
	Tobit Model		Marginal Effects for Censored sample
Explanatory Variable	Coefficient	P>t	
Sex	0.448	0.459	0.448
Age	0.329	0.000	0.329
Education	0.485	0.086	0.485
HH member job holder	1.255	0.082	1.255
Household size	-1.086	0.026	-1.086
Monthly income	1.927	0.005	1.927
Amount of SWG	0.703	0.010	0.703
Frequency of SWC	0.766	0.244	0.766
_cons	4.676	0.128	
/sigma 5.436798			
Obs. summary: 362		7 left-censored observations at maxwtp<=0	
Log likelihood = -1116.6389		355 uncensored observations	
Number of obs = 362		0 right-censored observations	
LR chi2(9) = 124.95			
Prob > chi2=0.0000			
Pseudo R2 = 0.0530			

Therefore, the promising explanations for each significant independent variable are given consecutively as follows. However, the researcher used marginal effect to interpret each significant independent variable coefficient

4.6.1. Demographic Factors

In this model, the three demographic factors were used such as Age, Sex and Education. Among these variable Age of household was statistically significant relationship at 5% level. Further, Educational attainment of household was statistically significant relationship at 10% level while Sex of the household variable was statistically insignificant at 5% level even at 10% level.

Age of household: this variable had positive relationship and significantly influences the households' WTP for new improved SW collection services at 5% significance. The positive sign shows that WTP for the new improved urban household SWM services is higher in older respondents than in younger one. This is because as household head older they are becoming more matured to make decisions linked to evaluating health & environmental matters and leading them to express high WTP value.

According to the marginal effect, other things at constant, as the age of household increases, the expected WTP value for the new improved urban household SWM project increased by Birr 0.3294554 for the entire population. Therefore, the study finding is agreed with the expected sign.

This study finding also confirms the results of Ayenew et al. (2019) which indicated that age has significant effect in improving SWM service. Further, Bhattarai (2015) found that age of household has positive and important effect on the households' WTP for improved SWM. The study conducted by Alhassan et al. in 2017 identified that age found to has a positive and important effect on WTP of household.

Education of household: this variable had positive relationship and significantly influences households' WTP for new improved SW collection service at 10% level of significance. The result is in line with Getachewa and Fufa (2018) and Dagnachew (2013) found that educational level of the households is significant variable in explaining WTP in improving SWM. Further, studies such as Ayenew et al. (2019), Bhattarai (2015) and Alhassan et al. (2017) portrayed that household's educational level has significant influence in improving SWM.

4.6.2. Socio-Economic Factors

In this model, the three socio-economic factors were used such as Household income, solid waste amount generated (Amount of SWG) and Household size were statistically significant relationship at 5% level. While Number of household's member having job, factor was statistically significant relationship at 10% level.

Household size: the result indicates negative sign for household size variable and significantly influences the households' WTP for new improved SW collection service at 5% significance. This is because having higher household members will increase consumption expenses, food, clothing, and health-care expenses and other living expenses of the households which limit the households' WTP for the new improved urban household SW collection service. Therefore, households with small household family sizes are probably to support new improved SWM than larger family size.

According to the marginal effect, other things at constant, the result reveals that as the number of household's family size become smaller, the expected WTP value for the new improved urban household SWM service increased by Birr 1.086287 for the entire population. Therefore, the study finding is agreed with the expected sign

This research finding is agreeing with earlier studies of Dagnachew (2013), He found that household size negatively significantly correlates with the amount of WTP at 5% significance. Moreover, this research consistent with Ayenew et al. (2019) and their study showed that household family size is negatively impact households' maximum amount willing to pay.

Solid waste generated: this variable had positive relationship and significantly influences households' WTP for new improved SW collection service at 5% significance. The possible explanation is that as solid waste amount generated by a household in sacks (50 kilograms) per month increases then the households will be more WTP for new improved SW collection service.

According to the marginal effect, other things at constant, the result displays that the WTP of households for new improved SW collection service increase by about Birr 0.7033595 for all observation for a sack of SW amount generated by households increases vice versa. Therefore, the study finding is agreed with the expected sign.

This study finding is supported by Getachewa and Fufa (2018) found households that generated more solid waste have a higher request for new and improved SWM provision. Moreover, the research finding of Muhammed et al. (2016) displayed that the more waste amount generated by households the more they are WTP for better SW collection service

Number of household's member having job: this variable had positive relationship and significantly influence households' WTP for new improved SW collection service at 10% level of significance. This because households with greater number engaging in work generating income will increase the household's income. Hence, they can allocate appropriate money for their consumption and other related expense, overcome unexpected contingencies and households with fewer members with jobs are WTP.

According to the marginal effect, other things at constant, the result discloses that when a member of the household's income increase by one Birr, the expected WTP value for new improved urban household SWM management service would increase by about Birr 1.255722 for all observation.

Household income: this variable had positive relationship and significantly influences households' WTP for new improved SW collection services at 5% significance.

4.6.3. Institutional factors

In this model, only one institutional factor, frequency of Solid waste collection (Frequency SWC) was used. The tobit result showed that Frequency SWC factor had statistically insignificant relationship with households' WTP at 5% level.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

This study's main objective was to analyze households' WTP for new improved SWM in Addis Ababa, Kolfe Keraniyo Sub-City. The study applied contingent valuation method via in-person interviews. The analysis is done based on 94.3% (362) response rates. Tobit model employed to identify factors influencing households' WTP for improved solid waste collection service. The following conclusions are drawn from the study's findings.

The first objective was to examine the existing condition of SWM practices in Addis Ababa, Kolfe Keraniyo Sub City. The study finding disclosed that greatest number of the sample households discharge dry type of solid waste. From the findings, solid waste amount generated by households per month in average is 3.08 sacks with a minimum of 1 sack and maximum of 5 sacks. The solid waste produced from households still cause serious problem. The majority of households do not obtain door-to door SW collection service twice a week. Also, they are inadequately satisfied on the existing door-to-door SW collection service. Furthermore, most of the sampled households ascertained that the efforts made so far by the Kolfe Keraniyo Sub City Administration to control households' solid waste are somehow unsatisfactory.

The second objective was to identify factors which affect households' WTP for improved SW collection service in Addis Ababa, Kolfe Keraniyo Sub City. The Tobit model result revealed that income of household, household size, Age of household and Solid waste amount generated (Amount SWG) were statistically significant relationship at 5% level. Further, Educational attainment of household and Number of household's member having job were statistically significant at 10% level. However, the rest two explanatory variables namely, Sex of the household and Frequency of SW collection service (Frequency SWCS) were statistically insignificant.

The other objective was to show households' mean and maximum WTP for new and improved SW collection service in Addis Ababa, Kolfe Keraniyo Sub City. The result

disclosed that almost all of the respondents (98.1%) were WTP for new SWM collection project. Based on raw data the average amounts each household WTP for new and improved collection service which hold 50 kgs solid wastes is Birr 24.00, minimum of zero Birr, maximum of Birr 50.00 and median of Birr 20.

5.2. Recommendation

Based on the conclusions of the study, the researcher recommends the following:

- The study disclosed that the respondents were willing to support and WTP for new improved household SW collection service project. As a result, the administrations of Addis Ababa, Kolfe Keraniyo Sub City, and the AASWM agency must consider this chance to improve households' SWM service of the city simultaneously to raise funding for SWM.
- The study identified that the key determinants which influence households' WTP for new improved household SW collection service. Therefore, the municipality SWM agency should consider significant factors such as income of household, Household size, Age of household, and Solid waste amount while designing an improved SW collection service.
- In order to fix the price for the improved urban household SW collection service the municipality could use mean WTP fee to charge on every low-income households who lives in Addis Ababa. So that the municipal agency will improve households' SWM service and narrow the budget gap so that can minimize the burden of the agency in looking for other sources of finance.
- In order to fix the price for the improved urban household SW collection service the municipality could use maximum WTP fee to charge on every high-income households who lives in Addis Ababa. So that the municipal agency will improve households' SWM service and narrow the budget gap so that can minimize the burden of the agency in looking for other sources of finance.
- The study finding indicates that almost all (98.1%) of the households are ready to support and WTP for the new improved solid waste collection service. Subsequently, this shows the demand of the households to practice alternative options of solid

waste collection service. As a result, it is desirable for urban households to organize an ad hoc taskforce, with this taskforce asking the AASWM agency to develop alternative solid waste collection services in order to enhance households' solid waste collection and thereby to solve the city's solid waste management problem.

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APPENDIX

Annex-i: Tobit Model Regression Result

```
. tobit maxwtp sexofhousehold ageofhousehold educatioal_hh hh_member_job_holder hou
> sehold_size monthlyincome amountofswgenerated frequency_collectionservice, ll(0)
```

```
Tobit regression                               Number of obs   =       362
                                                LR chi2(8)       =      124.95
                                                Prob > chi2      =       0.0000
Log likelihood = -1116.6389                    Pseudo R2       =       0.0530
```

maxwtp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
sexofhousehold	.4486008	.605631	0.74	0.459	-.7424864	1.639688
ageofhousehold	.3291516	.0407368	8.08	0.000	.249035	.4092682
educatioal_hh	.4854348	.2817038	1.72	0.086	-.0685887	1.039458
hh_member_job_~r	1.255731	.7191193	1.75	0.082	-.1585523	2.670014
household_size	-1.086294	.4855289	-2.24	0.026	-2.041178	-.1314106
monthlyincome	-1.927895	.6863748	-2.81	0.005	-3.27778	-.5780097
amountofswgene~d	.7033644	.2733385	2.57	0.010	.1657929	1.240936
frequency_coll~e	.7660254	.6564018	1.17	0.244	-.5249121	2.056963
_cons	4.676467	3.027184	1.54	0.123	-1.277059	10.62999
/sigma	5.436838	.2055887			5.032509	5.841167

```
Obs. summary:      7 left-censored observations at maxwtp<=0
                   355 uncensored observations
                   0 right-censored observations
```

Annex-ii: Average Marginal Effects for Censored Sample

```
Conditional marginal effects                    Number of obs   =       362
Model VCE      : OIM
```

```
Expression      : E(maxwtp*|maxwtp>0), predict(ystar(0,.))
dy/dx w.r.t.   : sexofhousehold ageofhousehold educatioal_hh hh_member_job_holder
                  household_size monthlyincome amountofswgenerated
                  frequency_collectionservice
```

	Delta-method					
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]	
sexofhousehold	.4485977	.6056268	0.74	0.459	-.7384091	1.635604
ageofhousehold	.3291493	.0407366	8.08	0.000	.2493071	.4089915
educatioal_hh	.4854314	.2817019	1.72	0.085	-.0666942	1.037557
hh_member_job_~r	1.255722	.7191144	1.75	0.081	-.153716	2.66516
household_size	-1.086287	.4855258	-2.24	0.025	-2.0379	-.1346738
monthlyincome	-1.927881	.6863701	-2.81	0.005	-3.273142	-.5826206
amountofswgene~d	.7033595	.2733367	2.57	0.010	.1676294	1.23909
frequency_coll~e	.7660201	.6563973	1.17	0.243	-.5204949	2.052535

```
.
end of do-file
```

Annex-iii: Average Marginal Effects for Truncated Sample

```

Conditional marginal effects          Number of obs   =       362
Model VCE      : OIM

Expression   : E(maxwtp|maxwtp>0), predict(e(0,.))
dy/dx w.r.t. : sexofhousehold ageofhousehold educatioal_hh hh_member_job_holder household_size monthlyincome
               amountofswgenerated frequency_collectionservice

```

	Delta-method					
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]	
sexofhousehold	.4485393	.6055498	0.74	0.459	-.7383164	1.635395
ageofhousehold	.3291065	.0407478	8.08	0.000	.2492422	.4089707
educatioal_hh	.4853682	.2816773	1.72	0.085	-.0667092	1.037446
hh_member_job_holder	1.255559	.7190345	1.75	0.081	-.1537228	2.66484
household_size	-1.086146	.4855083	-2.24	0.025	-2.037724	-.1345667
monthlyincome	-1.92763	.686313	-2.81	0.005	-3.272779	-.5824818
amountofswgenerated	.703268	.2733238	2.57	0.010	.1675633	1.238973
frequency_collectionservice	.7659205	.6563166	1.17	0.243	-.5204364	2.052277

```

.
end of do-file

```

Annex-iv: Post Estimation Test Results

```

. linktest, ll

Tobit regression          Number of obs   =       362
                          LR chi2(2)         =       126.50
                          Prob > chi2        =       0.0000
Log likelihood = -1115.8656      Pseudo R2      =       0.0536

```

maxwtp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_hat	.0408178	.7739058	0.05	0.958	-1.481126	1.562762
_hatsq	.0200024	.0160501	1.25	0.213	-.0115613	.0515661
_cons	11.25417	9.237559	1.22	0.224	-6.912182	29.42053
/sigma	5.420287	.2050214			5.017097	5.823477

```

Obs. summary:      7 left-censored observations at maxwtp<=0
                   355 uncensored observations
                   0 right-censored observations

```

```

.
end of do-file

```

```
. estat vif
```

Variable	VIF	1/VIF
hh_member~r	10.11	0.098946
monthlyinc~e	9.74	0.102711
ageofhouse~d	1.47	0.680229
frequency~e	1.36	0.733992
household~e	1.20	0.836402
educatioal~h	1.05	0.951602
amountofsw~d	1.04	0.958033
Mean VIF	3.71	

```
.  
end of do-file
```

```
. sktest res
```

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint	
				adj chi2(2)	Prob>chi2
res	362	0.1454	0.4019	2.83	0.2424

```
.  
end of do-file
```

Annex v: Questionnaire for Household Head



Dear respondents,

My name is Getahun Seid. This survey is developed with an objective to conduct research on *households' WTP for improved SWM in Sub City of Kolfe Keraniyo, Addis Ababa*. It helps to complete my Master Science in Economics at Addis Ababa University.

The ultimate intention of this survey is to provide an effective SWM service for the residents of the city to create more a clean environment. Now, I kindly ask you some questions regarding an improved SWM system that may be implemented in your community. Dear respondent, you are randomly selected to give information for the given questions below. All the responses you provide are firmly confidential & exclusively used for this research purpose.

Thank for your valuable time and cooperation!

Part I. Current Situation of MSWM

1. What are the most important solid waste compositions coming out from your household?

Wet Dry Hazardous Electronic Biomedical

Other _____

3. On the average, how many sacks (50_{kgs}) of solid waste amount are generated in your household per month? _____.

4. Have you noticed an increase in the amount of SW in your surrounding recently?
Yes No
5. Currently, do you think that the solid waste is still a problem?
Very serious Serious Not serious Do not know
6. Has solid waste imposed any negative cost in your household or surrounding?
Yes No
7. If “yes” to No. 5, please specify_____.
8. Is your household getting the service of SW collection?
Yes No
9. How often do you get SW collection service?
Every week every two weeks Every three weeks
Once in month Other (specify)_____
10. Are you satisfied with the current SW collection service in the town?
Highly satisfied moderately satisfied Satisfied
to a limited extent
11. How do you assess the effort made so far by the municipality of the city to control SW from the household?
Very good Good Fair Poor

Part II. Valuation scenario (new improved urban SWM service)

Currently, SW collection workers employed by Addis Ababa solid waste agency are collecting solid waste generated from all household’s door-to door twice a week. And you are paying for the waste collection service a monthly fee with water bill.

Suppose a decision is made to provide new improved urban SWM service especially SW collection service for the residents of Addis Ababa city. The municipal agency will prepare different official plastic bags for collection attached with density (kgs) and seated price. The solid waste collection workers will use the municipal official plastic bags for collection. The households will be obligated to pay for SW collection service as per the generation density which will be indicated in the official plastic bag.

At household level, the project is designed to avoid infrequent coming of collection workers and to maintain the schedule all the time. Besides, it also helps the municipal to minimize

- It is payment when collection is made
- How much can you afford.
- How important the proposed SW collection project is for you.
- The money raised would only go toward SW collection service in the town.
- If the raised money is not enough, the SW collection project cannot be established.

In light of the above points,

- The most/maximum I would be WTP for official plastic bags which hold 50 kgs solid waste or for the SW collection project for the town is: _____ Birr.

16. If you would not WTP to any money to the project, what is your reason (Please Cross your answer among the following options. You can make several options)

- Satisfied with the existing system
- I am not able to afford
- It is government's responsibility
- Money should be collected from big companies, NGOs and Business companies
- I am afraid that the money will not be used for the SW collection project
- It is none of my business
- Other reason: _____

Part IV. Respondent's Demographic/Socio-Economic Questions

17. Gender: Ma Femal
18. Household head _____ years.
19. Educational level of the household?
 Illiterate Primary school High school College diploma
 B.A/B.Sc. degree Above Master's degree Literate
20. Number of workers in the household that generate income _____.
21. How many members are there in your household (*including you*)?
 1 2 3 4 5 Over 5
22. What is your approximate monthly gross income in Birr (before tax)?
 Birr 0-3,000 Birr 3,001-6,000 Birr 6,001-9,000
 Birr 9,001-11,000 Above 11,000