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Urban Household Demand for Improved Solid Waste Management Services: A Contingent Valuation Study

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Urban Household Demand for Improved Solid Waste Management Service in Dire Dawa City: A Contingent Valuation Study

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Declaration

I hereby declare that this MSc thesis is my original work and has not been presented for a degree in any other university, and all sources of material used for this thesis have been duly acknowledged.

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ABBREVIATIONS

MSWM	Municipal Solid Waste Management
SWM	Solid Waste Management
ISWM	Improved solid waste management
DDASBA	Dire Dawa Administration Sanitation and Beautification Agency
WTP	Willingness to Pay
CVM	Contingent valuation methods

ABSTRACT

Solid waste management (SWM) involves the collection, storage, transportation, processing, treatment, recycling and final disposal of waste. To achieve the above stated means of management, household considered as one of the stakeholders and have their own responsibility. The primary objective of solid waste management activity is to make the environment sound and safe in human health via disposed waste in a well-organized manner. The main objective of the study is to estimate households' determinate factors for solid waste generation and their WTP for improved solid waste management services in Dire Dawa city. The study employed cross-sectional study design because the study employed both qualitative and quantitative method of research. Both descriptive and inferential analysis were employed. Ordered probit model was employed to analyze determinants of households' willingness to pay for improved solid waste management services using STATA 14.0. 81.3.27% of sample households were willing to pay for improved solid waste services with the mean 23.3 ETB for open ended and double bounded CVM elicitation formats. The distribution of the double-bounded dichotomous choice response was analyzed using their willingness to pay for improved solid waste management practice versus their initial amount that a household is willing to pay for the service. The higher the price is; the lower acceptance by the respondent and the double-bounded dichotomous is in line with the law of demand theory. The finding revealed that most of the households are willing to pay for SWM service and the respondents' average WTP is much higher than the current SWM service charge. As a result, it is better to design and implement SWM service to collect more funds and deliver better service for Dire Dawa City dwellers.

Key words: Waste Solid, Orderd probit, Regreession Analysis, Dire Dawa, Ethioia

TABLE OF CONTENTS

LIST OF TABLES

1. INTRODUCTION

1.1. Background of the Study

The rapid urbanization that has been taking place during the 20th century virtually transformed the world in to communities of cities and towns facing similar challenges on environmental issues in which most of them have to be addressed at international level (Smith P., 2010). Cities are the threat to the environment from time to time due to increasing quantity and complexity of waste related to their expansion. The estimated quantity of Municipal Solid Waste (MSW) generated worldwide is 1.3 billion metric tons in 2012 and 2.2 billion tons are expected by a year 2025. Urbanization, industrialization, increasing population and economic development are all contributing to the rise in waste production and also to its increasing complexity and hazardousness (UNEP, 2016). Solid waste generation has become an increasing environmental and public health problem everywhere in the world, particularly in developing countries. The fast expansion of urban and industrial activities stimulated by rapid population growth has produced vast amounts of solid and liquid wastes that pollute the environment and destroy resources. Consequently, solid waste is not only increasing in quantity but also changing in composition from less organic to more paper, packing wastes, plastics, glass, metal wastes among other types which leading to low decomposition and collection rates (UNEP, 2016).

According to World Bank (2012), "Solid waste management (SWM) involves the collection, storage, transportation, processing, treatment, recycling and final disposal of waste. To achieve the above stated means of management, household considered as one of the stakeholders and have their own responsibility. The primary objective of solid waste management activity is to make the environment sound and safe in human health via disposed waste in a well-organized manner. Controlled waste disposal can help improve and protect the health of population and preserve valuable environmental resources. But at present in low and middle income countries collection coverage can be as low as around 40%, compared to 98% for high-income countries. The rest is either burned or left to decompose in open space or dumped in unregulated landfills, which is damaging the environment (UNEP, 2016). Waste is a serious dilemma for environment and health related problem of Dire Dawa city society. Most of solid wastes that are generated in the city remain uncollected and simply dumped in open areas, road sides, river, drainages, and gullies and sometimes burned. All these practices severely harm Dire Dawa city environment

and health of the society in many ways. The disposal method that the town used is also open dumping type which widely practiced in many developing countries and has hazardous effect on health of the public and the environment. Solid waste management in Dire Dawa City has been always evaluated based on the role and performance of the city municipality which runs the solid waste management activities, the supply side, while the demand side is ignored. However, with the increasing volume of solid waste, the city administration could not be able to satisfactorily collect and dispose the waste. The problem is usually inadequate budget, infrastructural and lack of community participation for its management compared to solid waste generation in the city (Tariku Birhanu, 2017). All the same, households are the main sources of solid waste as well as the main victims of the negative effects of unmanaged solid waste, so it is reasonable to participant the household's as stakeholders.

Therefore, this study is designed to generate demand side information, which is vital for the planning process of improved solid waste management system. So detail study on the demand of households for improved solid waste management (ISWM) service should be the first step required for design appropriate solid waste management strategies.

The growth of any city is evidenced through d its developmental and economic activities. Such activities are normally closely linked with and driven by the production and consumption patterns in and around cities. Job opportunities attract more and more people to cities. With increasing population, improving standards of living and extent of commercialization in the cities, the waste composition and volume change significantly. Lack of full understanding of the problems of waste generation and characterization have resulted in transforming Waste Management as one of the most compelling problems of urban environmental degradation.

The management of wastes, particularly in low-income settlements, is one of the most intractable problems of developing countries. In the absence of regular and reliable waste management system, wastes are dumped in open spaces, green areas, recreational centers along watercourses, on access roads, and other available spaces. The pollutants (contained in the waste), eventually percolate to the nearby sources of water, resulting in the contamination of food, water and other resources causing environmental degradation and serious health problems. Indiscriminate solid waste disposal can block drains leading to flood and related hazard and health problems. These

problems are further aggravated by rapid outward expansion of urban areas, high population density, congestion and lack of access roads.

Waste management has been a very difficult and challenging issue over the years. This difficulty has manifested itself in the perennial outbreak of diseases such as cholera, dysentery and pollution of water resources, air, soil or land contamination, proliferation of pests and vermin, and the loss of aesthetic beauty. Improvements are desired in waste management covering aspects of waste minimization, generation, collection, reuse, recycling, treatment and disposal. The categorization of wastes is also useful in formulating various controlling mechanisms and in facilitating ways of recycling. Appropriate regulations and management schemes are also required for various types of wastes.

The inappropriate and often inadequate handling of both municipal and industrial wastes including those that are hazardous has all too often created problems for human health and the environment.

Poor solid waste handling is threatening the lives of Dire Dawa residents. To improve this pressing problem the Administration together with all stakeholders has to put maximum effort. Though there are efforts to collect revenue from the community through water bill in monthly basis but still there is high budget gap as compared to solid waste generation in the Administration. In line with this, it is very important and timely to look for the possibility of cost sharing by households, and for this we need to analyze the demand side for improved solid waste management. Therefore, this study is designed to generate demand side information, which is vital for the planning process.

1.2. Statement of the Problems

Rapid population growth and urbanization in general have led to serious solid waste generation in most cities worldwide Daily global generation of municipal solid waste in 1.3 billion metric tons in 2012 and 2.2 billion tons are expected by a year 2025 (UNEP, 2016).As a consequence, the environment undergoes degradation as reported in various parts of the world, particularly in developing and under-developed countries (Rahji and Oloruntoba, 2009).

According to Gebreegziabher *et al*., (2012) many Ethiopia towns lack the financial resources and institutional capacity to provide the most basic municipal infrastructures and services including solid waste management. Ethiopia has experienced rapid urbanization and increasing urban population in the last few years due to more rural-urban migration and rising per capita incomes. Presumably, increased demand for infrastructure and public services accompanies this growth.

Poor solid waste handling is threatening the lives of Dire Dawa residents. Waste materials that are generated from residential households are mostly organic but if not controlled and just dumped anywhere, it can harm people and constitute a major environmental and health hazard providing fly breading, black roads, cause flood disaster when dumped into rivers and attract animals which may cause zoonotic infections. The problem is usually inadequate budget, unable to meet the cost in managing the ever increasing volumes of waste (DDASBA, 2014).In the city the provision of solid waste management services had for long been from administration which had focused on the technical aspects of collecting and disposal of solid waste.

Currently, the volume of solid waste generated in Dire Dawa city was raise. Results from many contributing factors, among these factors unplanned settlement, rural migration from east Hararge and Somali regain to the city and rapid urbanization are the major ones. Problems related to inadequate collection and disposal services facility, inability of the government to find efficient ways to manage and finance environment needs of the people are also observed (Dire Dawa Administration Sanitation and Beautification Agency, 2020).

S.No	**Population**	**Annual Solid Waste Generated in M3**	**Annual Collected and Disposed Solid Waste m^3**	**Coverage**
2010	249460	146979	69120	47
2011	255450	150510	69874	46
2012	261,582	154123	103480	67
2013	267861	157822	102200	64
2014	274,292	161612	128200	79
2015	280,875	165450	92672	56
2016	287,616	169462	102246	60.3
2017	294,519	171811	94924	56
2018	301,587	177694	121029	68
2019	308,825	181959	141928	78

Source DDASBA, 2020

According to DDASBA (2020) the city generated about 500 tone solid wastes every day. Generation of solid waste in the city has increased significantly in the past three years. Between 2013 and 2018, solid waste generation in the city increased from 157,822 tons/year to more than 177,694 tons/year. Due to the inadequate transport capacity and deficient workforce, collection efficiency in the city has been 63%. Uncollected waste mostly comprises of organic substance and in some cases human and animal excreta. It may also contain hazardous waste like industrial and medical waste (Haile, 2013). The uncollected garbage is often dumped indiscriminately resulting in clogged drains and sewerage that serves as a breeding ground for rodent's vectors and insects leading to spread of diseases (DDASBA, 2020).

The government has a role to protect public health and the environment. In order to accomplish this, there is a need to improve environmental amenities and provide clean environment at household level. For any attempt aimed at environmental quality improvement to be successful and sustainable, it has to make use of demand side information. In line with this, this study will provide the required information as to what value households give to any effort the government makes to ensure better environmental quality, specifically household's capacity or willingness to pay for improved SWM and the factors that influence their WTP for improved SWM can be an input in the design of sustainable and effective SWM.

To the researcher's knowledge only few studies in the area of solid waste management are done in Dire Dawa city. Haile(2013) and Dire Dawa Administration Sanitation and Beautification

Agency (2014) studies mainly focused on the supply side of solid waste management with little or no reference to the demand side.

Those previous works focus on the theoretical and empirical review of analyzing the quality of service in collection and disposal of solid waste and preference of solid waste management, but did not estimate the households' WTP improve solid waste management which is a gap to be filled by this study.

However, studies undertaken regarding SWM on the demand side like Amiga(2002), Gebreegziabher, et al, (2012) and Asrat (2014) employed contingent valuation eliciting single-bounded dichotomous choice format. Single bounded dichotomous choice approach yield inefficient welfare measurement due to limited information obtained from each respondent. Double dichotomous choice format has the gain in efficiency over the single bounded elicitation format by asking respondents a second follow up binary question based on the response of the first offer these makes clear bounds on unobservable true WTP. Asrat's (2014) study was undertaken in Dire Dawa too. Tariku's (2017) study was done using double dichotomous choice format. But there has been observed a significant change in population, an increase in quantity of solid waste, and major changes in solid waste management since then. This paper also intended to fill this time gap and uses additional dependent variables.

Moreover, unlike the previous studies, this study will use the Order Probit model which is assumes to follow the normal distribution of error terms. And also, it will consider the effectiveness of policy framework in Dire Dawa town.

1.3. Objectives of the Study

1.3.1. General objective

The general objective of the study is to estimate households' determinate factors for solid waste generation and their WTP for improved solid waste management services in Dire Dawa city.

1.3.2. Specific objectives

The Specific objectives of this study are:

- To assess the current solid waste management system in operation in Dire Dawa
- To identify determinate factors of households' willingness to pay for improved solid waste management services and solid waste generation

- ❖ To elicit and determine households' WTP for improved solid waste management service supply and

1.4. Research Questions of the Study

This study was guided by the following research questions:

- What are the current municipal solid waste management practices in Dire Dawa City?

- What are the available policy and legal frameworks of MSWM in Dire Dawa?

- How are the residents understanding and contribution in SWM?

- How much are the residents willing to contribute to the SWM?

1.5. Significance of the Study

The research will be critical to the academia and policy makers. The study will enhance the researcher's skills in terms of his research competencies. The experience gained will enable the researcher to carry out other studies of better quality in terms of methodology used and how the results are presented and analyzed.

It will also provide a strong basis for further research in related areas of study. The view that, research studies should contribute to fundamental knowledge or provide solutions to real world problems. The information obtained would be used as a springboard for exploring new areas related to it. Thus it is used as an eye opener.

Furthermore, the study will become integral part to the university's database relating to solid waste management research and this information can be used by other scholars as reference material for research in similar areas of study. Recommendations emanating from the study may be considered for adoption by the local authority in Dire Dawa as a means of enhancing the solid waste management strategies.

1.6. Scope of the Study

There are three types of delimitations which are conceptual, geographical and population delimitation. Conceptually, this study will focus on demand side information about solid waste management. Thus non- solid waste is outside the scope of the study for example industrial gases, industrial effluent as well as flowing sewage. In this study solid waste does not include

human waste. Geographically, the research will be confined to Dire Dawa Administration. The population of the study will be confined to the residents of Dire Dawa City Kebeles. The contingent valuation method which this study is going to use, even if it is the best for it measures total economic values and not requiring detailed micro data, it has its own limitations. The hypothetical nature of the questions used in CVM surveys may pose problems since respondents may have little incentive to provide their true willingness to pay.

2. REVIEW OF LITERATURE

In this chapter, important theoretical concepts on solid waste management, Contingent valuation methods (CVM) and empirical studies on determinants factors for willingness to pay for improved solid waste management services (SWMS) and Conceptual framework of the study are presented.

2.1. Theoretical Perspectives

2.1.1. Municipal solid waste concept

Municipal solid waste (MSW) is any kind of by-product in urban centers that include household waste, municipal waste, food waste, and some industrial waste. Solid waste composition varies considerably with community size and with the activities conducted (U.S. EPA, 2000). Urban solid waste can incorporate domestic or household refuse, institutional waste and commercial waste. Municipal refuse can be divided into two parts: organic or biodegradable waste and non-organic or non-biodegradable waste. Organic waste includes kitchen waste, food leftovers, rotten fruit and vegetables and peelings, straw and hay, leaves and garden trimmings, crop residues, rags, paper, animal excreta, bones and leather. The non-organic components of solid waste include earth, including ash, stone and bricks, coal and cinders, glass, plastics, rubber, and ferrous and non-ferrous metals (SIDA, 2006).

The composition of solid waste differs for different countries and regions. Developing countries generally have high food and yard wastes as compared to developed countries with a large fraction of paper and plastic contents that can be recycled (Senkoro, 2003). The quantity and composition of the generated solid waste in urban areas provide a mirror of the society that reflects among others cultural and religious habits of the population.

The composition of waste is also closely related to the overall economic levels of the population from which it originates. An important difference between the urban waste generated by low-income and industrialized countries is the percentage of organic material. In industrialized countries some 20-50% of the urban waste is organic, compared with about 40-85% in low-income countries. The abundant organic waste in less developed countries could therefore form an important source for recovery (Petts, 2000).

Most household, and some commercial and industrial refuse, is organic, whereas hardly any organic waste can be found in institutional waste. The bulk of organic waste is generated by households. This waste forms a valuable source for recovery because of the quantity, it‟s easiness to collection (since it is stored in bins at particular locations), and because it is unlikely to be contaminated with non-organic material. For the same reasons, some types of industrial waste, such as sawdust, can be reused relatively easily (McDougall *et al*., 2001).

2.1.2. Sustainable municipal solid waste management

Solid waste management include all activities that intended to the control, collection, transportation, processing and disposal of those in accordance with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations. Municipal solid waste management (MSWM) is a complex task which depends as much upon organization and cooperation between households, communities, private enterprises and municipal authorities as it does upon the selection and application of appropriate technical solutions for waste collection, transfer, recycling and disposal. Furthermore, waste management is an essential task which has important consequences for public health and well-being, the quality and sustainability of the urban environment and the efficiency and productivity of the rural economy (Zerbock, 2003).

UNEP (2006) defines ISWM as the selection and application of technologies and management strategies appropriate to the characteristics of the municipal solid waste (MSW) aimed at the achievement of specific waste management goals. This process takes into consideration various aspects involved in waste management such as technical, legislative, economic, socio-cultural, institutional and environmental aspects. Thus the use of a variety of practices to handle MSW safely and effectively using sustainable

techniques for source reduction, recycling, composting, combustion and land filling can be defined as ISWM (USEPA, 2006; SIDA, 2006).

The concept of integrated waste management links waste streams, waste collection, and treatment and disposal methods with the life cycle analysis (LCA) concepts while aiming at achieving environmental benefits, economic optimization and social acceptability. For a waste management system to be sustainable, it needs to be environmentally effective, economically affordable and socially acceptable (McDougall, 2001). The best MSWM must be related to local environmental, economic and social priorities and must go further to involve the public before important waste management decisions are made. Social, environmental and economic compatibilities are; therefore, observed to be the dimensions of the sustainable waste management models or strategies. For the waste management system as it aims at sustainability, should function within the principles of Agenda 21 (established at the UNCED World Summit in Rio in 1992) and within its local manifestation (Local Agenda 21) (Morrissey and Browne, 2004).

The strategies that can be adopted for integrated SWM are:

- To reduce the amount of solid waste generated
- To recycle as much refuse as possible
- To incinerate or to change the waste into compost with the appropriate environmental controls and with energy recovery options.
- To continue sanitary land filling for selected waste items.

Reducing and reusing are the most viable alternatives; however, no single method will control the waste problem as effectively as a comprehensive program that relies on a number of solutions for different situations (Mc Dougall *et al.*, 2001).

Nearly all human activities produce waste. Of these organic waste is a major component of MSW and agricultural waste. Most organic waste originates in urban areas from household waste, but commercial, institutional, and industrial waste can also contain significant proportions of organic waste e.g. market waste (Lechner, 2007). Waste separation at source can enhance the homogeneity of the waste recovered and minimize its level of

contamination. Both the technical and economic hurdles for recycling can then be lowered and this increases the recycling viability.

2.1.3. Solid waste management in Dire Dawa City

In Dire Dawa city, the city administration gives most of the solid waste collection service and the entire transportation and disposal service. The majority of the households get the service of solid waste collection service and disposal without any direct charge. Only those households disposed there solid waste by street sweepers and adult laborers to drains and sewerage, on an open space or on the street and the nearby river non-fixed payment mechanisms.

Dire Dawa Sanitation and Beautification Agency introduce service charges (sanitation fee) to households in the city that paid added to water bill depend on amount of water they consume. Based on DDASBA, (2014) a review of the available sanitation fee proposals for solid waste generator in Dire Dawa city are summarized as follows:

The Agency establish sanitation fee by principle " all generators shall pay " by assuming all people are consume water so they pay according to their consumption of water by added to water bill.

Table 1. Sanitation fee proposals

Amount of Water they consume by m^3	Type of customer and service payment		
	Households	Trade sector & institution	Additional payment "Bono Wiha"
0—10	14.40 Birr	100 Birr	**5%**
11—20	17 Birr	300 Birr	
Above 20	20 Birr	500 Birr	

Source DDASBA, 2014

The proposal has been taken by the principle of "all generators shall pay". In the cities there is some improvement in solid waste management, however, the provision of this service should not entirely depend on the ability of the household to pay for this service since there are externalities involved in this service. Almost half of total household's Dire Dawa pay for this service because of only 21,780 households on water Metter (DDASBA, 2014).

Even in some season because of desert characteristic the city households consume more water due to these they should have to pay more. On the rivers if one household doesn't have water Metter or live in rental house does not pay sanitation fee or little contribute. The proposal doesn't consider all the people because of this the government has lose revenue from the left household that cover the cost this service, House-to-house collection of waste is not fully covered in the cities, Even if, households how are paying sanitation fee doesn't get the service. Those households will have an incentive to dispose of the waste on the street since the private cost of doing that is lower than the social cost. From this illegal disposal, it is all the individuals including those who are paying and getting the service that get hurt.

Deposit-Refund Systems are playing a very important role in waste minimization. However, DRSs in Dire Dawa city are used only for soft drink, beer in which people pay a surcharge and are re-funded when they return the empties.

The administration should work hand in hand with firms that have possibilities in creating solid wastes at the end of their product usage to create means of DRS. Though this process it would also be possible to create jobs for unions to work in the area of DRS

The three R's (Reduce, Reuse and Recycle) should always be part of a well-designed solid waste management. The three R's are almost non-existent in Dire Dawa city. Collection of refuse poses another problem as household waste is thrown indiscriminately in the open area. Absence of segregation at the source makes it very hard to recycle the collected waste and gain value from it. According to DDASBA 2014, 60-70% solid waste are organic waste it can reuse but simply without segregation of waste it dispose, only two corporative are decompose organic waste and some people collect 'atela' (residual from a local drink 'tela') to be used as feed for cattle. There are also some people who collect and/or buy broken objects made of clay for recycling purpose.

To improve solid waste management the city administration together with all stakeholders has to put maximum effort on encourage and advocate the three R's (Reduce, Reuse and Recycle).

2.2. Environmental valuation Techniques

There are a number of cases in relation to environmental issues where it is not possible to know or even estimate the value of environmental resources (the costs of environmental damage or benefits of environmental quality improvement) using conventional concepts such as market

prices or costs. Economic value is a measure of what the maximum amount an individual is willing to forego in other goods and services in order to obtain some particular goods, service or state of the world. Such a measure of welfare is formally explained by the concept called WTP. WTP is about measuring the use and nonuse value of resource and there are generally two recognized methods of estimating WTP of economic agents for economic resources. These are the revealed preference technique which is based on indirect observations of behavior and the direct technique which is based upon stated preference (Hales, 2013).

A. Revealed Preference Technique

The indirect (inferential) approach (or revealed preference method) rely on observable behavior in order to deduce how much something is worth to individuals even though it is not traded in markets. These methods produce value estimates that are conceptually identical to market values, but they must be measured more creatively since market data are not available. Revealed preference measure only the use value of the good in question. The technique includes travel cost models and the hedonic pricing method (Hales, 2013).

B. Travel cost Method

The travel cost method is popular for describing the demand for the natural resource service and environmental attributes of specific recreational sites. People usually visit recreational and scenic sites from different points of origin at diverse distances. This observed travel behavior is then used to evaluate the WTP of the agents to visit the site. This technique assumes that visitors to a particular site incur time and travel expenses and such economic expenditures indirectly reflect the minimum amount that a visitor is willing to pay for the use of the site (Assefa, 2012).

C. Hedonic Pricing Method

The hedonic pricing method provided an inferential measure of people's WTP for the amenity under study. This method is mostly used to estimate willingness of the economic agents for variations in property values due to the presence/absence of specific environmental attributes like air quality, noise and scenic views. By comparing the specific environmental attributes of two properties over time, it is possible to determine the implicit price of the amenity. This is done by correcting for other factors that might influence the value of the subject property and hence

economists able to isolate the implicit price of some or bundle of amenities which have changed over time (Freeman, 2003).

D. Stated Preference Technique

The direct approach (or stated or expressed preference method) refers to the direct expression of individuals' willingness to pay or willingness to accept in compensation for any change in quantities, qualities, or both of the goods in question. The method involves direct estimation of values based on the hypothetical valuation questions which presented to individuals, and hence it does not depend on market information (Freeman, 2003). The stated preference technique could potentially apply in almost any valuation context (Mattiaet al., 2010). The technique includes the contingent valuation method.

2.3. Definition of contingent valuation method (CVM)

CVM is a technique used to estimate the value of non-market environmental goods by eliciting the willingness-to-pay (WTP) and/or willingness-to-accept compensation (WTA or WAC) of a sample of respondents through a survey and by constructing a carefully structured hypothetical market. CVM is said to have been originally used by Davis (1963) to estimate the benefits of outdoor recreation although it is Ciriacy Wantrup (1947) who suggested the use of the "direct interview method" to measure the values associated with natural resources. The CVM is a survey method which requires a very careful preparation of a questionnaire(s) as it may involve introducing a market which does not exist at all and therefore is new to the respondent. It is thus important to stress at the outset the importance of conducting a CVM in a very careful manner starting from the stage of problem identification, questionnaire preparation, survey administration and analysis as it is quite different from other studies based on standard surveys such as expenditure surveys which are typically relatively easier.

The main steps that are involved in a CVM exercise may be divided into four:

1) Design and administration of the survey
2) Empirical analysis of the results
3) Estimation and aggregation of measures of value (benefits or costs)
4) Evaluation of the CVM exercise

2.4. Policy and Legal Frameworks for Municipal Solid Waste Management in Ethiopia

Ethiopia has several policies and legal frameworks that support the enforcement of the MSWM system in the country. Moreover, Ethiopia has ratified a few international waste management conventions. Some of these municipal solid waste management policies and legal frameworks formulated by the Federal Democratic Republic of Ethiopia (FDRE) and the international waste conventions are discussed below.

The 1995 FDRE Constitution: The 1995 Constitution of the Federal Democratic Republic of Ethiopia is the cornerstone of all policies in the country, including environmental policies, and has highlighted some environmental issues in the country. Article 44 addresses environmental rights in Sub-article 1: "all persons have the right to a clean and healthy environment", while Article 92 addresses the government's environmental objectives in Sub-article 1: "the government shall endeavor to ensure that all Ethiopians live in a clean and healthy environment", and Sub-article 4 indicates that "government and citizens shall have the duty to protect the environment". These provide all Ethiopian people with the right to live in a clean and healthy environment and the responsibility imposed on the government and citizens to protect the environment.

The 1997 Ethiopian Environmental Policy: The Environmental Policy of Ethiopia was adopted in 1997, and its overall goal is to improve and enhance the health and quality of life for all Ethiopians and promote sustainable social and economic development through sound management of environmental resources. This policy addressed the concept of waste management in the next three sub-articles. Article 3(7) Human Settlement, Urban Environment, and Environmental Health indicated waste collection services, recycling of solid waste, safe disposal, and the essence of scientific studies to identify suitable sanitary landfills. In addition, Article 3(8) Hazardous Materials and Pollution from Industrial Waste explained safe sanitary landfill sites, formulation of guidelines and regulations to control waste from different sectors, as well as waste minimization and recycling, handling, and storage of hazardous and dangerous materials, and monitoring of waste management implementation. Moreover, Article 3(9) Atmospheric Pollution and Climate Change addressed the essence of appropriate measures on the contributors of atmospheric pollution and climate change, such as methane gas, which can be emitted from unmanaged landfills.

Public Health Protection Proclamation No. 200/2000: Article 12 of this proclamation states that "any person shall collect waste at an especially designated place and in a manner, which does not affect the health of the society". It prohibits the disposal of solid, liquid, or any other waste in a manner that affects the environment and public health. In addition, this proclamation indicates that any waste generated from hospitals should be handled through disposal procedures that meet public health and environmental standards.

Environmental Impact Assessment Proclamation No. 299/2002: The EIA proclamation enforces project proponents to undertake an EIA for projects considered to have significant environmental and social impacts. Waste disposal facilities, such as waste incineration and landfill sites, require an EIA before implementation. Therefore, EIA is very significant in the municipal solid waste management system.

Environmental Pollution Control Proclamation 300/2002: This proclamation covered the management of hazardous and non-hazardous wastes, specifically Article 5 of the proclamation. Sub-article 1 of Article 5 states, "all urban administrations shall ensure the collection, transportation, recycling, treatment or safe disposal of municipal waste through the institution of an integrated municipal waste management system". The proclamation also addressed the importance of cooperation between municipal solid waste management and relevant environmental authorities to monitor and evaluate the municipal solid waste management systems and to ensure the effectiveness of their implementation.

Ratified International Waste Conventions: Ethiopia has ratified two international conventions: The Rotterdam Convention via proclamation No. 278/2002 and the Basel Convention via proclamation No. 357/2003, which have an essential role in the improvement of the solid waste management systems in the country. The Rotterdam Convention promotes shared responsibility and cooperation among parties in the international trade of hazardous chemicals to protect the environment and human health. Concurrently, the Basel Convention is an international treaty on the control of the transboundary movement of hazardous waste and its disposal. The main goal of the latter convention is to protect human health and the environment from the adverse effects of hazardous and other kinds of waste and to control its movement between countries. Thus, the ratification of these conventions by the Ethiopian government has a significant role in the

development of municipal solid waste management systems in the country and at the international level.

Solid Waste Management Proclamation No. 513/2007: This proclamation is the first national policy on solid waste management in Ethiopia and its main objective is to enhance the capacity to prevent adverse impacts of solid waste at all social levels while creating economically and socially beneficial assets from solid waste. This policy mainly covers the general obligations of urban administration, solid waste management planning, the inter-regional movement of solid waste, the management of household solid waste, waste collection and storage, transportation, recycling, incineration, disposal, and auditing of solid waste disposal sites. It also addresses the significance of community participation in its mission. The solid waste management action plans designed by and implemented at local urban administrative levels help ensure community participation. The main drawback of this policy is its lack of supporting guidelines, which is highly important to implement solid waste management laws and proclamations. Additionally, sustainable solid waste management strategies, such as waste prevention and reduction, solid waste segregation at source, and waste collection fee systems have not got attention.

Electrical and Electronic Waste Management and Disposal Regulation No. 425/2018: It was the first national regulation on electrical and electronic waste management and disposal in Ethiopia. It addresses the hierarchy of waste management to minimize the environmental and social impacts of electrical and electronic waste by reducing waste generation, refurbishing, reuse, recycling, and disposal of such waste. It also implements the extended producer responsibility principle for electrical and electronic waste management, the first of its kind in Ethiopia.

Hazardous Waste Management and Disposal Control Proclamation No. 1090/2018: This proclamation aims to create a system for environmentally sound management and disposal of hazardous waste and to prevent damage to human or animal health, the environment, biodiversity, and/or property due to the mismanagement of such waste. It is the primary national hazardous waste management and disposal control proclamation, which identifies the categories of waste to control, chemical constituents, and the characteristics of hazardous waste. The proclamation contains 24 basic articles covering clean production principles, the responsibilities of hazardous waste generators and hazardous-waste labeling, storage, reuse, treatment, and

recycling, as well as the handling and disposal of hazardous waste. It also addressed transboundary movement, illegal transactions, and the inter-state movement of hazardous waste.

2.5. Empirical Literature Review

The contingent valuation method has been a technique used to elicit respondents 'willingness to pay for improved solid waste disposal services in both developed and developing countries reliable results have been found. In Ethiopia, too, some researches undertaken using this method have shown CVM to be an important instrument.

There are various studies that identified the determinant factors for urban household willingness to pay for improved solid waste management services. Accordingly, the research conducted by Margaret *et al*. (2011) in Uganda at Kampala city identified that by employing the double-bounded contingent valuation method, households' mean willingness to pay for improved solid waste collection service was estimated to be US 2,439 per month. Both the decision to pay and the amount households are willing to pay for improved solid waste collection services are influenced by income, education, age, and home ownership.

Moreover, the study conducted in Bahir Dar city, Ethiopia by Birara and Kassahun, (2018) that focused on Urban households' demand for improved solid waste management service and used contingent valuation method (CVM). This study identified that 22% of the respondents were satisfied with the existing waste management service. Whereas, only 29% of the sample households received solid waste management services based on weekly plan of the city municipality. The contingent valuation result revealed that the mean willingness to pay is 13 ETB per month which is higher than the monthly flat fee of urban households. The model result demonstrated that education level of household head, monthly aggregate income, access to solid waste management service, disease outbreak, number of children and quantity of waste generated per week had statistically significant positive effect on households' willingness to pay. But sex of the household head had statistically significant negative effect on households' willingness to pay.

In addition, the study conducted at Injibara town, Northwest Ethiopia by using CVM and Tobit model indicated that 81.06% were willing to pay for the service. The average amount of money

the participants would be willing to pay per month was 29.7 ETB ($1.07)). The study revealed that sex (β=3.24, (95% CI 1.98, 4.50)), age (β=-0.09: 95% CI -0.19, -0.01), educational status (β=6.19: 95% CI 3.54, 8.84), occupation (β=2.43: 95% CI 1.009, 3.86), amount of solid waste generated (β=1.74: 95% CI 0.19, 3.29), distance from dump site (β=1.58: 95% CI 0.45, 2.72), satisfaction with the existing service (β=3.89, (95% CI 2.75, 5.06) and wealth status (β=2.43: 95% CI 1.0, 3.86) were statistically significant. Therefore, the level of premium load should consider the amount of waste generated, wealth status and the distance from the dump site (Selamawit *et al*., 2019).

Furthermore, the study conducted in Bharatpur Metropolitan City, Nepal using the conditional logit model revealed that almost all households (95%) were participating in the waste collection service in the study area, more than half (53%) expressed dissatisfaction with the existing service. The households also identify waste collection frequency, timing of door-to-door waste collection services, and cleanliness of the streets as the critical elements of municipal waste collection
that affect their welfare and willingness to pay (Rajesh et al., 2019).

Besides, the study conducted in Hawasa, Ethiopia used observed and unobserved preference heterogeneity are analyzed using mixed logit choice models. A large majority of the respondents (98 percent) is interested in, and willing to pay extra for, improved solid waste services and always chose one of the hypothetical alternatives over the status quo. The results show that there exists substantial willingness to pay to increase collection frequency and separate recyclable waste. Significant gender effects are found: women are more interested than men in increasing waste collection frequency and value the abolishment of child labor more highly, as do higher income households. Respondents living in wealthier neighborhoods are more likely to pay higher service charges. Education indirectly influences preferences for waste separation (Solomon Tarfasa and Roy Brouwer, 2018).

2.6. Conceptual Framework of the Study

The conceptual framework of this study is developed based on literature reviewed related to the study and knowledge of the study area. The factors that determine urban household willingness to pay for improved solid management services are categorized in three factors including socio demographic factors (age, gender, marital status, educational status, family size, time spent in the

area, and Disease outbreak), Economic factors (household ownership, Occupation, and Monthly aggregate income), Service related factors (awareness about SWM, quantity of waste generated, satisfaction with current service, and Access to waste management service) (Figure 1).

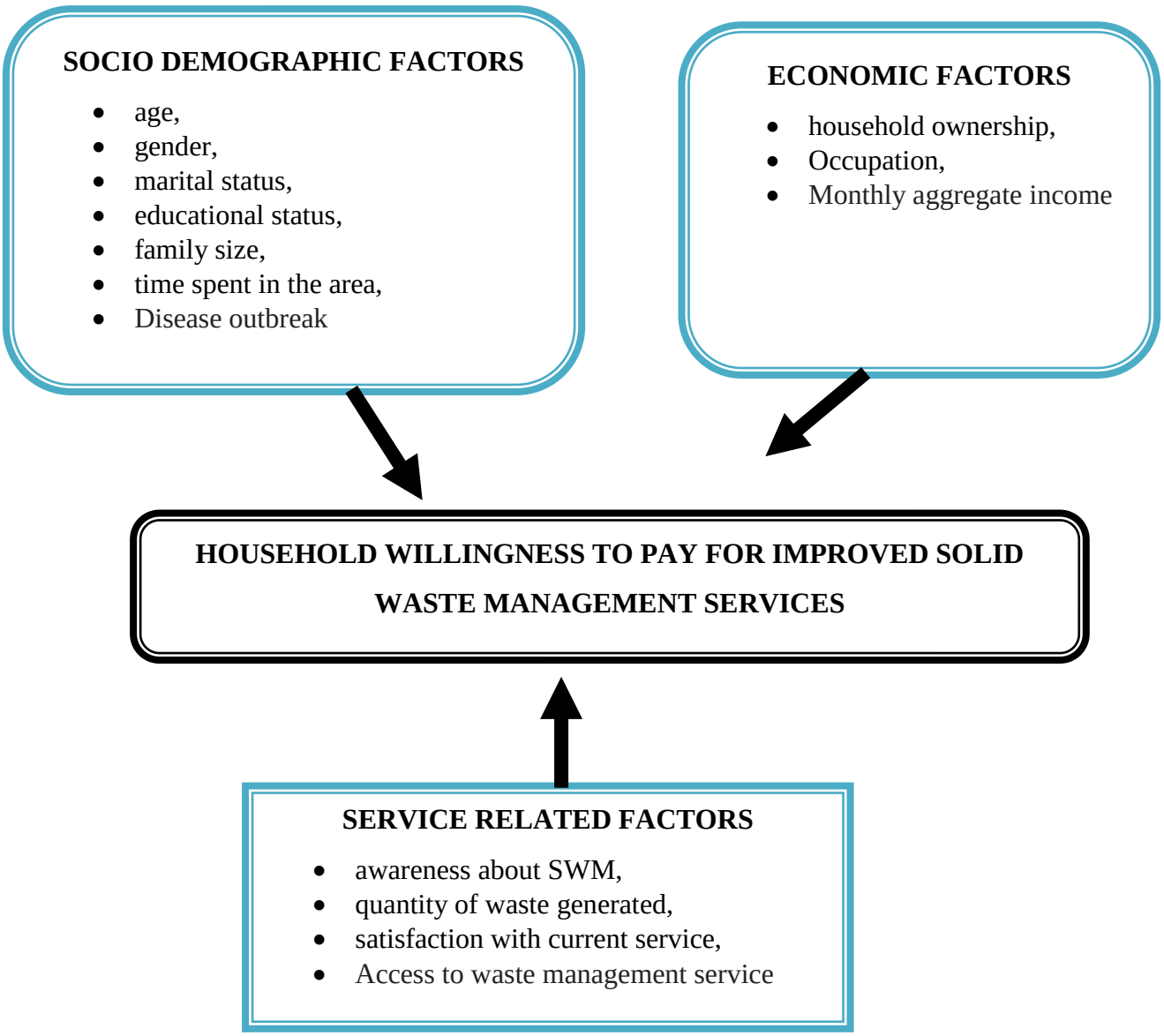

Figure 1: Conceptual framework of the study

3. METHODOLOGY

This chapter presents brief description of the study area, the sources of data and methods of data collection, sample size and method of sampling, and the method of data analysis which include both descriptive statistics and econometric model.

3.1. Description of the Study Area

3.1.1. Location and Area coverage

Dire Dawa city administration is geographically located in the eastern part of the country specifically lying between $9^{0}0$ 27' and $9^{0}0$ 49'N latitudes and between $41^{0}0$ 38' and $42^{0}0$ 19'E longitudes. It is bordered by the Sitti zone of the Somali National Regional State on the Northwest and Northeast, and by the Eastern Hararghie zone of the Oromia National Regional State on the South, Southeast, and East (Figure 2). Dire Dawa city is 515km away from Addis Ababa, 55km from Harar, and 311km from Djibouti. The administration has 9 urban and 38 rural Kebeles. The total land area coverage of the Administration is 128,802 hectares (1977km^{2}) in

which 97.73% cover the rural area and 2.27% used for the main urban center (DDAAWMEB, 2016).

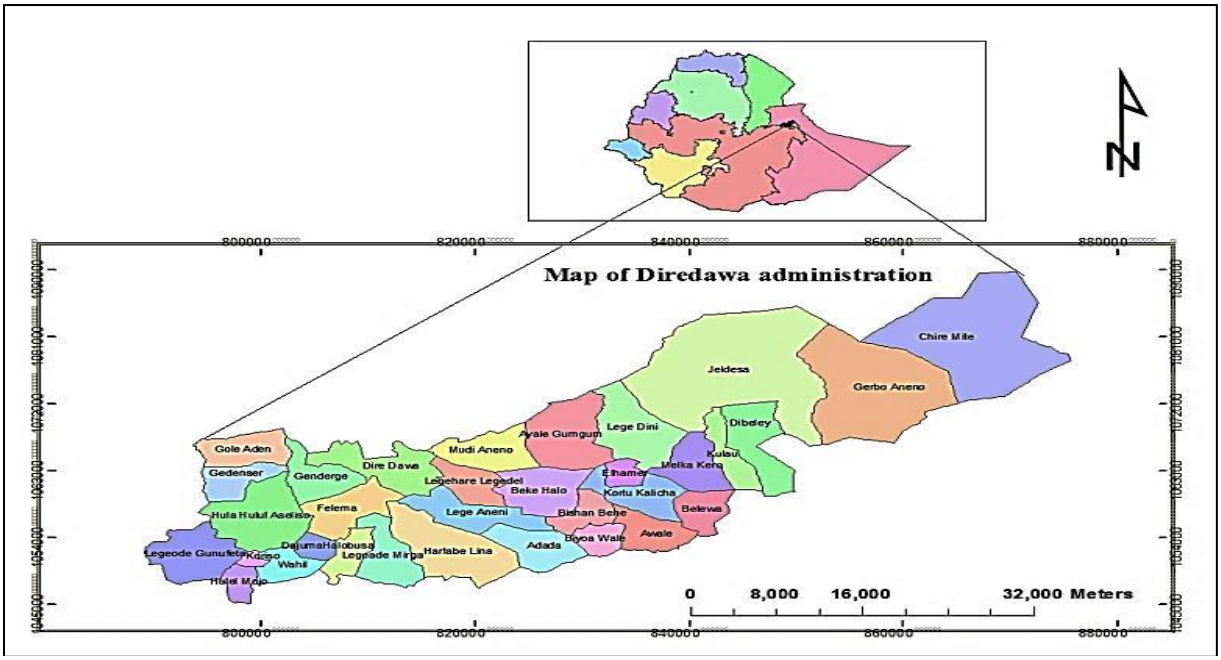

Figure 2: Map of the Dire Dawa Administration

3.1.2. Socio-Demography

According to the estimation of (CSA, 2012) inter censual population survey report the total number of population of DDA in 2020 is 507,000 (255, 000 Male and 252,000 female). Among them, 323,000 (163,000 male and 160,000 female) or 62.91% of the population are urban inhabitants and it is estimated to be 184,000 (92,000 male and 92,000 females) in the rural area. The estimated overall population density of the Administration is 289 persons /km^2 in 2017. In general, the density is high in the urban areas and the western and eastern parts of the administration. Moreover, the total fertility rate of the administration was 3.4. the infant mortality rate was 56.7 deaths per 1000 live birth. Children age 12-23 months fully vaccinated was 58.6%. The health professionals working in government health institutions to population of the administration ratio were 1: 15,600 for physician, 1:9085 for health officers, and 1:5000 for nurses. The number of government school that found in the rural areas of DDA was 41 primary schools and 2 secondary schools. The trend of student enrolment in rural areas were 23,731 (13,472 male and 10,259 female) in primary school and 567 (394 male and 173 female) in secondary school (BoFED, 2016).

3.2. Research Design

The study was cross-sectional study design because the study employed both qualitative and quantitative method of research.

3.2.1. Data type, sources and methods of data collection

This study use quantitative and qualitative data that was collected from primary and secondary sources. The primary data sources were obtained from 385 randomly selected households through interview schedule, focus group discussions, and key informant interview and field observation. The data that were collected include information related to socio demographic characteristics, economic variables as well as service related factors for willingness to pay for improved solid waste management services. Secondary data were collected from government line offices, NGOs and other relevant sources such as books, journals, internet, and related research documents.

3.2.2. Sample Size and Sampling Method

The disadvantage of the sample size based on the mean is that a "good" estimate of the population variance is necessary. Often, an estimate is not available. Furthermore, the sample size can vary widely from one attribute to another because each is likely to have a different variance. Because of these problems, this study will apply proportionate to size method by (Kothari, 2004).

$$n = \frac{pqZ^2}{e^2}$$

Where n = required sample size for this cross sectional survey

P = the proportion in the target population estimated to have characteristics being measured

q = (1 – p) = (1-0.5)= 0.5 Z is percentiles of the standard normal distribution corresponding to 95% confidence level which is equals to 1.96.

e is margin of error which is 5%

$$n = \frac{0.5*0.5(1.96)^2}{(0.05)^2} = 0.9604 / 0.0025 = 384.16$$

Hence, the sample size of the study will be 385.

Representative samples need to be taken to represent the study population adequately who are all 9 urban kebeles Dire Dawa administration. Hence, the unit of analysis for this research is household heads. The sampling frame of the study were the list of all household heads disaggregated by Kebele.

Multi stage random sampling technique were employed to address the objective of this study. In the first step, Dire Dawa city was selected because of three major reasons: lack of background information about households' solid waste disposal practices, current solid waste management system and its challenges; the increment of solid waste disposal induced problems in the city and the presence of high rate of migration from rural areas in all directions, and these increases pressure to manage waste effectively in order to avoid outbreaks of diseases. In the second stage, 9 kebeles' of Dire Dawa city was stratified based on geographical location, i.e. inner (kebele close to the center of the city), middle (kebele located in the middle distance to the center) and periphery (kebele located far from center of the city). In the third step, a total of three kebeles (one from each stratum) were selected. In the fourth step, 385 randomly selected urban households were allocated to the sample kebeles using probability proportional to sample size. Finally, systematic random sampling was applied to draw sample respondents from each stratum.

3.2.3. Methods of Data Analysis

This study used both descriptive statistics and econometric methods.

3.2.3.1. Descriptive Analysis

Descriptive statistics such as mean, percentages, standard deviation, frequency of occurrence, chi-square and t-test will be employed to analyze socio-demographic, economic, and service related factors. The statistical significance of the variables will be tested for both dummy and continuous variables using chi-square and t-tests, respectively to compare the willingness to pay among households.

3.2.3.2. Econometrics Model

The dependent variable of this study is households' willingness to pay which takes 1 for low, 2 for medium and 3 for high. This implies that the dependent variable has order responses. To do

this, consecutive focus group discussions will be made with selected individuals to order sample households willingness to pay for improved solid waste.

As a result, ordered logit and probit models are the right econometric models to analyze ordered response dependent variables (Wooldridge, 2002). How do logit models differ from probit models? This question is answered by (Park, 2015). The core difference lies in the distribution of the error term. In the logit model, error term is assumed to follow the standard logistic distribution; whereas, probit model is assumed to follow the standard normal distribution. With this minor difference, ordered probit model will be employed to analyze determinants of households' willingness to pay for improved solid waste management services. Following (Wooldridge, 2002), the model is specified as follows:

$$y = j \text{ if and only if } \alpha_{j-1} \leq y^* \leq \alpha_j \quad j = 1, \ldots\ldots, J$$

$$y = 0 \text{ if } y^* \leq \alpha_1$$
$$y = 1 \text{ if } \alpha_1 \leq y^* \leq \alpha_2$$
$$\ldots$$
$$\ldots$$
$$y = j \text{ if } \alpha_{j-1} \leq y^* \leq \alpha_j$$

$$y^* = \beta_0 + \beta_i \sum_{i=1}^{n} X_i + \varepsilon$$

Where α_{j-1} and α_j are threshold parameters

β_o = constant term,

β_i = coefficients of explanatory variables,

X_i = Explanatory variables, and

ε = Error term

An econometric software known as SPSS 25 and STATA 14 versions were be employed for descriptive analysis and to run the probit model respectively.

3.3. Working Hypothesis and Definition of variables

Based on review of previous empirical studies (Solomon Tarfasa and Roy Brouwer. 2018; Selamawit Mulat, Walelegn Worku and Amare Minyihun. 2019; Rajesh Kumar Rai, Mani Nepal, Madan Singh Khadayat and Bishal Bhardwaj. 2019; Hagos, Mekonnen, & Gebreegziabher, 2013; Nkansah, Dafor, & Essel-Gaisey, 2015; Thirumarpan & Dilsath, 2016), household socio-demographic and economic characteristics and service related factors of solid waste management which are hypothesized to affect urban households' willingness to pay for improved solid waste management service were selected (Table 2).

The dependent Variable of the Orderd probit model: It is urban households' willingness to pay for improved solid waste management service which takes 1 for low, 2 for medium and 3 for high.

The Independent Variables of the Study:

Households WTP for improved SWM services were depend upon a number of important determinants. In this study HH's WTP is treated as the dependent variable, and it is taken as categorical dummy variable which assumes only two values. So, the conceptual framework of the study focused on how to elicit households' WTP for better SWM in study area? And what are the major socioeconomic factors that affect the farmer's WTP for better SWM service supply? Based on the related literatures, the researcher has developed the following conceptual framework for the purpose of analysis. As stated above, MSWs are generated from different sources such as from industries, institutions, commercials, households and the like. This study was emphasized on households' WTP, and determinants of households WTP for improved SWM services in the case of Dire Dawa city.

Some of these factors with their expected signs are defined as follows.

IHH (Monthly Income of the Household) - this variable refers to the monthly money income of the household in terms of Birr. It includes the income of the head and all other members of the household from all sources. There is a general agreement in environmental economics literature on the positive relationship between income and demand for improvement in environmental

quality. Therefore, we expect income to affect willingness to pay and its amount positively and significantly.

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

AR (Age of Respondents) -this refers to the age of the respondent and it is expected to affect willingness to pay negatively. This is because old people may consider waste collection, as government's responsibility and could be less willing to pay for it. While the younger generation might be more familiar with cost sharing like for education, health, etc and could be more willing to pay.

ER (Education of Respondent) -this variable is taken to capture the level of understanding of the

respondent about the desirability of proper management of solid waste. It is hypothesized that the higher the level of education the more the respondent would understand the consequence of mishandling solid waste and the more the value the individual would give in order to avoid the risk of being a victim of unclean environment. ERPD is a dummy variable taking 1 if the respondent has attended primary educations; 0 otherwise. ERSD is a dummy variable taking 1 if the respondent has attended secondary education; 0 otherwise. ERTD is a dummy variable taking 1 if the respondent has attended any tertiary educations; 0 otherwise. Education is expected to have positive and significant effect with higher levels having higher effects on willingness to pay and its amount.

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

TS (Time Spent in the Area)-this refers to the number of years the household has been living there. This is expected to influence willingness to pay in the positive direction, since the longer

the year the household has been there, the more they would understand the problem of solid waste management of that area, and the more they are expected to pay.

NCH (Number of Children in the Household) -this refers to the number of children below 15 years of age. This variable is expected to have a positive effect on willingness to pay. This is due to the fact that the more children in the household, the more willingness to maintain a clean environment in the future in which children will grow with lesser risk due to cleaner environment.

QW (Quantity of Waste Generated)-this variable stands for the quantity of waste the household generates within a week. For this the unit of measurement used is a shopping plastic bag ('Kurtu'), which was common almost to all respondents during the survey. The study hypothesizes willingness to pay to be positively related with the quantity of solid waste generated, since the higher the generation, the more would be the problem households face in storage and taking the waste for collection, and they would be willing to pay more.

RSWM (Responsibility of Solid Waste Management)-this variable is taken as proxy to examine the attitude of the respondent towards cost sharing in solid waste management. RSWM is a dummy variable taking 1 if the respondent believes households have responsibility to the improvement of solid waste management (including cost sharing) with the government; 0 otherwise, i.e., if the respondent feels it is entirely government's responsibility. This study expects positive attitude towards cost sharing to influence willingness to pay in the positive direction.

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

HA (Housing Arrangement)-this is a dummy variable taking 1 if the household is renting the house from kebele, Public Agency or individuals; 0 otherwise (if the household owns the house in which it is living). Those living in their own houses are expected to be more willing to pay for the improvement. This could be partly explained by the belief some renters have that the owner

of the house should pay solid waste charges. The fact that house owners get extra income from renting rooms in their house or extra houses in their compound is also expected to make them more willing than those who pay a good part of their income as house rents.

SP (Starting Price)- As mentioned earlier this study has used starting prices in eliciting willingness to pay amounts. Therefore, the existence of starting point bias is examined by including the starting price in the regression analysis.

SRH (Status of Respondent in the Household) - this variable is included to examine whether interviewing the head rather than its representative has an impact on willingness to pay and it take 1 if the respondent is the head of the household; 0 otherwise. The study expects heads to be more willing than their representative since the latter might happen to be less courageous to give the correct value wondering what the reaction of the head would be.

Table 2: Independent Variable

S.N	Variables	Measurement	Type of variable	Expected sign
1	Age of the house hold head	Year	Continuous	-
2	Sex of the Household Head	1 for male, 0 otherwise	Dummy	-
3	Marital status	1 for married, 0 otherwise	Dummy	+
4	Educational status	Level of formal education	Continuous	+
5	family size	Number of family members	Continuous	+
6	Time spent in the area(Current Residence Area)	Year	Continuous	+
7	Disease outbreak	1 yes, 0 otherwise	Dummy	+
8	Household Ownership	1 for private, 0 for government	Dummy	+
9	Occupation	1 for employed, 0 for	Dummy	+

		unemployed		
10	Monthly aggregate income	Birr	Continuous	+
11	Awareness about SWM	1 yes, 0 otherwise	Dummy	+
12	Quantity of waste generated in weekly basis	Plastic bag	Continuous	+
13	Satisfaction with current service	1 yes, 0 otherwise	Dummy	+
14	Access to waste management service	1 yes, 0 otherwise	Dummy	+

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Introduction

This chapter presents and discusses the analysis of the data collected from the various respondents. The data was interpreted according to research questions. The data analyzed and presented in form of Graphs, frequency and percentage tables. It also contains summary of data analysis of all the variables included in the questionnaire.

4.2. Socio-Demographic Characteristics of the Respondents

Table 4.1: Summery descriptive analysis of categorical variables of the house hold

Variable	Categories	Count	Frequency	Chi-Square (P-Value)
What is the status of the respondent in the household?	Head	211	54.8%	68.263 (0.000)
	House Hold Member	174	45.2%	
Sex of the household	Male	209	54.3%	

head	Female	176	45.7%	84.744 (0.000)
Age of the household	Under 20 Years	4	1.0%	14.716 (0.02)
	20-30 Years	104	27.0%	
	31-40 years	120	31.2%	
	Over 40 Years	157	40.8%	
Marital status of Household	Married	223	57.9%	6.536 (0.088)
	Single	20	5.2%	
	Divorced	100	26.0%	
	Widowed	42	10.9%	
The highest formal educational level achieved by household head	Illiterate	4	1.0%	29.667 (0.000)
	Primary School	4	1.0%	
	High School	198	51.4%	
	Diploma	46	11.9%	
	Degree and Above	133	34.5%	
The occupation of the household	Government	80	20.8%	103.122 (0.000)
	private employed	60	15.6%	
	NGO	4	1.0%	
	Own Business	189	49.1%	
	Unemployed	52	13.5%	

From the total surveyed households, around 56 percent of the households surveyed were household heads while the remaining 46 percent of them were simply household members. About 54 percent of the respondents are male and 46 percent of the respondents are females. Regarding age of the respondents, most of the respondents (around 41 percent) were over 40 years old, only 1 percent of the respondents were less than 20 years old while the others were

between 20 and 40 years old. More than half of the respondents (above 57 percent) were married, around 26 percent of the respondents were legally separated while only 5 percent of the respondents were single households.

Most of the surveyed respondents (51 percent) are high school) completed, around 35 percent of the respondent's educational status are first degree and above, 12 percent of them are diploma holders and the remaining 2 percent of the respondents are illiterate and primary school completed. Regarding the current occupation of the house hold, most of the households (49 percent) are working on their own business, 21 percent of the households are employed by the government, around 16 percent of the households are private employers, 13 percent of them are unemployed and the remaining 1 percent of the households are employed by NGO.

The chi-square tests of association indicates that result all scociodemographic variables (sex, age, marital status, educational status and occupation of the household) were significantly associated with households willingness to pay for solid waste management service at 10% levels of significant.

4.2.1. Residential Status of the household

With regard to house ownership of the respondent, 26.5 percent of households were live in their own houses, 26 percent of households were live in rented houses from individuals, only 7 percent of from kebeles while around 41 percent of households were live in rented houses from house rented agencies. These result summarizes that only one out of five households were live in their own houses and around 75 percent of the households were live in rented houses.

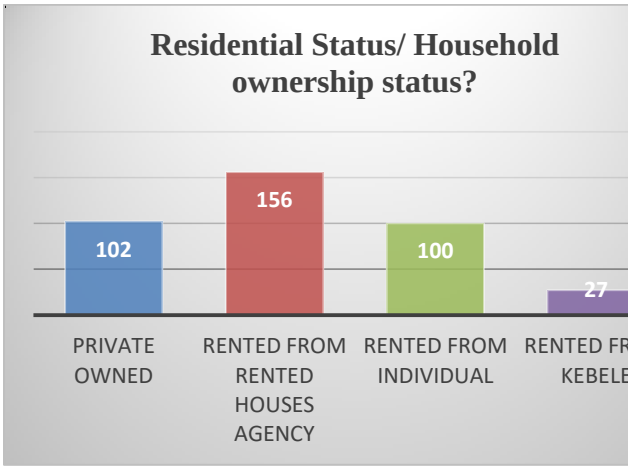

***Figure 4.1**: Bar diagram of Residential Status of the household*

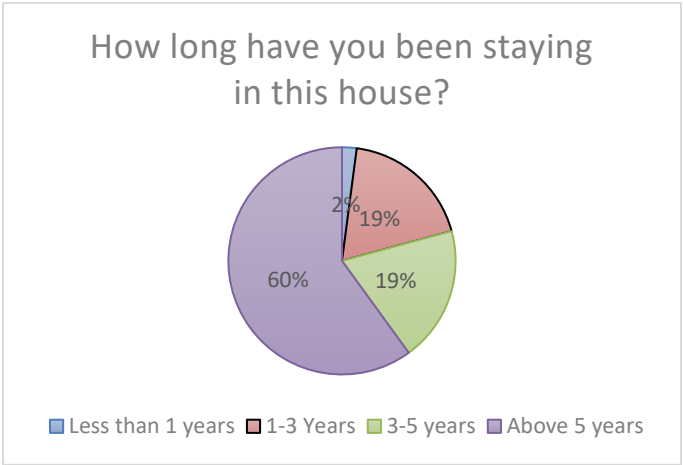

***Figure 4.2:** pie-chart of the number of years the household have been lived in the house*

The result from the above pie diagram shows that 60 percent of the households have been staying above five years in their homes, 19 percent of the households have been staying between three and five years in their homes, the same 19 percent of the households have been staying between one and three years in their homes and only two percent of the households have been staying less than one year in their homes.

4.2.2. Descriptive statistics of Quantitative Variables

Table 4.2: Descriptive Statistics of Socio-demographic Quantitative Variables

Quantitative Variable	Mean	Max	Min	Standard Deviation	Independent Sample T-test
Family size of the household	5	9	2	2	-9.132 (0.000)
monthly income of the household	10832	32000	1000	8488	2.400 (0.017)
monthly Expenditures of the household	9720	32000	1000	7472	3.022 (0.003)

Regarding Family size of the household, the average family size was 5 and the minimum and maximum was 2 and 9 respectively. The average family size of 5 in this study is less than with the national average family size, which is 5.76 in 2020. The reason was that may be household head were not interested disclosing their family size. On the other hand, the mean income of the respondents was 10, 832 ETB per month with minimum and maximum aggregate income 1000 ETB and 32, 000 ETB, respectively. This average income is also lower than the national average income (which is 15,021 ETB). The difference might be due to the fact that only 20 percent of the respondents in this study were government employees and around 45 percent of the respondents were household members and might not know exactly the monthly salary.

4.3. Descriptive Analysis of Solid waste management Practices

Table 4.3: Descriptive Statistics of Solid waste management practices

Variables	Category	Count	Percent	Chi-Square (P-Value)
Do you Separate SW by type when you stored?	No	310	80.5%	21.426 (0.000)
	Yes	75	19.5%	
Do you get waste management service from the government?	No	36	9.4%	9.264 (0.002)
	Yes	345	90.6%	
Is Solid waste management a serious problem in your locality?	No	4	1.0%	17.571 (0.000)
	Yes	381	99.0%	
Do you have enough awareness on the solid waste management done in your locality?	No	350	90.9%	8.856 (0.003)
	Yes	35	9.1%	
Who do you think is responsible to properly manage solid waste (for instance financing it) in Dire Dawa?	Households Only	81	21.0%	76.156 (0.000)
	Government Only	55	14.3%	
	Both	249	64.7%	
Is the present final disposal environmentally safe and acceptable?	No	82	21.3%	20.569 (0.000)
	Yes	21	5.5%	
	Do Not Know	282	73.2%	
Which of the following do you think is the best institute to handle solid waste management in Dire Dawa?	Private Companies	105	27.3%	8.834 (0.012)
	The City Government	185	48.1%	
	Public Private partnership	95	24.7%	

The result from the above table indicates that most of the households, around 81 Percent, in the study do not separately store the Solid waste management by their types and only 20 percent of the households separately store the Solid waste management by their types. On the other hand

almost 91 percent of the respondents replied that they get solid waste management service from the government. Regarding to the seriousness of the problem, 99 percent of the respondents replied that solid waste management is a serious problem in their locality and only 1 percent of the households replied that solid waste management is not a serious problem in their locality. From this result, we can clearly examine that even though the government delivers solid waste management service, still the problem serious which should be improved.

On the other hand, only 9 percent of the households have enough awareness on the solid waste management done in their locality while most of the households (91 percent) have enough awareness on the solid waste management done in their locality. This result indicates that most of the respondents doesn't have enough awareness on the solid waste management practices in their locality. Regarding to the responsibility of properly managing the solid waste especially for financing the practice, 64.7 percent of the households argued that both the city government and the individual households have the responsibility to properly manage and give financial support for solid waste management practices, 21 percent of the households replied that only the individual households have the responsibility to properly manage and give financial support for solid waste management practices while only 14.3 percent of the households replied that only the city government have the responsibility to properly manage and give financial support for solid waste management practices in Dire Dawa. On the other hand, half of the households replied that the city government the best institution to handle solid waste management in Dire Dawa, 27.3 percent of the households replied that the private companies are the best institution to handle solid waste management and 24.7 percent of the households replied that the Public Private partnership is the best institution to handle solid waste management in Dire Dawa.

The chi-square tests of association indicates that result all solid waste practice related variables were significantly associated with households willingness to pay for solid waste management service at 5% levels of significant since they yield small p-values which are less than 0.05.

4.3.1. Descriptive analysis for the frequency of solid waste collection

Table 4.4: Summary of the frequency of solid waste collection time in Dire Dawa

How many times (frequency) do you get solid waste collection services most of

The time?				
	Frequency	Percent	Valid Percent	Cumulative Percent
Once a week	18	4.7	4.7	4.7
Once within 10 Days	176	45.7	45.7	50.4
Once within 15 days	64	16.6	16.6	67.0
There is No fixed time	127	33.0	33.0	100.0
Total	385	100.0	100.0	

45.7 percent of the households get solid waste collection services within 10 days interval, 16.6 percent of the households also get solid waste collection services within 15 days interval while 4.7 percent of the house hold get once in a week and 33 percent of the households get the service with an arbitrary time interval (Table 4.4). Regarding the service delivery organizations, 52.5 percent of the households were receiving solid waste collection services from government agencies, 45.7 percent of the households were receiving solid waste collection services from private collectors and only 1.8 percent of the households were disposing by themselves by burning on the fires. The result clearly shows that government agencies and private collectors are the most disposing institution of the solid waste collection in Dire Dawa (Figure 4.3).

The following figure 4.4 indicates the solid waste collection site that the household mostly gets nearby. The result indicates that almost 97 percent of the households gets a service from government agencies or private collectors who disposes the solid waste in door to door service. Only 3 percent of the households were walking for 5-10 minutes to drop the solid waste material in Dire Dawa. This indicates that the government agencies or private collectors are delivering a door to door service to dispose the solid wastes in the City.

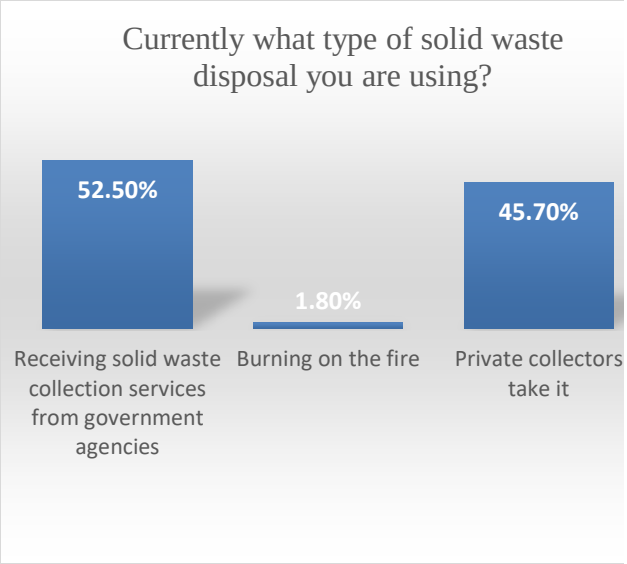

***Figure 4.3**: Bar diagram of household's solid waste disposal type*

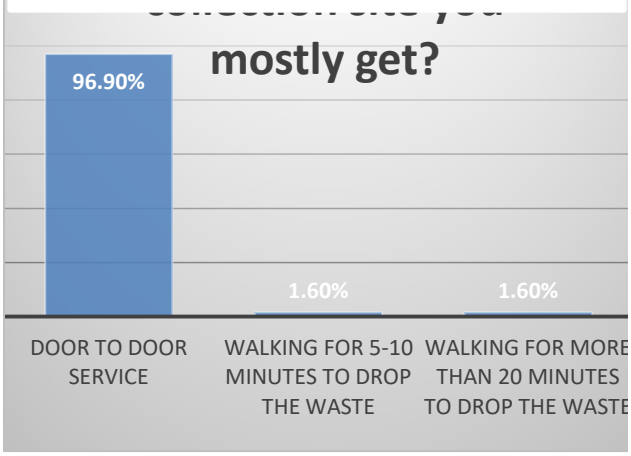

***Figure 4.4**: Bar diagram of household's solid waste disposal cite*

4.3.2. Levels of satisfaction of households on solid waste collection practice

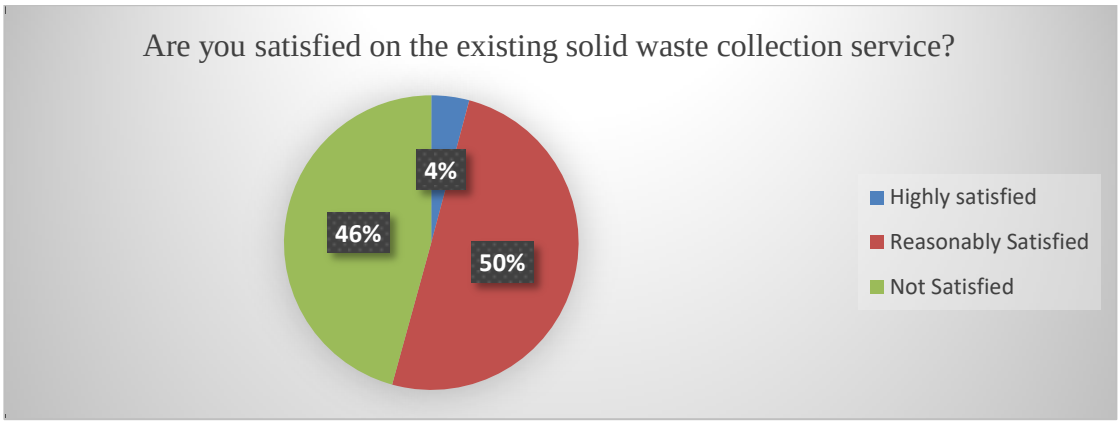

***Figure 4.5**: Pie diagram of household's levels of satisfaction on solid waste collection practice*

The above diagram shows that 54 percent of the households were satisfied by the existed solid waste collection and disposal service provided by the municipal while larger number of households (46 percent of the households) were not satisfied by the existed solid waste collection and disposal service provided by the municipal in Dire Dawa City. The reason for this much dissatisfaction by the existed solid waste collection and disposal service are due to lack of uniform time for the arrival of tractor to collect the waste, lack of frequent service by the municipal, the service is not reliable, due to the fact that the waste remains uncollected for some days on the road and smell badly and others (table 4.5).

Table 4.5: Summary of the reasons of dissatisfaction on the existing solid waste collection and disposal service in Dire Dawa

Reason not satisfied Frequencies			
	Responses		Percent of Cases
	N	Percent	
Not reliable	84	18.5%	21.9%
There was not uniform time for the arrival of tractor to collect the waste	176	38.9%	45.7%
Service was not frequent	97	21.4%	25.3%

Sometimes sweepers collect the waste and put before the house but tractor does not come to collect the waste	24	5.3%	6.3%
The waste remains uncollected for some days on the road and smell badly	72	15.9%	18.8%
Total	453	100.0%	118%

4.3.3. Summary of estimated amount of solid waste

Table 4.6: Descriptive analysis of the estimated amount of solid waste generated by a household

	Descriptive Statistics			
	Minimum	Maximum	Mean	Std. Deviation
Amount per Kg per day	1	6	2.39	1.248
How much solid waste on average does your household generate within one week in plastic bag (madaberiya)	0.50	5.00	1.2221	.52728

An average of 2.39 Kg of solid waste were generated by a household in each day and averegically 1.22 plastic bag (madaberiya) of solid waste were generated by a household in each week in Dire Dawa City. This solid waste might be plastic bag and plastic bottles, Leftover food, broken glasses; small bottles of glass (like bottles of medicine, Vegetable and fruit peel, Pieces of papers, and other solid waste which are generated by the households in each day.

4.4. Descriptive analysis Households' willingness to pay for improved solid waste management

4.4.1. The dichotomous Responses

The distribution of the double-bounded dichotomous choice response was analyzed using their willingness to pay for improved solid waste management practice versus their initial amount that a household is willing to pay for the service. This of the double-bounded dichotomous is in line with the law of demand theory. That means, the percentage of NO–NO response increases with the initial bid price that the respondents faced. This distribution is just what is expected. The

higher the price is; the lower acceptance by the respondent. The result from the following table shows, the percentages of NO–NO increases as the initial bid price increase and inversely the percentages of YES-YES decreases as initial bid price increases.

Table 4.7: Distribution of binary responses for monthly payments for improved SWM services

Initial bid	YES-YES	YES-NO	NO-YES	NO-NO	Observation
15 ETB	143 (38.5%)	74 (50.3%)	64 (66.76%)	4 (18.2%)	285
30 ETB	135 (36.4%)	41 (27.9%)	16 (16.7%)	6 (27.3%)	198
60 ETB	93 (25.1%)	32 (21.8%)	16 (16.7%)	12 (54.5%)	153
Total	371 (58.3%)	147 (23.1%)	96 (15.1%)	22 (3.5%)	636

The result from the above table 4.7 indicated that, about 22 (3.5 percent) of the households rejected the initial offers (15 ETB) as well as the follow up discounted larger bids (NO-NO). Out of the total willingness to pay respondents, the percentage of households that did not accept the initial bid but accepted the second discounted bid (NO-YES) was found to be 96 (15.1 Percent). The third category of households that accepted the initial bid but rejected the higher second follow up bid (YES-NO) were found to be 147 (23.1 percent). The last category represents households who had responses for the first initial bid (15 ETB) as well as for the higher follow up bid (YES-YES) was found to be 371 (58.3 percent). This could indicates that the presence of the first response had an effect on the response of the follow up higher bids question and is in line with the law of demand theory.

4.4.2. Estimated Total Willingness to Pay for Improved solid waste Management

The study covers a total of 385 households out of 426, 129 households in the Dire Dawa City (World population review, 2021). The results of the study show that 313 (81.3 percent) of the households are willing to pay for improved solid waste management services but not the rest 72 (18.7 percent) of the households. As a result, the total households of sample stratification were estimated based on this ratio. It means that (426, 129 *0.813 = 346, 442) households are willing to pay for improved SWM service.

Table 4.8: Summery of willingness to pay for improved SWM services

Would your household be willing to pay per month for this improved solid waste management service?				
	Frequency	Percent	Valid Percent	Cumulative Percent
No	72	18.7	18.7	18.7
Yes	313	81.3	81.3	100.0
Total	385	100.0	100.0	

Descriptive Statistics				
	Minimum	Maximum	Mean	Std. Deviation
What is the maximum amount per month are your household willing to pay for the improved service?	10	100	36.29	13.456
Minimum amount WTP in ETB	10	45	23.30	8.379

Both open ended and double bounded CVM were used to compute the mean WTP. In the case of open ended format, what is the maximum amount you are WTP for better SWM services question was introduced. The open ended contingent valuation result demonstrated that the respondents' WTP of sample households ranges from 0 to 100 ETB for better SWM services. The mean of their WTP was found to 36.29 ETB. This implies that the respondents' average WTP is much greater than the current SWM service charge (15 ETB/month) by 21 ETB. This indicates that the current SWM service charge is not demand oriented. As a result, demand based SWM service increase the revenue stream of the municipality to improve the services supply as well as satisfaction level of urban households. The result of this study was greater than a study done in Injibara, Ethiopia (Selamawit *et al*., 2019) which was 29.7 ETB.

4.4.3. Bivariate Probit Model Estimation Results

The bivariate probit model estimation is a first step in the estimation of households' mean willingness to pay for the improved solid waste management. These bivariate probit models (or the double-bounded probit models) are estimated using households' responses to the first, second and the third bids.

Table 4.9: Parameter estimates of bivariate probit model from double bounded format

Payment	**Variable**	**Coefficient**	**Std. Err**	**Z**	**P>(z)**	**[95% Conf. Interval]**	
ETB/month	Bid1	.7973954	.2108384	3.78	0.000	.3841596	1.210631
	Cons	.4981796	.0911559	5.47	0.000	.3195173	.6768418
	Bid 2	-.6120928	.2456819	-2.49	0.013	-1.09362	-.1305651
	Cons	1.593219	.1203762	13.24	0.000	1.357286	1.829152
	Bid 3	-.0209597	.1811351	-0.12	0.908	-.375978	.3340585
	Cons	1.050305	.1475012	7.12	0.000	.7612078	1.339402

In addition to the open ended format, mean WTP from double bounded CV format was computed following the bivariate probit estimation. As the model result indicated, both the initial bid 1and the follow up bid 2 had statistically significant effect on responses to the stated bids at less than 5% significance level. But the third bid is not significant. The above table shows that an increase in the amount of bids decreases the respondents' willingness to pay for improved solid waste management service.

4.5. Econometrics Analysis

The dependent variable of this study is households' minimum willingness to pay which takes 1 for low, 2 for medium and 3 for high. This implies that the dependent variable has order responses. Based on the municipal solid waste management fee (15 ETB per month) and mean willingness to pay of households (23.3 ETB) were used as a cut of point to categorize their willingness to pay, i.e. $0 < WTP < 15$, low; $15 \leq WTP < 23.3$, medium and $WTP \geq 23.3$, high. As

a result, ordered probit models are the right econometric models to analyze ordered response dependent variables (Wooldridge, 2002).

Among the explanatory variables which were used socio-demographic variables (Sex of the HH, occupation of the HH, family size, income and expenditure) solid waste management related variables (total SW generated, separation of SW by type, service from government, frequency, satisfaction, and awareness) and household willingness to pay related variables were found to have statistically insignificant at 5% levels of significance. The remaining other variables were not statistically insignificant and could not be considered in the final ordered probit regression model. The details of the bivariate analysis were found on Appendix A.

4.5.1. Factors affecting households' willingness to pay

The study tested the joint significance of explanatory variables by using likelihood ratio test. The likelihood ratio test which takes a chi-squared ($\chi 2$) distribution with 15 degrees of freedom is about 370.03 with a p-value (Prob> chi2) 0.0000 tells us the ordered Probit model as a whole is statistically significant, as compared to the model with no predictors. The null hypothesis that all the coefficients of the independent variables are simultaneously equal to zero is rejected at 5% level of significance. Another method of goodness of fit is pseudo R2, which measures how well the model fits the data and it is 0.5409 indicates that 54.09 percent of the variation on household's willingness to pay for solid waste management service is accounted due to the considered independent variables. For this study showing the good model fit.

Nine explanatory variables were included into the multiple ordered probit model to predict factors affecting households' willingness to pay for improved solid waste management services. The following shows the sign, magnitude, standard errors, statistical tests, significance level and confidence intervals of each explanatory variable. Out of the nine variables considered in the final model that influences households' willingness to pay for improved solid waste management practices, six variables were found to be statistically significant at less than 5% significant level. These variables are occupation of the household, family size, getting support from the government, frequency of getting SWMS, levels of satisfaction on the services and awareness on solid waste management service. Whereas, sex of the household, quantity of waste generated per day and responsible institution were not significant at 5% significant level.

Table 4.10: Results of ordered probit model

Ordered probit regression	Number of obs = 381				
	LR chi2(15) = 370.03				
	Prob > chi2 = 0.0000				
Log likelihood = -157.06271	Pseudo R2 = 0.5409				
Status	Coef.	Std. Err.	Z	P>|z|	[95% Conf. Interval]
Sex	.0420403	.3706838	0.11	0.910	-.6844866 .7685671
Occupation					
Privately employed	-3.523816	.7292376	-4.83	0.000**	-4.953096 -2.094537
Own business	-.593428	.3582733	-1.66	0.098	-1.295631 .1087749
Unemployed	-1.980318	.5069162	-3.91	0.000**	-2.973855 -.9867803
Family Size	.2887085	.0895357	3.22	0.001**	.1132218 .4641951
Total SW |	-.0658767	.1176006	-0.56	0.575	-.2963696 .1646161
Get Support	-1.498877	.4242188	-3.53	0.000**	-2.33033 -.6674231
Frequency					
2	-1.345137	.6410969	-2.10	0.036**	-2.601664 -.0886105
3	-1.666862	.5661064	-2.94	0.003**	-2.77641 -.557314
4	-.4308126	.5854555	-0.74	0.462	-1.578284 .7166591

Satisfaction |						
1	-2.987119	.6618079	-4.51	0.000**	-4.284239	-1.69
2	-3.012175	.6066867	-4.96	0.000**	-4.201259	-1.823091
Awareness	1.74347	.5663989	3.08	0.002**	.6333482	2.853591
Responsible						
1	.8207481	.644786	1.27	0.203	-.4430093	2.084505
2	3.000925	.4290052	7.00	0.000**	2.16009	3.84176
/cut1 | -2.353432 1.265002			-4.83279 .1259259			
/cut2 | .0922628 1.221789			-2.3024 2.486926			

** Significant at 5 % levels of significance

In the ordered probit model estimation, only the sign of the variable are important for examining the direction of association since the coefficient magnitude does not show the effect of each independent variable on the probability of households' willingness to pay in each level for the improved solid waste management. In order to analyze the effects of each explanatory variable on the probability those respondents have low willing, medium willing and high willing to pay for the improved solid waste management, the partial/marginal derivatives of explanatory variables with respect to discrete responses must be taken (Greene, 1993). i.e., we need to estimate the marginal effects

Ordered probit regression					Number of obs = 381				
					LR chi2(15) = 370.03				
					Prob > chi2 = 0.0000				
Log likelihood = -157.06271					Pseudo R2 = 0.5409				
Variable	**Coef.**	**Std. Err.**	**Z**	**P>|z|**	**[95% Conf. Interval]**		**dy/dx (Marginal effect**		
					Lower	**Upper**	**Low**	**Medium**	**High**
Sex	.0420403	.3706838	0.11	0.910	-.6844866	.7685671	-.0072746	.0047747	.002499
Occupation									
Privately Epml	-3.52381	.729237	-4.83	0.000	-4.953096	-2.094537	.5599993	-.3993784	-.16062
Own business	-.593428	.3582733	-1.66	0.098	-1.295631	.1087749	.1054194	-.0393341	-.06608
Unemployed	-1.980318	.5069162	-3.91	0.000	-2.973855	-.9867803	.3860957	-.2517771	-.13431
Family Size	.2887085	.0895357	3.22	0.001	.1132218	.4641951	-.0499576	.0327897	.017167
Total SW |	-.0658767	.1176006	-0.56	0.575	-.2963696	.1646161	.0113992	-.0074819	-.00391
Get Support	-1.498877	.4242188	-3.53	0.000	-2.33033	-.6674231	.259363	-.1702331	-.08912
Frequency									
once within 10 d	-1.345137	.6410969	-2.10	0.036	-2.601664	-.0886105	.2258305	-.1147508	-.111079
once within 15 d	-1.666862	.5661064	-2.94	0.003	-2.77641	-.557314	.2736399	-.1489119	-.124728
No fixed time	-.4308126	.5854555	-0.74	0.462	-1.578284	.7166591	.0769843	-.0309522	-.046032
Satisfaction |									
Reasonably	-2.987119	.661807	-4.51	0.000	-4.284239	-1.69	.4559419	| -	-.392860

satisfy		9						.063081	
Not satisfied	-3.012175	.6066867	-4.96	0.000	-4.201259	-1.823091	.4601883	-.0657243	-.394464
Awareness	1.74347	.5663989	3.08	0.002	.6333482	2.853591	-.3016869	.1980125	.1036744
Responsible									
1	.8207481	.644786	1.27	0.203	-.4430093	2.084505	-.080498	.0687514	.011746
2	3.000925	.4290052	7.00	0.000	2.16009	3.84176	-.4974933	.3780068	.1194865
/cut1 | -2.353432 1.265002 -4.83279 .1259259									
/cut2 | .0922628 1.221789 -2.3024 2.486926									

4.5.2. Marginal effect estimates of the ordered probit model

Table 4.9: Results of Marginal effect estimates of the ordered probit model

The result of the model indicated that occupation of the household had statistically significant effect on household's willingness to pay at 5% significant level. The result from the above table shows that private employed households had negative statistically significant effect on household's willingness to pay at 5% significant level. This implies that private employed households are less willing to pay for improved solid waste management than government employed households in Dire Dawa. Similarly, government employee are more likely to willing to pay for improved solid waste management than unemployed households having their own business households. The marginal effect result of the model indicated that private employed households are 16.02 percent less likely to pay high amount and 39.93 percent less likely to pay medium amount for improved solid waste management service; whereas, they are more willing to pay low amount. Similarly, unemployed households and the owners of their business are 13.43 percent and 6.6 percent less likely to pay high amount for improved solid waste management service respectively. This might be due to the fact that government employees are more aware of and near for government directions for proper disposal of solid waste on the environment and human health.

Total family size in the household has a positive and statistically significant effect at 5% level of significance on their willingness to pay. Holding other factors remain constant, a unit increases in the total family in the household increases the probability of willing to pay for improved solid waste management. The result indicates that a unit increases in the total family of the household increases the probability of willing to pay high amounts for improved solid waste management by 17.16 percent. This implies that more family size has, the more could be the probability of being a victim of mishandling solid waste and hence the household willing to pay more. This suggests that positive relationship can also be the result of bequest value. One's expectation of their legacy increases with the number of children they have, as does their willingness to pay to keep the city clean for future generations.

Regarding the support they get from the government, getting waste management service from the government household had negative statistically significant effect on household's willingness to pay at 5% significant level. The result shows that the households who gets waste management service from the government are 8.9 percent less likely to pay high amount for improved solid waste management service on the other hand they are more willing to pay low amounts. This might be due to their wrong expectation that the government will cover more of the financial costs and services for solid waste management.

The result also found that frequency of getting solid waste management service had a significant effect on household's willingness to pay at 5% significant level. This implies that households who get solid waste collection service once in 10 days are 11.10 percent less likely to pay high amount for improved solid waste management service than the collection service is delivered once in a week. Similarly households who get solid waste collection service once in 15 days are 12.47 percent less likely to pay high amount for improved solid waste management service than the collection service is delivered once in a week. The result revealed that the later of disposing the solid waste by the service delivery organizations will cause the less probability of households willing ness to pay high amount for improved solid waste management service in Dire Dawa. This might be due to disposing the solid wastes by themselves like burning on the fire when the service delivery organizations are too late to collects and develops a sense of "why I will pay this much amount". On the other hand this might be due to the disappointments by the frequency of collection of solid wastes and disagreements to pay high amount.

Respondent's perception of satisfaction existing solid waste collection service was found to have a positive impact on willingness to pay for improved solid waste management at 5%. The positive relationship indicates that households who are highly satisfied on the current solid waste management system will be more willing to pay than households who not satisfied with the current solid waste management system. The marginal effect of respondents' perception of reasonably satisfied on current SWM are 39 percent less likely to pay high amount than the highly satisfied households on the current solid waste management service. Similarly the dissatisfied households on the current system are also 39 percent less likely to high amount than the highly satisfied households on the current solid waste management service.

4.6. Discussion of the study

This study was intended to study the determinant factors for solid waste generation and their WTP for improved solid waste management services in Dire Dawa city. Accordingly, descriptive analysis and ordinal probit regression analysis were used. The results which are obtained are discussed as follows

The descriptive analysis of the study revealed that 54 % of the households were satisfied by the existed solid waste collection and disposal service provided by the municipal in Dire Dawa City. The result is much more than the study conducted in Bharatpur Metropolitan City (Rajesh et al., 2019) in which only 47% of the participants were satisfied with the existing service and much more larger than the study conducted in Bahir Dar city, Ethiopia by Birara and Kassahun, (2018) where only 22% of the respondents were satisfied with the existing waste management service. The difference might be due to the difference of the study time, the nature of the population and the difference of the implementation strategies of solid waste management in each study area.

The result of the study also show that 313 (81.3 percent) of the households are willing to pay for improved solid waste management services but not the rest 72 (18.7 percent) of the households. The result of the study is almost similar with the study conducted at Injibara town (Selamawit *et al*., 2019) where 81.06% were willing to pay for the service. But the result is smaller than a study conducted in Hawasa (Solomon Tarfasa and Roy Brouwer, 2018) where 98% of the respondents were interested in, and willing to pay extra for, improved solid waste services.

The findings of this study revealed that the average of maximum amount per month a household willing to pay for the improved service are 36.29 ETB. This finding was greater than a study done in Injibara, Ethiopia (Selamawit *et al*., 2019) in which the average amount of money the participants would be willing to pay per month was 29.7 ETB. The result showed that demand based SWM service increase the revenue stream of the municipality to improve the services supply as well as satisfaction level of urban households.

The result indicates that a unit increases in the total family of the household increases the probability of willing to pay high amounts for improved solid waste management by 17.16 percent. This result is in line with the study conducted at Hawasa (Solomon Tarfasa and Roy Brouwer, 2018) which founds that value the abolishment of child labor more highly, as do higher income households. This suggests that positive relationship can also be the result of bequest value. The more children one has, the more bequest value he/she would expect, and hence the more the willingness to pay to make the city cleaner for the future generation. The result also revealed that occupation of the household had statistically significant effect on household's willingness to pay at 5% significant level. Similarly the study found that effect of respondents' perception of reasonably satisfied on current SWM are 39 percent less likely to pay high amount than the highly satisfied households on the current solid waste management service. These results were consistent with a study conducted in Injibara (Selamawit *et al*., 2019) and in Bharatpur Metropolitan City, Nepal (Rajesh et al., 2019).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

This study analyzes the households' determinate factors for solid waste generation and their WTP for improved solid waste management services in Dire Dawa city. The study used 385 sample household. To elicit households' WTP for improve SWM, the study used double bounded elicitation method with an open ended elicitation format of the contingent valuation method. Descriptive analysis, bivariate probit model and ordered probit models were used in this study.

5.1. Conclusion

The result indicated that 313 (81.3.27%) of sample households were willing to pay for improved solid waste services with the mean 23.3 ETB for open ended and double bounded CVM elicitation formats. Additionally, the result implies that the respondents' minimum average WTP is much higher than the current SWM service charge. The result also revealed that only 50 percent of the responded households are satisfied by the existed solid waste management service and 50 percent of the responded households are not satisfied by the existed solid waste management service. Most of the households quoted out the reason for the dissatisfaction by the existed service was not uniform time for the arrival of tractor to collect the waste.

The distribution of the double-bounded dichotomous choice response was analyzed using their willingness to pay for improved solid waste management practice versus their initial amount that a household is willing to pay for the service. The percentage of NO–NO response increases with the initial bid price that the respondents faced. The higher the price is; the lower acceptance by the respondent and the double-bounded dichotomous is in line with the law of demand theory. The result concludes that the presence of the first response had an effect on the response of the follow up higher bids question and is in line with the law of demand theory.

It also attempts to identify significant explanatory variables that are assumed to influence households' amount of WTP using ordered probit model. The result demonstrated that occupation of the household, family size of the household, government support, levels of satisfaction, frequency of collection solid wastes and awareness of households had statistically significant effect on households' WTP for solid waste management services. Government employed

households are more likely to willing to pay for improved solid waste management than unemployed households and households with their own business. The result concludes that family size had positive significant effect on willingness to pay. That means the more family size has in the household, the better to pay high amounts. In addition the result of the study concludes that levels of satisfaction had positive significant effect on willingness to pay for improved solid waste management service. It concludes that the highly satisfied households by the service of solid waste collection will have more likely to pay high amount. The more satisfied households will be the more willing to pay high amounts than the dissatisfied households in Dire Dawa.

5.2. Recommendations

Following the results from descriptive and econometric analysis, the following policy implications are forwarded as alternatives for the improved solid waste management.

- The result implies that most of the households are willing to pay for SWM service and the respondents' average WTP is much higher than the current SWM service charge. As a result, it is better to design and implement SWM service to collect more funds and deliver better service for Dire Dawa City dwellers.
- The policy makers should focus on sensitizing the public on their role in waste management. The right charging system should be established before rolling out any payment scheme for waste management services and to prevent free riding. Therefore, a need to involve households in setting the fees and the payment system to be used is paramount for the success of the scheme.
- There exists strong positive relationship between the family sizes, satisfaction, less frequency time of collection solid wastes, and awareness of current SWM and their willingness to pay for the improved SWM. Policy makers should consider these variables in designing improved SWM services in Dire Dawa city.
- The implications of the findings are that the municipality of Dire Dawa city should consider the significant variables like family size, employment status, government support, collection site and others to design and implement improved SWM services
- I recommend further studies should be conducted in a larger scope by considering qualitative aspects and identify other factors that are not identified in this study to gain further understanding on this subject.

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APPENDIX A

Results of Bivariate ordinal Probit regression models

Variable	Category	Coefficient	Std. Err.	z	P>|z|	[95% Conf. Interval]	
						Lower	Upper
Sex	Female	-.4577845	.12349	-3.71	0.000	-.6998205	-.2157485
Age	31 to 40 Years	.1939074	.1572814	1.23	0.218	-.1143584	.5021733
	Over 40 Years	.0172328	.1490583	0.12	0.908	-.274916	.3093817
Marital status of HH	Single	.2546553	.2533405	1.01	0.315	-.2418829	.7511936
	Divorced	-.4938233	.1477134	-3.34	0.001	-.7833363	-.2043104
	Widowed	-5.403215	141.9507	-0.04	0.970	-283.6214	272.815
Educational Background of HH	High school	4.014481	120.9822	0.03	0.974	-233.1062	241.1352
	Diploma	5.432474	120.9822	0.04	0.964	-231.6884	242.5533
	Degree and above	5.558904	120.9822	0.05	0.963	-231.5618	242.6796
Occupation of the HH	Privately employed	-1.990423	.278593	-7.14	0.000	-2.536455	-1.44439
	Own business	-.5220148	.1518039	-3.44	0.001	-.8195449	-.2244848
	Unemployed	-1.027034	.2186382	-4.70	0.000	-1.455557	-.5985108
Family Size of the HH		.1871148	.0369601	5.06	0.000	.1146744	.2595552
Average Monthly Income of HH		.00005	7.21e-06	6.94	0.000	.0000359	.0000642
Monthly Expenditure of HH		.0000635	8.33e-06	7.62	0.000	.0000471	.0000798
How long have you been	1 to 3 Years	4.149183	122.1678	0.03	0.973	-235.2953	243.5936
	3 to 5 Years	4.700052	122.1678	0.04	0.969	-234.7444	244.1445

staying in this house	Above 5 Years	4.985911	122.1677	0.04	0.967	-234.4584	244.4302
Household ownership status?	Rented Houses Agency	.1572128	.1520314	1.03	0.301	-.1407633	.4551889
	Rented from individual	-.2776234	.1740199	-1.60	0.111	-.6186962	.0634494
	Rented from kebele	1.175495	.2480795	4.74	0.000	.6892678	1.661722
SW generated by HH per day per KG		-.6960409	.0587449	11.85	0.000	.580903	.8111788
Separate the waste generated by type (Yes)		.8499971	.1512603	5.62	0.000	.5535324	1.146462
get SWM service from the Gov't (Yes)		-1.542507	.207396	-7.44	0.000	-1.948995	-1.136018
How many times do you get SWM services	Once within 10 days	-2.418004	.3227648	-7.49	0.000	-3.050611	-1.785397
	Once within 15 days	-1.530365	.3339062	-4.58	0.000	-2.184809	-.8759205
	No fixed time	-1.447512	.3179478	-4.55	0.000	-2.070678	-.824346
satisfaction on the SWMS	Reasonably satisfied	-1.555833	.3262897	-4.77	0.000	-2.195349	-.9163166
	Not satisfied	-1.828373	.3293931	-5.55	0.000	-2.473972	-1.182775
Awareness	Yes	1.648804	.2180781	7.56	0.000	1.221379	2.076229
environmentally safe SWM	Yes	1.603295	.2961831	5.41	0.000	1.022787	2.183803
	Do not Know	.0897859	.154504	0.58	0.561	-.2130364	.3926081
responsible to SWM	Households only	1.191638	.2857267	4.17	0.000	.6316235	1.751652
	Both	1.708278	.2440635	7.00	0.000	1.229923	2.186634
WTP	Yes	.7418352	.1754521	4.23	0.000	.3979554	1.085715

APPENDIX B: QUESTIONNAIRE

HOUSEHOLD QUESTIONNAIRE

This survey is being undertaken by a student of Dire Dawa University Faculty of Business and Economics in the Department of Economics as partial fulfillment for the award of MSC in Environmental and Natural Resource Economics. This questionnaire is designed to obtain information on the current situation of solid waste and households' willingness to pay for an improved solid waste management in Dire Dawa city.

The information collected will be confidential and for academic purpose only. Thus you are requested to participate in this discussion as truthfully as you can.

Name of the interviewer: _____

Date of Interview: _____

I. SOCIO-ECONOMIC BACKGROUND

1.1.Address Kebele:_____

1.2. What is the status of the respondent in the household? A. Head B. Household Member

1.3.Sex of the household head A. Male B. Female

1.4. Age of the household head

A. Under 20 Years Old C. 31 – 40 Years Old

B. 20 – 30 Years Old D. Over 40 Years Old

1.5.Marital status of Household head

A. Married B. Single C. Divorced D. widowed

1.6.The highest formal educational level achieved by household head _____ year

A. Illiterate B. primary school C. high school D. Diploma E. Degree and Above

1.7 The occupation of the household head

A. Government B. privately employed C. NGO
D. Own business E. Unemployed

1.8 Family size of the household (People currently leaving under the same roof)

Male |____ Female |____| Total |____|

1.9 What is the average monthly income of your household that can get?_____ Birr

1.10. Estimated total monthly Expenditures of the household _____ Birr

A. Housing_____
B. Food_____
C. Energy Consumption (Electricity, Diesel, Charcoal, Firewood, etc.,)_____
D. Phone_____
E. Education_____
F. Health_____
G. Other Expenses ('Eder', 'Ekube', etc.) _____

1.11. How long have you been staying in this house?

A. < 1 Year B. 1- 3 Years C. 3 – 5 Years D. Above 5 Years

1.12. Residential Status/ Household ownership status?

A. Privately Owned B. Rented from Rented Houses Agency

C. Rented from individual D. Rented from kebele

II. SOLID WASTE MANAGEMENT PRACTICES

2.1. Indicate the estimated amount of solid waste generated by the household by type

S.N	Type of solid waste	Amount per Kg per day
1	Plastic bag and plastic bottles	
2	Leftover food	
3	Broken glasses; small bottles of glass (like bottles of medicine	
4	Vegetable and fruit peel	
5	Pieces of papers	
6	Useless clothes	
7	Shoes and sandals	
8	Covers of biscuits, chocolates and noodles	
9	Dust collected while sweeping the house	
	Other	

	Total waste of the household hold in Kg per day	

2.2.Type of Storage material used for storing the solid waste until deposal

A. Durable metal container B. Durable plastic container C. Plastic bag

D. Basket or cartoon container E. Dumping waste before their houses to burn on the fire

F. Dump waste every day before their house and next day the sweepers take the waste,

using waste to make compost.

2.3.How much solid waste on average does your household generate within one week?_____ plastic bag (*madaberiya*)

2.4. Do you Separate the waste generated by type when you stored? A. yes B. No

2.5. If you do not separate and store the solid waste what is the reason? _____

2.6. If you separate the waste generated and how you separate_____ _____

2.7.Do you get waste management service from the government? A. yes B. No

2.8.Currently what type of solid waste disposal you are using?

A. Receiving solid waste collection services from government agencies
B. Emptying out on an open pile of solid waste on the neighborhood
C. Burning on the fire
D. Damping in river banks
E. Used to make compost
F. Private collectors take it
G. Other specify_____

2.9.If the answer is "F" for Qt No 2.7

A) How much do you pay for this service per month? _____

B) How many times they collect your waste per week? _____

C) Are you satisfied with their service? _____

2.10. How many times (frequency) do you get solid waste collection services most of the time?

A. Daily B. Once a week C. Once within 10 days

D. Once within 15 days E. There is no fixed time

2.11. Where is the solid waste collection site you mostly get?

A. Door to Door Service

B. Walking for 5-10 minutes to drop the waste

C. Walking for 11-20 minutes to drop the waste

D. Walking for more than 20 minutes to drop the waste

2.12. Is Solid waste management a serious problem in your locality? A. Yes B. No

2.13. Are you satisfied on the existing solid waste collection service?

A. Highly satisfied B. Reasonably satisfied C. Not satisfied

2.14. If you are not satisfied with the existing solid waste collection and disposal service provided by the municipal why? (More than one choice)

A. Not reliable

B. There was not uniform time for the arrival of tractor to collect the waste

C. Service was not frequent

D. Sometimes they go to get emptied the waste but the vehicle already goes out before they reach there;

E. Tractor puts so big amount of waste that while moving it waste falls on the road;

F. Sometimes sweepers collect the waste and put before the house but tractor does not come to collect the waste

G. The waste remains uncollected for some days on the road and smell badly

H. The price is high

2.15. What do you suggest to improve the existing solid waste and disposal services provided by the municipal?

_____

2.16. Do you have enough awareness on the solid waste management done in your locality?

A. Yes B. No

2.17. Do you know the final disposal site of the collected solid waste? _____

2.18. Is the present final disposal environmentally safe and acceptable? A. yes B. No C. Don't Know

2.19. Who do you think is responsible to properly manage solid waste (for instance financing it) in Dire Dawa?

A. The city government only B. Households only C. Both

2.20. Which of the following do you think is the best institute to handle solid waste management in Dire Dawa? A) The city government B) Private companies C. Public Private Partnership

2.21. What are your reasons for choosing the city government/private companies/PPP?

_____

2.22. What problems do you think, households face as a result of mishandling solid waste?

_____

2.23. Did some diseases related to poor solid waste management occur in past one year in your locality?

A. Yes list them _____

B. No

2.24. Did any of your family members suffered from (died of) any of the mentioned disease in the past one year? A. Yes B. No

III. HOUSEHOLDS' WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT

Assuming that in order to provide improved solid waste management by the municipality, involves collecting your solid waste by the house twice every week, transport the waste safely where it is going to be disposed-off and the disposal involves making quality compost from decomposable solid waste and manage indecomposable wastes separately by recycling those which can be recycled and the reset will be landfilled properly, human resource and number of vehicles should be increased, which incur cost. The municipality can finance the program by imposing a waste collection fee. Given this

3.1. Would your household be willing to pay per month for this improved solid waste management service?

A. YES, go to Question No(3.3) B. NO, go to Question No (3.2)

3.2. If NO to Question No (3.1) could you tell me the reason why your household does not willing to pay anything for improved solid waste management?

A. We are poor and we cannot afford to pay

B. We are satisfied with the current situation (it does not need improvement)

C. Proper management of solid waste is the responsibility of the government

D. Any other reasons(specify)_____

3.3. If YES to Question No (3.1) would your household be willing to pay **Birr 30** per month for improved services?

A. YES, go to Question No (3.4) B. NO, go to Question No(3.8)

3.4. If YES for Question No (3.3) would your household be willing to pay **Birr 60** per month for improved services?

A. YES B. No

3.5. What is the maximum amount per month are your household willing to pay for the improved service?_____ Birr

3.6. What is the main reason for your maximum willingness to pay**?**

A. I can afford more

B. It improves hygiene and sanitation of the city

C. I think it worth that amount

D. It has low cost than the cost to treat solid waste related diseases

E. Other reason (specify)_____

3.7. In what form should the fee be collected?

A. With water bill B. With electric bill
C. On its own D. Any Other (specify)_____

3.8. If NO for Question No (3.3) would your household be willing to pay **Birr 15** per month for improved solid waste management?

A. YES B. NO (go to Question No 3.9)

3.9. If NO for Question No (3.8) what is the minimum amount per month are your household willing to pay for improved services? _____ Birr.

THANK YOU FOR YOUR COOPERATION!!