



ST. MARY'S UNIVERSITY SCHOOL OF GRADUATE STUDIES

**FACTORS AFFECTING MUNICIPAL SOLID WASTE MANAGEMENT
AND VALUATION OF ENVIRONMENTAL AND ECONOMIC COSTS
THAT IMPOSED ON THE SOCIETY: THE CASE OF KOLFE KERANIYO
SUB-CITY, ADDIS ABABA**

BY

ADDISU BELACHEW

JUNE 2020

ADDIS ABABA, ETHIOPIA

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**A THESIS SUBMITTED TO ST.MARY'S UNIVERSITY, SCHOOL OF
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REQUIREMENTS FOR THE AWARD OF MASTER OF ARTS DEGREE
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JUNE 2020

ADDIS ABABA, ETHIOPIA

DECLARATION

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

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June, 2020

ENDORSEMENT

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

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June, 2020

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LIST OF ACRONYMS

CVM= Contingent Valuation Method

ETB= Ethiopia Birr

SWM= Solid Waste Management

WTP= Willingness to Pay

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ABSTRACT

In most developing countries policies and frameworks that govern solid waste management strategies have often been directed at the waste management service providers and less attention is often given to the demand side of the problem. The objective of this study is to assess the current situation of solid waste management services, households' willingness to pay and the amount of WTP for improved residential solid waste management services. The study also determine factors affecting household's willingness to pay decision and the amount of fees paid for an improved solid waste management in Kolfe keraniyo Sub-city, Addis Ababa. The data for the study was from a contingent valuation survey that was conducted among 400 households in Kolfe keraniyo Sub-city, Addis Ababa. Both descriptive statistics and econometric models were employed to analyze the qualitative and quantitative data. A binary logit model and tobit model was used to account for the factors influencing their willingness to pay and determined the amount of they were willing to pay. The economic model data were analyzed by using statistical package 'Stata 13'. The results showed that 96.5% of the household received standard service from the municipality for the collection of waste service more than two times per week. According to this result the majority of surveyed households (84.75%) were willing to pay for the improved solid waste management. The mean WTP amount that households were willing to pay was ETB.53.16 (1.56 US\$) per month. The factors that significantly influence the households' WTP for improved solid waste management were monthly household income, household family size and the amount of waste generated. The significant factors that influenced the maximum amount of money households willing to pay for improved solid waste management were monthly household income, household family size and the amount of waste generated. The findings from this study could contribute to the knowledge regarding the implementation of a more sustainable residential waste management strategy in Addis Ababa city administration and other cities and sub cities that have similar conditions.

Keywords: Contingent valuation, Logit and Tobit model, Solid Waste Management, Willingness to Pay

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Cities in developing countries are facing increasing generation of waste and accompanying problems associated with waste collection and disposal resulting from urbanization process that brings a lot of problems in most third world countries (Begum et al., 2007), Kwabena and Danso-Abbeam 2014). Increase in population, income level and urbanization increases the amount of solid waste generation, and if not managed properly, it creates serious negative impacts on human health, environment and also the economy (Hoorweg, D.; Bhada-Tata, P, 2012). Greater economic prosperity and increase in the consumption level have intensified the problem of Solid Waste Management (SWM) and is now a major challenge in urban areas of developing countries (Japan International Cooperation Agency (JICA), 2005).

According to a World Bank study the urban areas of Asia produce about 0.76 million tons of municipal solid waste (MSW), or approximately 2.7 million m³ per day. And also they projected in 2025 this figure may increase up to 1.8 million tons of waste per day or 5.2 million m³ per day. And also, according to World Bank study urban per-capita waste generation rate for most of the low-income countries will increase by approximately 0.2 kg per day by 2025 because of relatively high annual growth rates of GNP and urban population. According to the Zerbock, (2003), collecting and managing municipal waste is an important challenge for countries across the world. This problem is often magnified in cities where a dense concentration of people leads to a substantial amount of waste generation. In developing countries like Ethiopia, this problem is exacerbated by an arrival of people moving to urban centers (Montgomery, 2008).

Solid waste is one of the major problem human being continued to face for different reasons. Firstly, it is adversely affecting the environment (Birhanu, Berisa,2015). Secondly, it has become the major cause of health problem in urban areas (Koyachew EK,2016). Finally, it is causing loss of human life in some countries by a sudden fall of the accumulated waste on people. The Ethiopian government had proclaimed the solid waste management proclamation in 2007 and encouraged community participation. Despite this, waste management continues to be one of the major challenges that many urban centers of the country including Addis Ababa faces.

With more and more people moving to urban centers in Ethiopia, cities like Addis Ababa the capital of Ethiopia. The city is, located in its own region (of the same name) with a population of about three million people (Abiye et. al., 2009). Settled in the late 19th century, today the city is comprised of three government levels, including the formal city government at the top, ten sub-city administrations in the middle, and 116 woreda – roughly equivalent to a neighborhood – at the bottom (UN, 2010). Addis Ababa city started its solid waste management some three decades back (Regassa N, Sundaraa D, Seboka B.(2011).

In Addis Ababa city, the main bottlenecks associated with waste management are high and varied amount of waste generate from households; disposal on streets, in ditches and rivers; low perception and attitude of community on waste management; inefficient services rendered by municipality; low willingness of households and lack of appropriate waste disposal site. These problems are observable in Kolfe Keraniyo sub-city.

The solid waste collection and management coordinated by the Addis Ababa City Administration and their efforts are assisted with the contribution of fees collected from all registered Addis Ababa Households and businesses outlets (Schleicher T, Manhart A, Amera T, Belay A, Zamanu G,2015).It is carried out by pre-collectors (micro-enterprises) that collect unsorted waste from households, businesses and public spaces. In 2010, it was estimated that the city of Addis Ababa generated upwards of 0.4kg/capita of waste per day, with more than 200,000 metric tons collected each year (UN, 2010).

It is clear from the literature that the existing condition of waste management in Addis Ababa is not to the expected level despite there are a number of efforts to tackle problem related to solid waste management. This is actually the factor that initiated the researchers to carry out their study on solid waste management. Hence, the purpose of this paper is to assess the current situation of solid waste management, to identify the factors determining households' willingness to pay for an improved solid waste management and to estimate the amount of willingness to pay (WTP) of households for improved SWM in Kolfe keraniyo Sub-city, Addis Ababa.

1.2 Statement of the Problem

Waste management in most cities of developing countries is highly unsatisfactory. Improper Municipal waste management causes all types of pollution. The main impacts created by

Municipal waste pollution are health impacts, environmental impacts like contamination of surface and ground water due to indiscriminate dumping of wastes and the formation of leachate, economic impacts like land price decrease and social impacts like nonexistence of recreation area, loss of children playing site and not having a place for greenery.

The challenge to improve the problem of SWM, in Kolfe Keraniyo sub city Addis Ababa requires strong commitment on the part of all concerned authorities. The government of Federal Democratic Republic of Ethiopia, as indicated in proclamation number 513/2007, realized that it is hardly possible to address the problem of environment, particularly solid waste management, without involvement of local communities. Even if solid wastes management services are the responsibilities of Addis Ababa municipalities, the local communities should be involved in the development, implementation, and monitoring of interventions designed to improve SWM.

One reason for this view is that beneficiaries' participation ensures that individuals have a say in activities that will affect their well-being. It is important to study local communities, especially households', interest to contribute for the improvement of SWM and which factors are affecting it. Mary and Adelayo (2014) indicated that the progress of solid waste management has always been assessed based on the performance of the supplier or service provider. This has restricted the success of the improvement in solid waste management system due to the fact that low or no attention has been given to the demand side, Tamura, K. (2005). However, the participation of local communities or service recipient is essential in making effective decisions and providing solutions to problems of solid waste management. With the view of that, this study aims to assess the current situation of solid waste management, to identify the factors determining households' willingness to pay for an improved solid waste management and to estimate the amount of willingness to pay (WTP) of households for improved SWM in Kolfe keraniyo Sub-city, Addis Ababa.

In this regard, various researchers in different parts of the world conducted their study to identify and analyze the factor affecting the municipal solid waste management and the determinants of households' contribution or WTP for improved solid waste management in their respective countries. Some of the most important works are: Rahji, M. and Oloruntoba, O. (2009), Roy et al (2013), Anjum (2013), Alhassan, M. and Mohammed, J. (2013), Mary and Adelayo (2014), Adebo and Ajewole (2012), Adewuyi and Oyekale (2013), and Niringiye and Omortor (2010),

Rahji, M. and Oloruntoba, O. (2009). In Ethiopia also there are some studies on the Municipal solid waste management and determinants of WTP for improved solid waste management; Regassa N, Sundaraa D, Seboka B.(2011), Hagos, D., Mekonnen, A. and Gebreegziabher, Z. (2012), Hayal (2014), Dagneu et al (2013), Tewodros and Samson (2009) and Birtukan (2013).

From these studies, it is controversial whether which variable has an impact on households' WTP for improvement of SWM system. As demographic, social, economic and environment factors change solid waste management; this in turn affects the households' WTP for waste management. Households' WTP is a dynamic concept that we need to study again and again to identify factors affecting WTP and hence draw reasonable conclusions for policy directions.

Nonetheless, there is lack of sufficient evidence on the study particularity undertaken in Kolefe Keraniyo sub-city. Thus, it has become highly important to assess the conditions of solid wastes; people's perceptions and attitudes on solid waste management and household's willingness to pay for improved solid waste management in this area. Therefore, conducting study on current demographic, social, economic and environmental conditions is very essential. The study aimed at understanding and figuring out the estimation of amount of WTP and factors that affecting it and the valuation of environmental and economic costs that Municipal Waste imposes on the society in case of Kolefe Keraniyo sub-city, Addis Ababa, Ethiopia.

1.3 Objectives of the Study

1.3.1 General Objective

To determine factors affecting Municipal Waste Management Services and estimate related environmental and economic costs imposed on the society taking Kolefe Keraniyo sub-city as a case, Addis Ababa.

1.3.2 Specific Objective

1. To assess the current situation of solid waste management in Kolfe keraniyo Sub-city, Addis Ababa.
2. To determine factors affecting households willingness to pay decision for an improved solid waste management in Kolfe keraniyo Sub-city, Addis Ababa.
3. To estimate the amount of fees households are willing for an improved SWM Services in Kolfe keraniyo Sub-city, Addis Ababa.

1.4 Research Questions

1.4.1 Research Questions

Given the specific objectives, the study addresses the following research questions:

- What are the existing conditions of solid waste management practices in the sub-city?
- What factors are affecting households willingness to pay decision to improve solid waste management service in the study area?
- How much average amount of money that households are willing to pay for an improved Waste Collection Service (WCS)
- Which factors determine the amount of money households are willing to pay for improved solid waste management service?

1.5 Significance of the Study

This study is very important to understand the determinants waste management system as its sustainability depends on numerous factors and its impact on the society. It uncovers and examines the key features and challenges of waste management system in Addis Ababa, making kolfe Keraniyo sub city the main area of focus. Though the experience of the waste management system is personal but it is more or less the same for all segments of the society. The research will produce information on the better ways of addressing the issue aided by the improved understanding and the vision to see it from different perspectives. However, the most important is the will and commitment of the people to change the existing system and develop something better.

The people of Kolefe Keraniyo sub-city, Addis Ababa, Ethiopia, could be willing to contribute positively and to participate in a waste management system so long as the approach will set the people free from bondage of waste congestion that causes infections and illnesses. It is on this premise, that recommendation for developing of a sustainable waste management system. This document tries to describe the environmental, economic and social realities in connection with the daring societal challenge of Municipal Waste Management system. For this, the study made use of research methods collecting data through observation, in-depth interview, FGD and case study. The main objective of the study is to determine factors that affecting Municipal Waste Management in Kolefe Keraniyo in an effort to explore the underlying constructs and determine its implication for a society.

1.6 Scope and Limitations of the Study

The study focuses on municipality solid waste management system at household level in Kolfekiraniyo sub city. The study measured the maximum amount of fees paid for an improved solid waste management and its determinants in Kolfekiraniyo Sub-city. The survey covered 5 Woredas out of 15 with a sample size of 400 households. Other potential source of waste generation such as industries, health institution, commercial institution and institution (schools and offices) were not covered.

The study limitations include lack of representativeness and data gaps. The fact that this study is planned to be conducted in Kolfekiraniyo Sub city of Addis Ababa, raises the key question of representation for a bigger image. Hence, the intention of the study is not to represent the reality for the entire city of Addis Ababa. This study has the following limitations. Statistics relating to the Municipal Waste Management system are dispersed and inadequate. Municipalities don't keep adequate data and quantifiable treatment of the environmental issue is hardly possible. Within these constraints, tools that are popular to analyze environmental issues are used based on a sample study. The limitations applicable to any sample study will be applicable to the present study also. It's hard to imagine for a study of this kind could possibly be without limitations.

1.7 Organization of the Study

The study comprises five main chapters. Chapter one is devoted to the general introduction covering the background of the study, the statement of the problem, the objectives, significance, scope and how the research was organized. Chapter two is mainly concerned review of related literatures on solid waste management. Chapter three provides the methodology that was applied to achieve the research objectives including primary data and method of analysis. Chapter four covers the analysis and discussion. This chapter discusses the result obtained in accordance with the research questions. Finally, chapter five deals with conclusions of the findings and recommendations forwarded.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2. Theoretical and Empirical Review

2.1 Waste

Waste can be simply defined as useless remains or byproducts. Solid waste can be defined as the non-liquid waste materials arising from domestic, trade, commercial, industrial, agricultural and mining activities and from the public services (WHO, 1976). Although waste can be generally defined as worthless and useless byproduct (Webster's 1984), a more specific and precise definition is given by environmental literature. Gilpin (1976) gave a comprehensive definition for waste and defined waste as a matter, liquid, solid, gaseous or radioactive which is discharged or emitted or deposited in the environment in such a volume, constituency or manner as to cause alteration of the environment. Allaby (1977), extended the definition by adding the disposal component of waste and defined waste as any substance, solid liquid or gaseous for which no use can be found by the organism or system that produces it and for which a disposal method has to be devised. Hoornweg et al (1999), defined waste as an unwanted material intentionally thrown away for disposal.

2.2 Solid Waste

The issue of solid waste emerged in the literature mainly due the environmental awareness created by the publication of *'Silent Spring'* by Rachel Carson in the early seventies. One of the earlier definitions for solid waste was given by World Health Organization (W.H.O) in 1971 defining solid waste as waste arising out of man's activity which is not free flowing. Another important definition was given by Gilpin (1976, 1996), defining solid waste as all material of solid and semi-solid character that the possessor no longer considers of sufficient value to retain. Solid waste is broadly defined as including non-hazardous industrial, commercial and domestic refuse including household organic trash, street sweepings, hospital and institutional garbage, and construction wastes; generally sludge and human wastes are regarded as a liquid waste problem outside the scope of MSW (OlarZorbeck et al 2003). Cointreau (1982) defined solid waste as organic and inorganic waste materials produced by households, commercial,

institutional and industrial activities, which have lost their value in the eyes of the first owner. Sinha (1997) defined solid waste as a heterogeneous mass of useless material, which may originate from homes or commercial or industrial activities. The Municipal solid wastes (Management and Handling) Rules (2000) by the Central Pollution Control Board, India defines solid waste as commercial and residential wastes generated either in solid or semi-solid form, excluding industrial hazardous wastes but including treated biomedical wastes. The Ecological Solid Waste Management Act of The Republic of Philippines (2000) defines solid waste as all discarded household, commercial waste, non-hazardous institutional and industrial waste, street sweepings, construction debris, agricultural waste and other nonhazardous/non-toxic solid waste.

2.3 Municipal Solid Waste

Solid wastes are now classified in different ways. On the basis of sources of origin it is classified into industrial, hospital and Municipal Solid Waste (MSW). It is also classified into hazardous and non-hazardous categories on the basis of the toxicity of materials in the waste. Municipal solid waste can be generally defined as wastes generated by residential, commercial, industrial, institutional, construction, demolition, process and municipal services. Schübeler (1996) points out that although certain contaminated medical wastes and hazardous industrial wastes are not included by definition, in many nations these are in fact part of the municipal waste stream. Municipal solid waste has been defined by The Ecological Solid Waste Management Act of the Republic of Philippines (2000) as the wastes produced from activities within local government units which include a combination of domestic, commercial, institutional and industrial wastes and street litters.

2.4 Solid Waste Management

Solid Waste Management (SWM) as a concept has evolved over a period of time. The earlier definitions gave importance to the operational aspects of solid waste management starting from the generation of waste to its final disposal. Gilpin (1976) defined solid waste management as a planned system of effectively controlling the production, storage collection, transportation, processing and disposal or utilization of solid waste in a sanitary, aesthetically acceptable and economic manner. It includes all the administrative, financial, legal and planning functions as well as the physical aspects of solid waste handling. BabuAmbat (2000) defines solid waste management as the process associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner to public attitudes. In its

scope, solid waste management includes all administrative, financial, legal planning and engineering functions in order to counter the problems raised by solid wastes.

2.5 Valuation of Solid Waste Externality

The collection and mainly disposal of waste pose external costs on society. The external cost takes varied forms: local pollution, trans boundary pollution, global pollution, visual nuisances etc. In theoretical terms these externalities arise when a real variable (not a price) chosen by one economic agent enters the utility or production function of other economic agents and there's no requirement to or incentive for the first agent to take into account the effect on others while making choices (Freeman 1993). In order to internalize these social costs one needs to know their appropriate "values". However for environmental goods like clean air there are simply no markets and no observable prices. So economists have to resort to another method to evaluate the goods.

Theoretically the value of environmental quality can be inferred from what people would be willing to pay (WTP) to improve or to restore it, using valuation techniques that measures people's preferences. Alternatively, in case where environmental quality is under threat, the minimum amount people are willing to accept (WTA) in compensation for the deterioration of environmental quality is a measure of the value of that environmental good or service. Once they are estimated the task before the policy maker is to implement them through market based instruments like tax and / or subsidy. Thus economic valuation of externalities can be defined as an attempt to estimate the value that individuals place on environmental goods and other goods with no observable market price.

2.6 Expressed Preference Method:

Methods based on expressed preference techniques try to recover individual's willingness to pay for a change in environmental quality by eliciting their willingness to pay for such a change. The Contingent Valuation Methods and the Stated Preference Methods comprise two main families of elicitation formats within the expressed preference grouping. Stated Preference Methods include techniques such as choice experiments, contingent ranking and contingent rating. While contingent valuation has been used quite often in the context of landfill externalities the stated preference method has not been found to be adopted widely in the literature.

Solid waste management is one of the most critical issues the world, particularly in developing countries. This had led to the recognition of improved SWM as a central point for international environmental sustainability and development. Several studies have been conducted to analyze the demand side or households' willingness to pay for improved SWM system. In India, Roy et al (2013) examined the WTP for sustainable solid waste management using binary tobit regression. The study revealed that monthly average household expenditure, household size, average education, environmental awareness and number of working woman presented in family positively associated with the WTP for solid waste management scheme. Informal waste disposal arrangement is not significantly associated with the WTP. The study finally concluded that if solid waste management scheme is introduced, there is a probability of success.

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

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

2.7 Waste Management in Ethiopia

Collecting and managing solid and human waste is an important challenge for countries across the world. This problem is often magnified in cities where a dense concentration of people leads to a substantial amount of waste generation (Zerbock, 2003). In developing countries like Ethiopia, this problem is exacerbated by an influx of people moving to urban centers (Montgomery, 2008). Densely populated areas are more susceptible to health risks as disease can be spread quickly (Harris & Kiel, 2006). The implementation of effective waste management practices has been identified as essential for economic development in low-income countries in particular (Scheinberg, 2010). Urban centers are usually the hardest hit as efforts to develop and grow lead to an influx of economic opportunities and people (Gilbert, 1998).

With more and more people moving to urban centers in Ethiopia, cities like Addis Ababa and Bahir Dar are under increasing pressure to manage waste effectively in order to avoid outbreaks of disease. With the Akaki River running through Addis Ababa, and Bahir Dar located on Lake Tana, there is temptation to use these water bodies as a quick and easy waste removal solution. If waste is deposited in local water ways, the likelihood of water borne chemical diseases rises dramatically (Kuma, 2004). Therefore, it is essential to study how current waste management practices affect local water quality and disease rates.

Waste management in Ethiopia is important because only a small percentage of the country's inhabitants have access to safe drinking water: 21% in rural areas, 84% in urban areas, and 30% country-wide. Additionally, only 7% of populations in rural areas, 68% in urban areas, and 15% of people country-wide have adequate access to latrines or other improved human waste disposal options (Kumie, 2005). Access to latrines is a critical aspect of waste management, especially since the practice of open defecation is prevalent in the country, which can contaminate groundwater and lead to disease (WHO, 2008; PLAN, 2007).

2.8 Description of Addis Ababa

Geographically, Addis Ababa is located between 8°55' and 9°05' N Latitude and 38°40' and 38°50' E Longitude. The city is located at the center of Ethiopia with an area of 540 km² of which 18.174 m² is rural and its altitude ranges from 2000m - 2800 masl (AACA 1998). Addis Ababa is a seat both for Federal Democratic Republic of Ethiopia (FDRE) and Oromiya National

Regional State Government. It is bordered with Oromiya National Regional State in all directions. There are 10 sub-cities (Kifleketema) and about 99 Kebeles (AACAA 1998).

2.9 Solid Waste Management in Addis Ababa

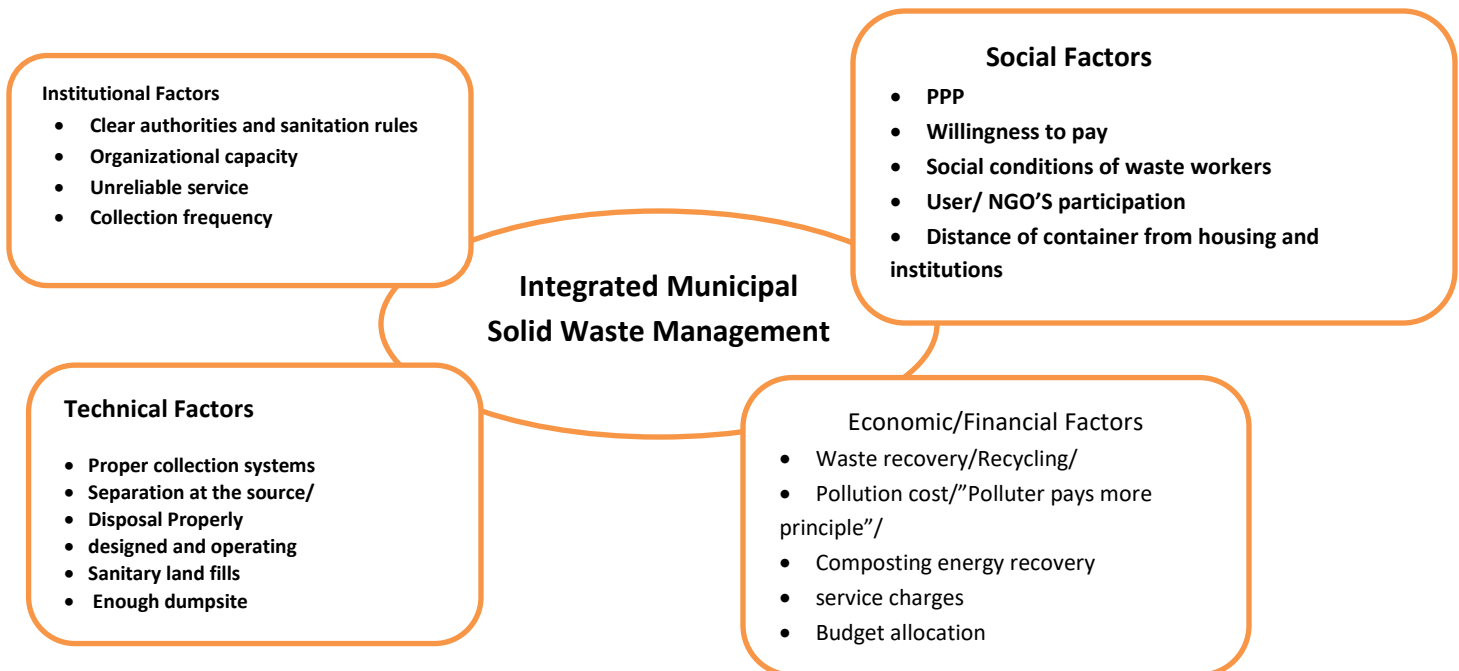
Addis Ababa city started its solid waste management some three decades back. The service cannot meet changing demands. The social waste collection service is unsatisfactory, and scenes of scattered waste are common in most part of the city (UNDP 2004). As a result, the population has the opinion that the municipal solid waste collection service is not functioning properly. As a result of this, the willingness of the population to cooperate with waste collection operation and to pay for the service is low. With respect to the organization of operations and management structure, collection and disposal are parts that are poorly organized. A disposal site situated at one corner of the city is also the main determining factor for collection and disposal of wastes in the city. This means that it is only those people close to the dumpsites that benefit. Dump sites and trucks for solid waste disposal are insufficient. In densely populated Kebeles, the majority of people live 0.5 – 1.00 km from accessible roads where transfer containers are located, when the recommended distance is 150 m from the housing units (Zerayakob 2002). Solid waste collected from hospitals, residential and business areas is dumped at the landfill sites on the outskirts of the city. It is common to find refuse pileup at road intersections or strewn in open spaces. With context to processing and recycling of social waste, little is done at all level of its management i.e. there is no source separation or sorting and this happens at disposal sites too. But some scavengers at landfill sites practice an informal type of waste recovery. Other options like energy recovery and composting are not practiced as alternatives for waste recovery. Most of the waste is administered by the government with no or little involvement of private sectors and tends to be costly and inefficient (ENDA 2006). Some communities receive little (in some cases no) solid waste collection services because local governments have no resources to cover all households. Thus, in the absence of collection services, households use forms of disposal most of which are heavily polluting. According to ENDA (1999), the city has a limited sewerage system, designed for 200,000 households, but presently covering only 6000 households. Data on the composition, volume and weight of solid waste generated and collected in Addis Ababa carried out in early 1980s and mid 1990s by Nure consultancy with the support of Louis Berger Company indicates that the estimates of waste generated per capita per day varies in volume from 0.4 to 1.23 lit/capita/day, in weight from 0.11 to 0.25 kg/capita/day and in density from 205

to 370kg/m³ (MAA 2002; Yami 1999). In other studies, the daily waste generation is estimated to be 0.35kg/capita/day (AASBPDA 2003). Regardless of increasing volume of waste generated, the performance of the city's solid waste collection and disposal system is poor (WHO 1996). Currently only 65% of the solid waste produced per day is collected and disposed by the municipality in the dumpsite, 5% is recycled, 5% is composted and the remaining 25% of the solid wastes are uncollected and dumped in unauthorized areas such as open fields, ditches, sewers, streets and many other available spaces in the city (AASBPDA 2003). Uncollected garbage is a serious environmental hazard for all, especially in areas where the roads are not accessible for collection by the municipality. These cause bad smells and attract various disease vectors and pests resulting in deteriorated aesthetic quality of the city. Thus, the health situation of the community is under serious threat (ENDA 2006). Addis Ababa provides many open garbage containers on streets and expects citizens to dispose of their waste in them. Waste is then collected and deposited in one of the city dumps.

2.10 CONCEPTUAL FRAMEWORK

According to UNDP (2004), solid waste management is a complex task which must go beyond purely technical considerations to political, institutional, social, financial, and economic aspects.

Figure 1: Conceptual framework of Integrated Municipal Solid Waste Management



Source: NigatuRegassa, Rajan D. Sundaraa&BizuneshBogaleSeboka (2011)

CHAPTER THREE

3 RESEARCH DESIGN AND METHODOLOGY

3.1 Description of Study Area

This study was carried out in Kolfe Keraniyo sub city, Addis Ababa. Kolfe Keraniyo is one of the 10 sub cities of Addis Ababa. The district is located in the western district of the city. It borders with the district of Gullele, Addis Ketema, Lideta and Nifas Silk-Lafto. It has 15 woreda administrative. The area of kolfe keraniyo stretches some about 15 km radius from the center of Addis Ababa City proper. The approximate geographical area of Kolfe Keraniyo sub-city has an area of 61.25 Km². The annual maximum and minimum temperature in the Kolfe Keraniyo sub-city varies between 20⁰C - 35⁰C and 8.5⁰C- 20⁰C respectively. Based on 2007 national censuses conducted by central statistics agency of Ethiopia (CSA), by 2011 E.C the city's population was projected to be 546,219. The annual population growth rate is also estimated to be 3.5%. From this total population 220, 859 and 235, 360 were men and women respectively.

3.2 Research Design

A survey design method was used for this study since effective research on municipal solid waste generation and disposal makes use of both quantitative and qualitative research approaches. The core reason which leads to the selection of this particular design is the need to perform an exploratory analysis on people will be willing to pay (WTP) to improve or to restore sustainable municipal waste management, using valuation techniques that measures people's preferences in kolfe keraniyo area, Addis Ababa. Previous researches as indicated on the problem of statement earlier are either country wide studies or are quantitative method. Using key qualitative and quantitative instruments like interviews, focus group discussion, and field observation were highlight the different stories that examine the factors that influence the WTP for the improved waste management system in case of in kolfe keraniyo sub city, Addis Ababa.

3.3 Population and Sampling Techniques

3.3.1 Population

To quantify the determinants and the impact of the dependent and independent variables on the study area of kolfe keraniyo sub city, Addis Ababa an appropriate population should be determine. Therefore, the total population size of the research is the number of household, their families and concerned organizations of the area. According to the data in the sub city it has 15

administrative woreda, out of this select the five woreda randomly and number of household, families and concerned organizations that are estimated 546, 219. Therefore, the population size for this study is 546, 219.

3.3.2 Sample Size

Sample size determination were undertaken using a statistically proven approach developed by Tara Yamane. In order to take a sample that can be the best representative of the whole population, sample size was calculated based on the simplified formula for proportions by Yamane (1967). At 95% confidence level and precision of 0.5, the formula is given as follows:

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

Where:

n- Signifies the sample size

N- Signifies the population under study area

e- Signifies the margin error (it could be 0.10, 0.05 or 0.01)

From the above formula 400 respondents were determined from the population of 546,219 drawn from the five woreda. By using Random sampling technique 5 woreda select out of 15 woreda of kolfe keraniyo sub city, Addis Ababa.

3.4 Sampling Technique

This study is focused on Municipal Waste Management to suggest optimal design of economic instruments for managing Municipal Waste and factors that affecting it and the valuation of environmental and economic costs that Municipal Waste could impose on the society in case of Kolfefe Keraniyo sub-city, Addis Ababa, Ethiopia. In the sampling process, the study followed a multi-stage sampling procedure with random sampling techniques. Kolfefe Keraniyo sub-city was purposively selected. In the first stage, random sampling technique was used and five woreda namely woreda 1, 4,7,10 and 13 were randomly selected out of the 15 Woredas. In the second stage, each woreda in the sub-city were classified in to strata based on sub-section or “ketena” formed by the Woreda administration. From the five selected Woredas’ 4 Ketenas (small village) and 20 respondents from each ketena were randomly selected. A systematic sampling technique was used to select households whereby every 20th building in the selected Ketena was sampled. In total 400 households were involved in the survey (i.e. 80 in each woreda). The survey was conducted from March to April 2020 using face-to-face household interview. Data were collected using structured questionnaire both closed and open-ended questions. Five competent

experts were hired as enumerators. The enumerators were also selected based on their familiarity with the selected survey areas. The questionnaires were administered with assistance of enumerators through face-to-face interview. For reliability and validity of the study conclusions, a half-day training session was held for the enumerators. Prior to the data collection, the data collection tools were pretested on 20 households. The questionnaire was amended based on the feedback from a pre-test.

The potential respondents were first introduced to the purpose, objective and scope of the survey that is to collect information from the households so that recommendations can be given to the concerned stakeholders to improve the current waste management service, and were told that the researcher cannot guarantee its implementation. It was also mentioned that their identity would be kept strictly anonymous. With their consent to be interviewed, the questionnaire interviews were conducted. The survey was conducted at once and it took an average of about 30 to 45 minutes to complete.

3.5 Types of Data and Instruments of data collection

3.5.1 Types of Data

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

3.5.2 Method of Data Collection

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

3.5.3 Questionnaire Design

A semi-structured questionnaire was used to collect data from the households, which included questions related to the socioeconomic characteristics of the households, current SWM services provided by the municipality, awareness about the impact of waste on the environment, and questions related to willingness of the households to pay a fee for improved waste collection service. The WTP for improved service is mostly reliant on a household's economic conditions and thus it could also be validated by regressing WTP against socioeconomic variables of the target group, Alberini, A.; Cooper, J.(2000), Mitchell, R.C.; Carson, R.T.(1998). The awareness of the impact of waste on the environment was an open-ended question, which allowed respondents to answer based on their own understanding rather than influencing their decision by providing additional information. The information was used to identify the current situation of SWM practices and characteristics of the households that can influence their WTP and the maximum amount they are willing to pay for the improved waste collection services.

3.6 Data Analysis

Based on the objectives of this study, both descriptive statistics and econometric models were employed to analyze the qualitative and quantitative data. The descriptive statistics included mean, standard deviation, percentages, frequency distribution and graphs. Two levels of analysis using logit and tobit regression models were used in this study. The logit model was used to identify the determinants of households' WTP for improved waste collection service and the tobit model to identify the factors influencing the maximum amount of money they are willing to pay. All statistical tests were conducted at a significance level of (1%,5% and 10%). The economic model data were analyzed by using statistical package 'Stata 13'.

3.7 Econometric Model Specification

In this study, the households were asked at first whether he/she is willing to pay or not for improved service. This was analyzed with binary logit model. The next inquiries were, if the household was willing to pay then and the maximum amount that he/she would be willing to pay question and analyzed with Tobit.

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

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

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

Where β is a vector of parameters to be estimated and

X is a vector of the respondent attributes.

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

$$p(\mathbf{0}) = 1 - p(\mathbf{yes}) \quad (2)$$

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

Manipulation of (2) and (3), gives

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

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

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

The logarithm of the odds ratio is given as follows:

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

$$WTP_{wm} = \beta_0 + \beta_1 x_1 + \dots + \beta_n x_n + \varepsilon \quad (5)$$

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

β_0 = is the intercept,

β_1 = is the coefficient associated with the price x_1 , and

β_n = a vector of regression coefficients associated with other attributes of the respondent x_n

ε = is the error term which is logistically distributed.

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

$$\frac{1}{n} = \sum_{i=1}^n \partial p \left(\frac{Y_i-1}{\partial x_i} \right) = \beta_j \frac{1}{n} \sum_{i=1}^n f(X'_i \beta), j = 2, \dots, k. \quad (6)$$

i.e., the mean marginal effects over the sample of n individuals

The maximum likelihood method was used to estimate the parameters of the multiple logistic response function. The log-likelihood function is as follows:

$$\text{Log } L(\beta) = \sum_{i=1}^n Y_i(X'_i \beta) - \sum_{i=1}^n \log [1 + e(X'_i \beta)] \quad (7)$$

However, the logit model provides information only about respondents' decision to pay or to not pay for the improved SWM service, but not on the maximum amount of money they are willing to pay. Therefore, the tobit model was used to evaluate factors influencing the maximum amount of money households are willing to pay as used by other similar studies ,Padi, A.; Addor, J.A.; Nunfam, V.F.(2015).

The Tobit model can be given by:

$$y_i = \beta X_i + \varepsilon_i \quad i = 1, 2, \dots, n \quad (8)$$

Where y_i is the dependent variable, i.e., the maximum amount of money the respondents are willing to pay;

X_i is a set of explanatory variables, and is assumed to be $N(0, \delta^2)$, i.e., normally distributed and independent of X_i . The observed y_i counterpart of y_i^* can be expressed as:

$y_i = 1$ if $y_i^* > 0$, for willing to pay for improved waste collection service

$y_i = 0$ if $y_i^* \leq 0$, for not willing to pay for improved waste collection service

and y_i^* is a latent (unobservable) variable for WTP_i ,

The log-likelihood function for the Tobit model is given by:

$$\mathbf{Log L} = \sum_{i=1} - \frac{1}{2} \left[\mathbf{log}(2\pi) + \mathbf{log} \delta^2 + \frac{(y_i - x_i \beta)^2}{\delta^2} \right] + \sum_{y_i=0} \mathbf{log} \left[\mathbf{1} - \Phi \left(\frac{x_i \beta}{\delta} \right) \right] \quad (9)$$

Where $\Phi =$ is the standard normal cumulative distribution function. The maximum likelihood estimates of the parameters are calculated by maximizing the likelihood function with respect to β and δ . In the case of open-ended questions, the mean WTP can be calculated by averaging the total amount, Alberini, A.; Cooper, J.(2000) that the households are willing to pay, which is given by:

$$\mathbf{MeanWTP} = \frac{1}{n} \sum_{i=1}^n y_i \quad (10)$$

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

The statistical software Stata13 was employed to run the logit and tobit models for this study.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Characteristics of Respondent in the Study Area

Regarding the gender of participants, 32.25% and 67.5% the participants were male and female respectively. Majority of the respondents (86.5%) were between the age of 18 and 60 years, 13.5% were above 60 years of age. Concerning the educational status of the respondents, 34 (8.5%) respondents had no educational, 102 (25.5%) had primary, 132 (33%) had secondary education, 83 (20.75%) respondents had certificate and diploma, 40 (10%) had Bachelor degree and only 9 (2.25%) respondents had the master degree and above (Table 2).

Majority of respondent (33.5%) earned a monthly income ranging between ETB 3,501 and ETB 5,000, 20% ranging between 5,001 and 7,500 ETB per month, 19.25% ranging between 2,501 and 3,500 ETB and 6.25% earned between 7,501 -10,000 birr per month. The remaining 19% of the respondents earned less than 2,500 birr per month (Table 2).

Table 1: The Mean Estimation of Respondent Family Size and Age

Mean estimation			Number of obs	=	400
	Mean	Std. Err.	[95% Conf. Interval]		
age	46.035	.6094263	44.83691		47.23309
householdsize	7.04	.2020782	6.642729		7.437271

Source: field survey (2020)

With reference to household size, most of the respondent (43.25%) had family size below five. The remaining 30% and 26.75% of the respondents had the household size of 5 to 8 and above eight respectively. As shown in table 1, the average family size was 7.04. The considerable majorities of the respondents had job. Out of 400 respondents, only 14.75% and 12.5% participants were unemployed and pensioner or house wife respectively. Hundred forty two (35.5%) respondents were small scale traders. The remaining 20.5%, 12.25%, and 4.5%, of the respondents were own business, private employed and Government employee respectively.

Table 2: Characteristics of Respondent in the Study Area

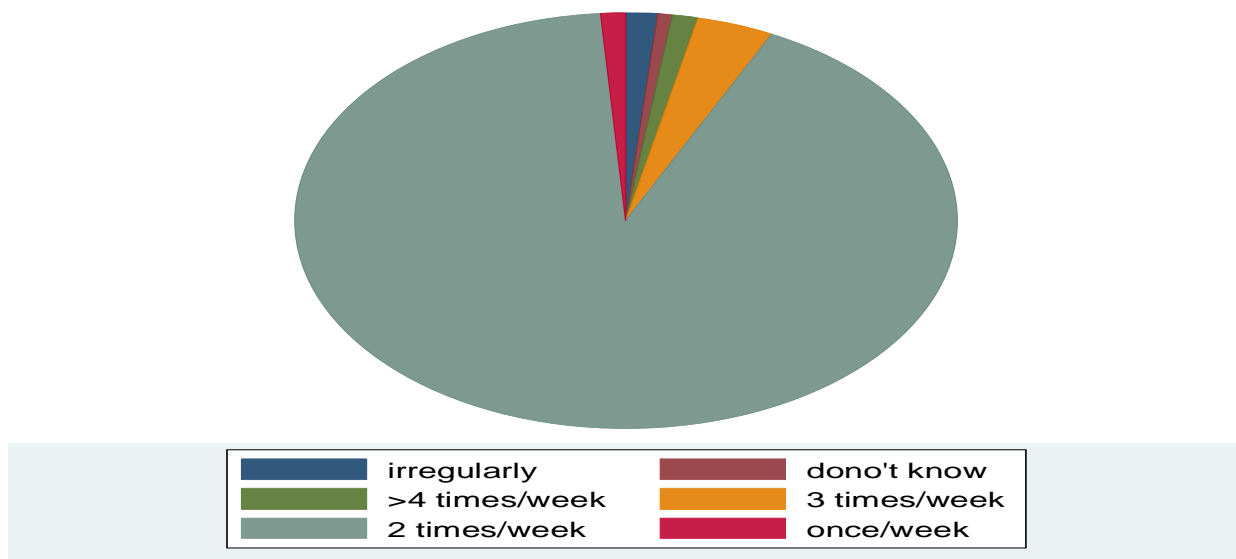
Variable	Freq.	Percent	Cum.
Gender			
male	130	32.5	32.5
female	270	67.5	100
Total	400	100	
age			
age group 18-30	46	11.5	11.5
age group 31-45	170	42.5	54
age group 46-60	130	32.5	86.5
age group >60 year	54	13.5	100
Total	400	100	
HH Education			
illiterate respondent	34	8.5	8.5
school < grade 4	33	8.25	16.75
school grade 5-8	69	17.25	34
school grade 9-12	132	33	67
school grade certificate	13	3.25	70.25
diploma	70	17.5	87.75
first degree	40	10	97.75
> two degree	9	2.25	100
Total	400	100	
Employment status of HH			
unemployment	59	14.75	14.75
government employee	18	4.5	19.25
private employee	49	12.25	31.5
street vendor/small trade	142	35.5	67
own business	82	20.5	87.5
other(pensioner/ house wife	50	12.5	100
Total	400	100	
Average monthly HH Income			
less than 2500 Birr	76	19	19
Birr b/n 2501-3500	77	19.25	38.25
Birr b/n 3501-5000	134	33.5	71.75
Birr b/n 5001-7500	80	20	91.75
Birr b/n 7501-10000	25	6.25	98
greater than 10001 Birr	8	2	100
Total	400	100	
Household Family Size			
family size < 5	173	43.25	43.25
family size 6-8	120	30	73.25
family size > 8	107	26.75	100
Total	400	100	

Source: filed survey (2020)

4.2 Current Situation of SWM in Kolfe Keraniyo Sub City

The current situations of solid waste management explanatory variables used in this study were described in Tables (shown in the appendix) and are explained below. Study found that 100% households were receiving the SWM service. Among the respondents who were getting SWM service, 0.75% did not know the service frequency, 1.25% were getting the service greater than 4 times per week, 3.75% were getting the service 3 times a week, 91.5% were getting the service twice a week and 1.5% respondents reported that they did not know the frequency of such services. The remaining 1.25% respondents were getting service in different ways, once a week.

Figure 2: Waste collection Service Frequency in Kolfe Keraniyo Sub- city

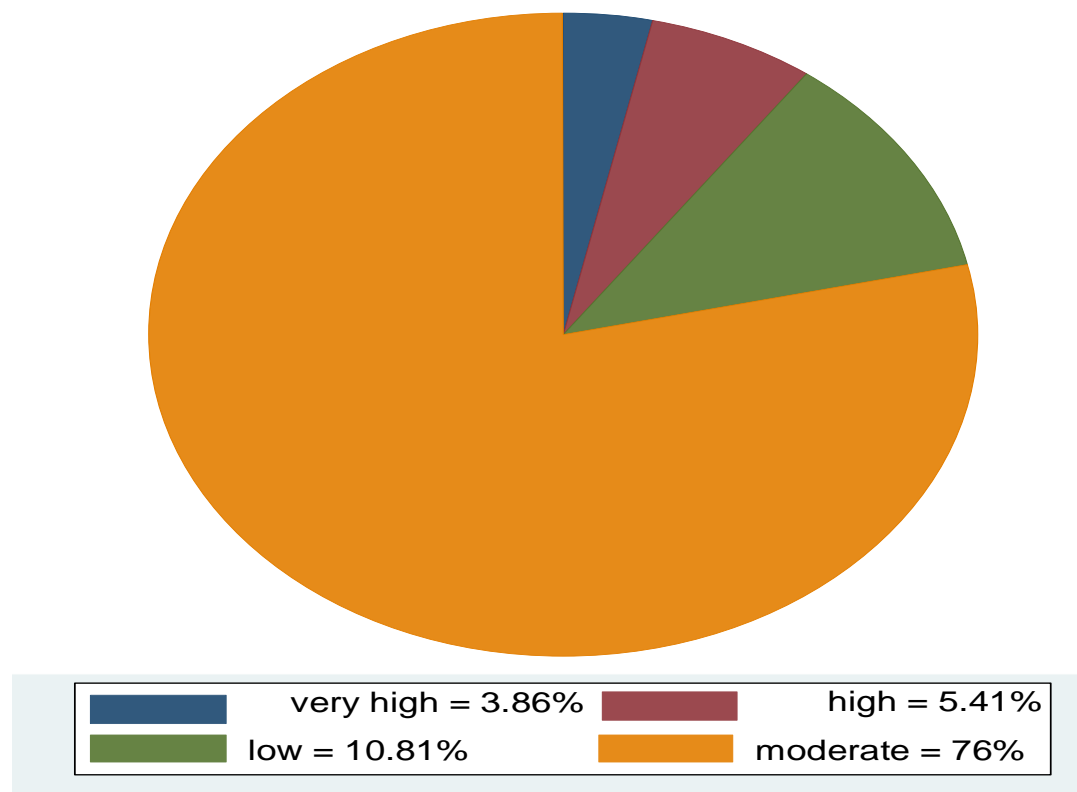


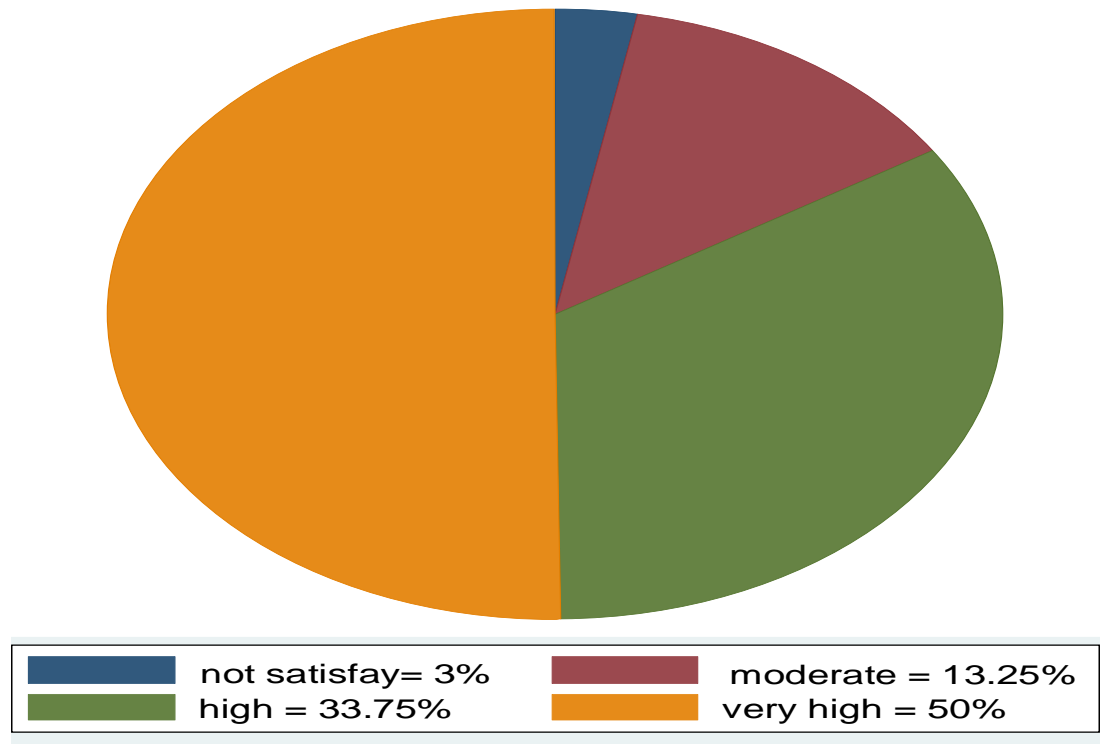
Source: field survey (2020)

About two thirds of the households reported that they were getting the SWM service from the municipality and only 3.5% were getting SWM service from private service provider. The remaining 32.75% households did not know from which provider they were receiving SWM service. There were different types of solid waste components they produced in the survey area, like plastic bags, rotten food and vegetables, peels of fruits and vegetables, Grass & Wood, old slippers and shoes, old clothes, covers of groceries, old papers and pencils, old books, different types of bottles, damaged electronic goods, old tooth brushes and paste, broken glasses, empty plastic bottles of soft drink and water, metals, stones & ceramics and rubber & leather, etc.

Households were found to be using different types of materials to store the solid waste. 5.5% respondents were using durable metal or plastic container of garbage can, 86.25% respondents

were using the sack (nylon bag), 7.5% respondents were using plastic bags and 0.75% respondents were using pit to store solid waste. The study shows that the great majority, 95.75% (383) respondents were aware of municipal solid waste management and the remaining 4.25% were not aware about municipal solid waste management. Among the 383 respondents who were aware of the municipal solid waste management services, 88.77%, 29.24%, 20.1% were practicing separating waste from the source, reuse wastes and preparing compost respectively for improved SWM service. On the other hand 79.9%, 70.76% and 11.23% respondents did not practice composting wastes, reused waste they produced and separate waste at the source respectively. Moreover, among the respondents who were aware of the municipal solid waste management services, 97.13% and 95.69% were willing to cooperate in separating and reducing wastes to enhance the services in the future. Among the households getting SWM service, 84.75% were willing to pay for improved service whereas remaining 15.25% were not willing to pay for improved service. About two thirds (259) of the study respondents believed that SWM was one of the major problems of the sub city. Regarding the intensity of problem 3.86% respondent reported it as very high, 5.41% reported as high, 76% reported as moderate whereas 10.81% respondents reported it as low.





Source: field survey (2020)

Respondents were asked whether they were satisfied with the current solid waste collection service. Only 50% and 33.75% respondents were very highly satisfied and highly satisfied respectively. 13.25% of respondents were moderately satisfied whereas 3% respondents were not satisfied at all. The reason behind being not satisfied at all was that the service collects were not returning the collection bags.

4.3 Willingness of Households to Pay for the improved solid Waste management

As shown in table 3, out of 400 respondents, about 84.75% were willing to pay for the improved waste collection service (Table 3). This share of respondents' WTP is somewhat consistent with other similar study where more than 60% of the respondents provided a positive response (Mahima, S.; Thomas, S. (2013)–26,35–37).

Although the respondents were free to give reasons for their willingness or unwillingness to pay for the improved waste collection service, most of the households gave similar reasons.

Table 3: Households' Willingness to Pay for Improved Waste Collection Service.

WTP	Frequency	Percent	Cumulative
NO	61	15.25	15.25
YES	339	84.75	100
TOTAL	400	100	

Source: Field survey (2020).

Identical answers were grouped together and categorized as one reason. For example, households gave reasons that they want to keep their house clean, surroundings clean or the environment clean. These answers were grouped together as “to keep their surroundings clean”. The answers were presented below based on the frequency of the provided reasons and because most of the respondents gave multiple reasons, the percentage did not tally to 100. The reasons for their WTP (84.75%) for improved waste collection service summarized as follows: (i) to keep their surroundings clean (72%). (ii) Can dispose of their waste on a regular basis (65%). (iii) Willing to share the cost for effective waste management (53%).

About 15.25% of the households were not willing to pay for the improved waste management service. The reasons for their unwillingness to pay were as follows: (i) as they did not pay for the service in the past, they did not the reason to pay for it (91%). (ii) Household earning low income did not afford (77%). (iii) Respondents believed that it was the responsibility of the government to provide the services (25%). (iv) Generate less amount of waste so could self-manage it (12%). (v) Pay municipal tax so the service should be free of charge (6%). Although some of the reasons for both willingness and unwillingness to pay are more or less interrelated, it can be generalized that those willing to pay are more concerned about the cleanliness of their house and surroundings, want better waste collection services and feel responsible to share the cost of proper waste disposal. Similarly, households who are not willing to pay do not feel that it is their responsibility and that it should be managed by the local government without any fee being imposed on them.

4.4 Factors Influencing Households' Willingness to Pay for Improved Solid Waste management

The results from the logit regression model are presented in Table 4. All 400 observations were used in this analysis. The log likelihood for this fitted model is -148.45341 and the likelihood ratio (LR) chi-square of 44.71 (df = 6) with a p-value 0.0000 (significant at 1%) stated that this model was statistically significant and as a whole fitted significantly better than an empty model, i.e., only with the dependent variable. Thus, the validity of the logit model to estimate determinants of WTP for waste collection service is consistent with other similar studies Addai, K.N.; Danso-Abbeam, G. (2014), Bhattarai, K.(2015).

This study found that the significant variables that influence households' WTP for the improved waste collection service were income, household size, and amount of waste generated. Gender, education, and age variables did not show statistically significant influence on the households' WTP. The total average income of the household was statistically significant at the 1% level and it positively influences households' WTP decision. This result is supported by other similar studies [Padi, A.; Addor, J.A.; Nunfam, V.F.(2015),Banga, M.; Lokina, R.B.; Mkenda, A.F.(2011),Bhattarai, K. (2015). The marginal effect result showed that a unit increase in household income would increase the likelihood for households' WTP for improved solid waste management service by 0.087%, i.e., if the monthly household income increases by ETB. 100, the likelihood for households' WTP increases by 7.95% (Table 4).

Household size had a positively influences on the households' WTP decision. This result is supported by other similar studies Hagos, D.; Mekonnen, A.; Gebreegziabher, Z. (2012). The marginal effect result shows that a unit increase in household family size would increase the likelihood for households' WTP for improved waste collection service by 2.36%, i.e., if the member household size increases by one person, the likelihood for households' WTP increases by 2.36%. The amount of waste generated by a household was also a significant factor at the 5% level of significance. The coefficient was negatives, which was not expected in this study. The marginal effect result showed a unit change in household amount of waste generated would change the likelihood for households' WTP for improved solid waste management by 1.27%, i.e., if the amount of monthly household waste generated increased by 10kg, the likelihood for households' WTP decreases by 12.68%.

All the other variables which were expected to have a significant relationship with WTP were found to influence households' WTP decision in kolfe keraniyo sub city.

Table 4: Logit regression results of factors influencing willingness to pay for improved waste collection service.

Logistic regression					Number of obs = 400		
					LR chi2(6) = 44.71		
					Prob > chi2 = 0.0000		
Log likelihood = -148.45341					Pseudo R2 = 0.1309		
Independent Variables	Coefficient	Standard Error	Z-Stat	P>z	[95% Conf. Interval]		Effect dy/dx
income	0.79	0.147	5.39	0000	0.50431	1.081208	0.0795
gender	0.43	0.317	1.34	0.18	-0.19609	1.046252	0.0426
householdsize	23.51	9.342	2.52	0.012	5.19729	41.81802	2.3581
education	0.02	0.032	0.66	0.508	-0.04129	0.083354	0.0021
amount of waste generated	-12.64	4.998	-2.53	0.011	-22.4379	-2.84741	-1.2682
age	-0.01	0.013	-0.78	0.437	-0.03519	0.015198	-0.0010
_cons	1.42	0.740	1.93	0.054	-0.02496	2.874357	

Source: Field survey (2020).

This study expected that female household heads would be more willing to pay for improved waste collection service like in other studies Addai, K.N.; Danso-Abbeam, G.(2014),Bhattarai, K.(2015). However, there was significant statistical relationship in this study. But still this finding is consistent with other similar studies Padi, A.; Addor, J.A.; Nunfam, V.F.(2015),Hagos, D.; Mekonnen, A.; Gebreegziabher, Z.(2012). Age of the household head was expected to have a negative relationship with WTP decision as found by similar studies [Banga, M.; Lokina, R.B.; Mkenda, A.F. (2011),Sumukwo, J.; Kiptui, M.;Cheserek,G.J.(2012). The result from this study showed a statistically non significant relationship. Similarly, other studies have also found similar insignificant relationships Awunyo-Vitor, D.; Ishak, S.; Jasaw, G.S.(2013), Padi, A.; Addor, J.A.; Nunfam, V.F.(2015).

The total years of education attained by the household head was also expected to increase the likelihood for the households' WTP for improved solid waste management. The total years of education attained by the household head was not statistically significant at 10%, 5% and 1%

level, with a positive coefficient value. But other studies found a statistically significant relationship at 5% level, with a positive coefficient value. The positive relationship between education and WTP for better waste management services is also supported by other studies Banga, M.; Lokina, R.B.; Mkenda, A.F.(2011),Bhattarai, K.(2015).

4.5 Average Amount of Money that Households Are Willing to Pay for Improved Solid Waste management

Out of 400 households surveyed in this study, 339 households, i.e., around 84.75%, are willing to pay for the improved solid waste management in kolfe keraniyo sub city. This study used the open-ended CV method to elicit the maximum amount those households are willing to pay for the improved solid waste management. The minimum and the maximum amount that the households are willing to pay are ETB.10 and ETB.200 per month, respectively. The mean WTP amount is calculated using Equation (10).

Table 5: Average Amount of WTP

Variable	Obs	Mean	Std. Dev.	Min	Max
maximumamo~p	400	53.1575	34.23987	10	200

Source: Field Survey (2020).

This study found that the mean WTP amount for the improved solid waste management in kolfe keraniyo sub city is ETB.53.16 (1.56 US\$) per month. The mean WTP amount from this study is grate than a similar study conducted in another municipality of Jima, Ethiopia, Fikadu T. (2016), which was ETB 17.26. per month, but is greater than the study conducted in mekele town,Hagos, D., Mekonnen, A. and Gebreegziabher, Z. (2012), which was ETB 11.89, per month. Studies conducted in Uganda [Banga, M.; Lokina, R.B.; Mkenda, A.F. (2011) and Nepal Bhattarai, K.(2015), found WTP amount to be 1.3 US\$ and 1.691 US\$, respectively. Hence, the WTP amount from this study is more or less similar to other similar studies in developing countries.

4.6 Factors Influencing Amount of Money that Households are willing to pay for Improved Solid Waste management

The result from the tobit model is presented in Table 6. All 400 observations are used in this analysis. To censor the 10 values for 30 observations, i.e., for the households who are a lower limit of 10 was specified and the model was run. The likelihood ratio chi-square of 38.77 (df =7) with a p-value 0.0000 (significant at 1%) shows that this model as a whole fits significantly better than an empty model, i.e., at least one of the regression coefficients in the model is not equal to zero.

The tobit model results shows that two independent variables, income and respondent age are statistically significantly related to the maximum amount of money that the households are willing to pay for the improved solid waste management. The income variables were also significant variables in the logit model used in this study. Although the respondent age variable was expected to positively influence the maximum amount that households are willing to pay, the relationship could be negatively established and significant in the tobit model. The significant result shows that the age of the respondent does influence the maximum amount of money the households are willing to pay for the improved solid waste management. Respondent gender and Education variables which are not significant in the logit model and also House hold size, amount of waste generated and solid waste management awareness variable are also not significant in the tobit model.

The household size was expected to have positive relationship with the maximum WTP amount for improved waste collection services. While some studies have found this positive significant relationship as Roy, A.T.; Deb, U. (2013), this study did not find any statistically significant relationship, in consistent with findings from other studies (Padi, A.; Addor, J.A.; Nunfam, V.F.(2015),Hagos, D.; Mekonnen, A.; Gebreegziabher, Z.(2012)).This study also expected that female household heads would be willing to pay more for the improved solid waste management service in Kolfe keraniyo sub-city than male household heads. However, gender did not show a statistically significant relationship with WTP for the services. The finding is consistent with other similar studies [Padi, A.; Addor, J.A.;(2015),Hagos, D.; Mekonnen, A.; Gebreegziabher, Z.(2012). Some studies show that age has a positive relationship with the maximum WTP amount [Awunyo-Vitor, D.; Ishak, S.; Jasaw, G.S.(2013),Nkansah, E.; Dafor, N.K.; Essel-

Gaisey, F.(2015). But in this study age had significant and negative relationship with WTP for the services.

This study showed that younger household heads, who could be more educated and aware of the importance of proper waste management, would pay more for improved waste collection services as found by Padi, A.; Addor, J.A.; Nunfam, V.F.(2015).

Table 6: Tobit regression results of factors influencing the amount of money household’s willingness to pay for improved solid waste management in kolfe keraniyo sub city.

Tobit maximum amount of wtp income gender house hold size education amount of waste generated age awareness about swm, ll

Tobit regression Number of obs = 400
LR chi2(7) = 38.77
Prob > chi2 = 0.0000
Pseudo R2 = 0.0103

Log likelihood = -1869.9197

Maximum Amount of WTP	Coef.	Std.Err.	t	P>t	[95% Conf. Interval]	
Income	7.631	1.485	5.14	0.000	4.710	10.551
Gender	-1.931	4.032	-0.48	0.632	-9.859	5.996
House Hold Size	115.619	107.450	1.08	0.283	-95.630	326.868
Education	0.344	0.385	0.89	0.372	-0.414	1.102
Amount of waste generated per HH	-61.702	57.460	-1.07	0.284	-174.669	51.265
Age	-0.414	0.150	-2.77	0.006	-0.708	-0.120
Awareness about SWM	-3.587	4.413	-0.81	0.417	-12.263	5.089
_cons	55.517	9.294	5.97	0.000	37.244	73.790
/sigma	34.671	1.296			32.123	37.218

Obs. summary: 30 left-censored observations at Maximum Amount of WTP<=10
 370 uncensored observations
 0 right-censored observations

Source: Field Survey (2020).

Solid waste management awareness variables were expected to have a positive influence on the maximum WTP amount but the tobit regression model gave an insignificant result and the relationship could not be confirmed. This result contradicts the findings from other studies Padi, A.; Addor, J.A.; Nunfam, V.F.(2015),Hagos, D.; Mekonnen, A.; Gebreegziabher, Z. (2012),Awunyo-Vitor, D.; Ishak, S.; Jasaw, G.S. (2013) that showed a positive relationship.

The income variable was significant at the 1% level of significance with a positive coefficient. The marginal effect shows that respondents who were a unit increase in monthly income

increases the maximum amount of money that the household is willing to pay, by ETB. 7.6 per month (table 7). This positive relationship is also supported by other similar studies Padi, A.; Addor, J.A.; Nunfam, V.F.(2015),Hagos, D.; Mekonnen, A.; Gebreegziabher, Z.(2012),Nkansah, E.; Dafor, N.K.; Essel-Gaisey, F. (2015). Age has negative significant relation with the maximum amount of willingness to pay to improve solid waste management. The marginal effect shows that as the respondent age increased by one year the maximum amount of willingness to pay decreased by ETB. 0.41(table 7).

CHAPTER FIVE

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The study found out that the great majority (96.5%) of the households received standard solid waste collection services from the municipality two times per week. About 85% of the respondents were satisfied with the services. The main reason behind not being satisfied with the services was related to the solid waste collectors not returning back the households waste collection bags. According to this result, the majority of the surveyed households (84.75%) were willing to pay for improved solid waste management services. The mean WTP amount that households are willing to pay is ETB.53.16 (1.56 US\$) per month.

The municipality or the concerned stakeholders may consider this as a reference amount to impose a solid waste collection fee in Kolfe Keraniyo sub-city as such fee has never been charged to the households. The household welfare can be increased by providing solid waste collection services regularly. As 100% households are getting waste collection services, there is a necessity to increase the service frequency and consistency. Improved regularity of SWM services and better geographical coverage of solid waste collection can be achieved by the revenue generated by the solid waste collection fees. Similarly, environmental awareness program should also be conducted by the municipality with practical learning lessons.

The factors that significantly influence the households' WTP for improved solid waste management are monthly household income, household family size and the amount of waste generated at the household level. Similarly, the significant factors that influence the maximum amount of money households are willing to pay for improved solid waste management services are monthly household income and respondent age. Concerned stakeholders and policy makers should consider these threats before enforcing a waste collection service fees. For instance, since households' awareness of the environmental impact is positively significantly related to both WTP and the maximum amount of waste collection fee they are willing to pay, the government and concerned stakeholders should educate the households about adverse effects of indiscriminate disposal of waste on the environment in order to rise more funding for SWM

services. According to the study with the growing amount of municipal solid waste and municipalities' inability to manage it properly mainly due to financial constraints, collecting fees from the public for improving the waste management service seems to be a viable option.

5.2 Recommendation

Based on the findings to improve SWM in kolfe keraniyo sub city the following recommendations are made. Awareness creation and training should be given to the community on efficient solid waste management (separate, reuse, recycling and disposal) through shared efforts of all stakeholders with practical training. Increasing the participation of local communities in solid waste management decision making activities is necessary. Give incentives and recognition and exempt from the various taxes for sanitary service provider and households that practice reusing and recycling activities. Policy makers should consider important variables like income, education, and family size, amount of waste generated and service provider in designing improved SWM services. Entrepreneurs and private service providers should be encouraged to develop improved schemes for waste collection and management.

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6 APPENDIX:

6.1 Table 7 STATA out put

Frequency that respondents use the collection service

frequency that use the collection service	Freq.	Percent	Cum.
irregularly	6	1.50	1.50
dono't know	3	0.75	2.25
>4 times/week	5	1.25	3.50
3 times/week	15	3.75	7.25
2 times/week	366	91.50	98.75
once/week	5	1.25	100.00
Total	400	100.00	

Respondants which collection service provider do they use

Which collection service provider do you use	Freq.	Percent	Cum.
public (manicipality)	255	63.75	63.75
private	14	3.50	67.25
3	131	32.75	100.00
Total	400	100.00	

Respondants awareness about manicipal solid waste mangement

respondent awareness about Municipal solid waste management	Freq.	Percent	Cum.
yes	383	95.75	95.75
no	17	4.25	100.00
Total	400	100.00	

Type of material used to store the solid waste at house hold level

types of materials to store the solid waste	Freq.	Percent	Cum.
in the pit	3	0.75	0.75
by garbage can	22	5.50	6.25
in the sack (lylon bag)	345	86.25	92.50
with plastic bag	30	7.50	100.00
Total	400	100.00	

Respondent answer of separated different type of waste at household's level

separate different type of waste at your home	Freq.	Percent	Cum.
yes	340	88.77	88.77
no	43	11.23	100.00
Total	383	100.00	

Respondent answer the Reuse Waste different type of waste at household's level

reuse waste in your house	Freq.	Percent	Cum.
yes	112	29.24	29.24
no	271	70.76	100.00
Total	383	100.00	

Respondent answer using kitchen/Garden waste for composting at household's level

using kitchen/gar den waste for composting	Freq.	Percent	Cum.
yes	77	20.10	20.10
no	306	79.90	100.00
Total	383	100.00	

Respondent answer Solid Waste Management is the major problem the sub city

SWM is one of the major problems of the sub city	Freq.	Percent	Cum.
yes	259	64.75	64.75
no	141	35.25	100.00
Total	400	100.00	

Respondent answer the intensity of the problem of solid waste management

the intensity of the problem of SWM1	Freq.	Percent	Cum.
very high	10	3.86	3.86
high	14	5.41	9.27
moderate	207	79.92	89.19
low	28	10.81	100.00
Total	259	100.00	

Respondent answer the level of satisfaction with the collection service

the level of satisfaction with the collection service	Freq.	Percent	Cum.
very high	201	50.25	50.25
high	135	33.75	84.00
moderate	52	13.00	97.00
low	12	3.00	100.00
Total	400	100.00	

Respondent answer willingness to cooperate in separate garbage collection system

Willingness to cooperate in separate garbage collection system	Freq.	Percent	Cum.
Very much willing	313	81.72	81.72
Somewhat willing	44	11.49	93.21
Less willing	21	5.48	98.69
Not willing	5	1.31	100.00
Total	383	100.00	

Respondent answer willingness to cooperate in Reduce garbage collection system

Willingness to cooperate in reduce garbage collection system	Freq.	Percent	Cum.
Very much willing	207	54.05	54.05
Somewhat willing	150	39.16	93.21
Less willing	15	3.92	97.13
Not willing	11	2.87	100.00
Total	383	100.00	

Margins, dydx (income gender house hold size education amount of waste generated age awareness about swm)

Average marginal effects
Model VCE : OIM

Number of obs = 400

Expression : Linear prediction, predict()

dy/dx w.r.t. : income gender householdsize education amountofwastegenerated age awarenessaboutswm

	dy/dx	Delta-method Std. Err.	z	P> z	[95% Conf. Interval]	
income	7.630599	1.485436	5.14	0.000	4.719198	10.542
gender	-1.931497	4.03201	-0.48	0.632	-9.834092	5.971098
householdsize	115.6188	107.4502	1.08	0.282	-94.97975	326.2174
education	.3442627	.3854541	0.89	0.372	-.4112135	1.099739
amountofwastegenerated	-61.70228	57.45974	-1.07	0.283	-174.3213	50.91675
age	-.4142667	.1495276	-2.77	0.006	-.7073355	-.1211979
awarenessaboutswm	-3.587356	4.413012	-0.81	0.416	-12.2367	5.061989

QUASTIONERS

Dear respondent

My name is Addisu Belachew and I am a graduate student at St. Mary’s University School of Graduate Studies in Development Economics. I am working on my thesis entitled “Factor Affecting Municipal Solid Waste Management and Valuation of Economic and Environmental Cost that Impose on the Society: in the case of Kolfe Keraniyo sub city, Addis Ababa.”

I am inviting you to participate in this research study by completing the attached surveys. I would like to know about the environmental and economic issues faced at the HH level in Addis Ababa including the sanitation and the Solid waste management in the sub city kolfe keraniyo. Your response will help policy makers to formulate an informed policy about improved municipal solid waste management service. Your participation in this study is voluntary and there are no risks associated with participating in this study. The following questionnaires will take a few minutes to complete. In order to ensure that all information will remain confidential, please do not include your name. So, please answer the questions honestly and as truthfully as you can and return the completed questionnaires to data collectors.

For any information please contact me by mobile number 0911064205 and Email address addisubelachew@gmail.com

By completing and submitting this survey, you are indicating your consent to participate in the study.

Thank you taking the time to assist me in my educational endeavors.

Sincerely

Addisu Belachew

I. Respondent Details

- ❖ Sex:- Male Female Age -----
- ❖ Education of the HH head
Illiterate <grade 4 grade 5-8 rade 9-12 Certificate (level 1—4)
Diploma 1st degree >2nd degree
- ❖ Total members of the Household Male----- Female ----- Total -----
 years >18 ----- Children (11-18) ----- Kids (5- 10 years) ----- kids < 5 year
- ❖ Employment status of Household Head
Unemployed Street Vendor/Sn nformal Business
Government Employee Own Business
Private Employee Other -----

- ❖ Is there any occupant in your house? Yes No
- ❖ total number of occupant Household Male----- Female ----- total -----
- ❖ Total members of the occupant Household Male-----Female -----total -----
- ❖ Average Monthly Household Income
 - <2500 Birr 2501-3500 birr 3501-5000 Birr 5001-7500 Birr
 - 7,501-10,000 Birr >10,001 Birr

1. Are there garbage collection services in your area?
 - 0. Yes
 - 1. No
 - 2. Don't know
2. Do you use these services?
 - 0. Yes
 - 1. NO
3. How often do you use the collection service?
 - 0. Don't know
 - 1. Daily
 - 2. > 4 times/Wk
 - 3. 3 times/Wk
 - 4. 2 times/Wk
 - 5. Once/Wk
 - 6. Once per two Wk
4. Is the garbage collection service done at a fixed time on the collection?
 - 0. Yes
 - 1. No
 - 2. Don't know
5. Which collection service do you use?
 - 0. Public
 - 1. Private
 - 2. Partner cooperative enterprises
 - 3. I do not know
 - 4. Other—specify.....
6. How much do they charge per month? Birr per month
7. Are you satisfied with your current waste collection service?
 - 0. Yes
 - 1. No
8. What is the level of satisfaction with the collection service?
 - 0. vary satisfied
 - 1. satisfied
 - 2. medium
 - 3. Not satisfied
9. What is the main reason for your level of dissatisfaction?
 - 0. service charge is expensive
 - 1. Unreliability
 - 2. Improper collection
 - 3. not turn collection bag
 - 4. Service not fair
 - 5. Not properly done
 - 6. Frequency too low
 - 7. Is irregular
 - 8. Too early
 - 9. too late
 - 10. Bad workers' behavior
 - 11. Workers demand extra allowance
 - 12. Other
10. Have you ever complained about the garbage collection service to the authorities in this one year?
 - 0. Yes
 - 1. No
11. Yes, what is the main reason of your complain? -----

12. If you do not get regular garbage collection service, what is your decision?

0. I will be to wait the next time/program 2. I drop to straight at night 4. I report to the authority
1. I garbage dump open area 3. I dispose on garbage pin

13. From your opinion, do you agree the amount of waste produced and payment is reasonable?

0. yes 1. no

14. What type of Solid Wastes Components you produced?

- | | | |
|------------------|---------------------|----------------------|
| 0. Kitchen waste | 4. Soft Plastic | 8. Glass |
| 1. Paper | 5. Hard Plastic | 9. Stones & Ceramics |
| 2. Textiles | 6. Rubber & leather | 10. Others |
| 3. Grass & Wood | 7. Metals | |

15. how much waste produced per week in kg ----- kg

16. Who mainly handles wastes at home?

0. Adult male 2. Servant
1. Adult female 3. Other

17. Do you separate different type of waste at your home?

0. Yes 1. No

18. In your home occupant they do separate different type of waste?

0. yes 1. no

19. Would you do so if you are told by your collection service provider?

0. Yes 1. No

20. Willingness to cooperate in separate garbage collection system

0. Very much willin g 1. Somewhat willing 4. Doing already
2. Less willing
3. Not willing

21. What do you do with separate waste?

0. Sell 2. deliver for waste collector
1. to exchange other material 3. self-dispose

22. How much different type of material use to separate waste in your house?

0. one 1. two 2. three 3. four

23. Do you reduce different type of waste at your home?

0. yes 1. no

24. Are you beneficial by separate waste in your house?

0. Yes 1. no

25. Willingness to cooperate in reduce garbage collection system

- | | | |
|-----------------------|---------------------|----------------|
| 0. Very much willin g | 1. Somewhat willing | 3. Not willing |
| | 2. Less willing | 4. Doing ahead |

26. Do you reuse waste in your house?

0. yes 1. no

27. What type of Solid Wastes Components you reused?

- | | | |
|------------------|-----------------|-----------------|
| 0. Kitchen waste | 2. Textiles | 4. Soft Plastic |
| 1. Paper | 3. Grass & Wood | 5. Hard Plastic |

- 6. Rubber & leather
- 7. Metals
- 8. Glass
- 9. Stones & Ceramics
- 10. Others

28. If you reused waste in your house what type of benefit you have to get?

- 0. money
- 1. satisfaction
- 2. reduce waste

29. If you reused waste in your house do you have get any Support from government?

- 0. Yes
- 1. no

30. What type of material/shopping bag used to handle when you buy any goods and commodity?

- 0. plastic bag
- 1. paper bag
- 2. shopping bag
- 3. sack

31. If you are willing to cooperate in separate garbage collection system, why do you think recycling is important?

- 0. Reduce landfill amount
- 1. Protect environment
- 2. Can earn money
- 3. Others

32. Is there someone who comes around to collect or buy your reusable or recyclable materials ?

- 0. Yes
- 1. No
- 2. Don't know

33. Do you take for recyclable materials to shops for refund or sale?

- 0. Yes
- 1. No

34. What do you store your household rubbish in?

- 0. in the pit
- 1. garbage can
- 2. in the sack
- 3. with plastic bag
- 4. Cardboard boxes
- 5. No storage—direct disposal to dump

35. How do you dispose off garbage generated in your house?

- 0. on common dust bin
- 1. on open space
- 2. give to door to door waste collector
- 3. dump on straight
- 4. Discharge outside
- 5. Specific place
- 6. Composting
- 7. Give for recycling
- 8. other

36. Where do you dispose your generated waste?

- 0. Nearby container
- 1. Open spaces
- 2. Near home
- 3. Others—Specify

37. How often do you dispose off garbage generated in your house?

- 0. As soon as
- 1. Once daily
- 2. Once 2-3 days
- 3. once a week

38. Are there any small bins (baskets) in your area?

- 0. Yes
- 1. No

39. Who placed those small bins (baskets) in your area?

- 0. Government
- 1. community themselves
- 2. NGO's
- 3. Individuals

40. Do people dump their waste alongside the small bins (baskets) instead of putting it inside those?

- 0. Yes
- 1. No

41. Do you believe that the bins are given appropriate use?

- 0. yes
- 1. no

42. If no, why

- | | |
|--|-----------------------------------|
| 0. Difficult to put waste inside the bin due to height of the bin | 2. Indifference |
| 1. Difficult to put waste inside the bin due to waste and litter spread around the bin | 3. No awareness/No responsiveness |
| | 4. long space b/n bin |

43. Is there any illegal waste dumping place in your village (residence)?

- | | |
|--------|-------|
| 0. yes | 1. no |
|--------|-------|

44. What is the distance between your house and illegal waste dumping site? ----- m

45. What type of waste component dump in illegal waste dumping site?

- | | |
|-------------------------------|--|
| 0. waste generated from house | 4. Solid waste generated from urban agriculture activity |
| 1. non usable solid wastes | 5. Electronics related wastes |
| 2. Factories solid waste | 6. Hazardous solid waste |
| 3. Health centers solid waste | 7. Tiny solid waste |

46. Why the community dumping the waste illegally?

- | | |
|--|--|
| 0. do not get waste collection service frequently | 4. there is no controlled organization |
| 1. no large dustbin in the area | 5. no awareness about waste management system |
| 2. no stay at home when provide waste collection service | 6. No cleaning service providing organization that collect solid waste from houses |
| 3. do not concern about the environment | |

47. What is the main problem that affect the community with illegal dumping site occurred in the area?

- | | |
|--|--|
| 0. people activities immobilization | 3. health problem |
| 1. water pollution | 4. bereft children playing place |
| 2. river squalor/dirtiness and contamination | 5. Reduce environmental beautification |

48. Are there any temporary waste transfer stations in your area?

- | | |
|--------|-------|
| 0. Yes | 1. no |
|--------|-------|

49. What is the distance between your house and transfer stations? ----- m

50. What are the main problems that affect the community with temporary waste transfer stations in your area?

- | | | |
|-----------------------|---------------|---------------|
| 0. Waste lying around | 3. Flies | 5. Others - |
| 1. odor/stink | 4. No problem | Specify:..... |
| 2. Rats | | |

51. Is there any incineration in your area?

- | | |
|--------|-------|
| 0. Yes | 1. no |
|--------|-------|

52. What are the main problems that affect the community with incineration in your area?

- | | | |
|------------------|---------------|----------------------|
| 0. air pollution | 1. odor/stink | 2. reduce visibility |
|------------------|---------------|----------------------|

53. Is there any landfill (dumping, accumulation, burying or removal site) in your area?

- | | |
|--------|-------|
| 0. Yes | 1. no |
|--------|-------|

54. What is the distance between your house and landfill? ----- m

55. What are the main problems that affect the community with landfill in your area?

- | | | |
|-----------------------------------|-------------------|------------------------|
| 0. no interest living in the area | 1. health problem | 2. falling house price |
|-----------------------------------|-------------------|------------------------|

56. How to removes/dispose any domestic dead animals?

- 0. on common large dust bin
- 1. on open space
- 2. Request to responsible organization
- 3. Self-Burying
- 4. Dumping around the river
- 5. Dumping around the jungle

57. Do you have awareness about Municipal solid waste management?

- 0. Yes
- 1. NO

58. If you yes, who aware municipal solid waste management system?

- 0. from radio
- 1. from television program
- 2. from magazine from leaflet
- 3. door to door learning by experts
- 4. from school

59. What are the main problems with the current improper solid waste management system?

- 0. Environmental pollution/uncleanness
- 1. odor/stink
- 2. health problem
- 3. people activities immobilization
- 4. water pollution
- 5. river squalor/dirtiness and contamination

60. Do you have any community based organization to solve the waste problem?

- 0. Don't know
- 1. Yes
- 2. No

61. Have you ever discussed the methods of proper garbage handling and discharge at the meetings?

- 0. Yes
- 1. No
- 2. Don't know

62. Have you ever been taught method of proper garbage handling & disposal?

- 0. Yes
- 1. No

63. If you have learned, who taught proper garbage handling methods?

- 0. Parents
- 1. Community y
- 2. School
- 3. Local Gov
- 4. Central Gov
- 5. NGOs
- 6. Others

64. Do you think a campaign to raise awareness of people for maintaining the cleaner city and environment is necessary?

- 0. Very necessary
- 1. Somewhat necessary
- 2. Not very necessary
- 3. Not necessary at all

65. This year, did you or any member of the family participate in any community cleanup activities or other voluntary cleanups?

- 0. Yes
- 1. No

66. If yes, by what kind of participation you participate in any community cleanup activities or other voluntary cleanups?

- 0. by money
- 1. by labor
- 2. in kind (material)
- 3. all

67. In your opinion is waste management an environmental problem?

- 0. Yes
- 1. No

68. Do you consider that environmental degradation has negative effect on your family?

- 0. Yes
- 1. No

69. Suppose that you are satisfied with the service of Municipal solid waste management, either as is or as a result of improvement. Think for a moment about the largest amount of money that your household would be willing to pay each month as a garbage collection.

0. Willing to pay
1. Don't like
- 70. Are you using kitchen/garden waste for composting?**
0. Yes
1. No
- 71. If you do composting, how much of garden waste used for composting?**
0. < Half
1. Half
2. > Half
3. All
- 72. If you do composting, how much of kitchen waste used for composting?**
0. < Half
1. Half
2. Half
3. All
- 73. What do you do with produced compost?**
0. Sell
1. Own use
- 74. Has anyone in your household suffered from any of these listed diseases during the last six weeks?**
0. Yes
1. No
- 75. If Yes**
- | | | |
|--------------|------------|------------------|
| 0. Diarrhea | 5. Scabies | 10. Skin disease |
| 1. Dysentery | 6. Cholera | 11. Others..... |
| 2. Dengue | 7. Malaria | |
| 3. Typhoid | 8. Cough | |
| 4. Ringworm | 9. Asthma | |
- 76. What are the main causes of environmental degradation in your area?** -----

- 77. What are you more concerned about?**
- | | | |
|--------------------|----------------------------|----------------------------|
| 0. Air pollution | 3. Damage to scenic beauty | 5. Others (Please specify) |
| 1. Water pollution | 4. Noise pollution | |
| 2. Waste pollution | | |
- 78. Your household currently pays Birr. ____ per month as tariff for sanitation and solid waste management. However, there is certain level of dissatisfaction regarding the service provision. If you were to receive a proper sanitation within the street along with its proper cleaning plus you are provided with door to door collection of solid waste (five days a week), weekly street cleaning, weekly cleaning of intermediate waste bins and safe disposal of waste generated, would you be willing to pay birr 30 per month for such services? Note that this amount would be in addition to your current monthly household expenditures, but you have than nothing extra to pay in this regards.**
0. YES
1. NO
- 79. If YES, Will you be willing to pay birr. 50?**
0. YES
1. No
- 80. If YES, Will you be willing to pay birr. 400?**
0. YES
1. NO
- 81. If NO, Why Not?**
- | | |
|--|--------------------------|
| 0. You are satisfied with existing service | 2. You don't want to pay |
| 1. You cannot afford | 3. Others: _____ |

82. **Follow up Question: What is your Maximum WTP for improve solid waste management?**
birr:-----

