ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
FACULTY OF BUSINESS AND ECONOMICS

HOUSEHOLD DEMAND FOR IMPROVED SANITATION SERVICES: A CONTINGENT VALUATION STUDY ON ADDIS ABABA, ETHIOPIA

BY Biruk Gezahegne
JULY 2003

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A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMEMNT FOR THE DEGREE OF MASTER OF SCINCE IN ECONOMIC POLICY ANALYSIS

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JULY 2003

ACKNOLWEDMENT

I would like to express my gratitude to my advisor, Dr. Assefa Admassie for his constructive criticisms and guidance. I also would like to thank employees of AAWSA (especially Ato Essey Takele) for their assistance. Finally, I would like to acknowledge my family and friends for their support and encouragement.

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List of Abbreviations

AAWSA- Addis Ababa Water and Sewerage Authority

CVM - contingent valuation Method

NGOs- Non-governmental organizations

WTP-willingness to pay

WTP1-willingness to pay for sewer system

WTP2-willingness to pay for improved sludge disposal

WTP3-willingness to pay for public toilets

ABSTRACT

As any developing country, lack of adequate infrastructure provision is an enormous problem in Ethiopia. When we see the case of Addis Ababa, the current coverage of sanitation service is very low. It is this very fact that has made the government of Ethiopia to extend a concerted effort to improve the condition. In doing so, the government has stated that, the policy for increasing the coverage as well as the proper use of any sustainability of the service requires implementation of a cost recovery system. But this requires information on people's preferences and WTP for the proposed improvement.

Therefore, the paper examined the determinants of willingness-to-pay for improved sanitation service and investigates the possibility of cost recovery policy directions using the contingent valuation method. For the three suggested improvements (WTP for sewer connection, WTP for improved sludge disposal and WTP for public toilets) a face-to-face personal interview using bidding game elicitation technique on 440 households was conducted. The Heckman two-step estimator used for the empirical analysis revealed that income, education, family size and age are factors, which consistently affect the decisions whether or not one is willing to pay and the willingness to pay amount for the three WTP scenarios. In matching demand and supply, for the two suggested improvements (WTP for sewer system and WTP for improved sludge disposal), the mean WTP showed that consumers are not able to pay for the improvement to attain full recovery basis. The paper has shown the need for integrated design criteria for the respective sanitation facilities to achieve improvement in the service.

Key Words: Willingness-to-pay, improved sanitation service, Heckman two-step estimator, contingent valuation method, Addis Ababa, Ethiopia

Chapter One
INTRODUCTION

1.1. Statement of the Problem

Ever since the issue of economic development has been lauded and ridiculed by economists and practitioners around the world, the role of infrastructure provision has been given a center stage. Economic infrastructure is one of the basic ingredients in fostering economic development and betterment of human welfare of every nation. Besides, it affects the quality of life for the population and potentials for both local and foreign investment.

Most of the developing countries have been making substantial amount of investments in infrastructure (i.e. transport, water supply, power supply, sanitation services, telecommunication and irrigation) with the effort to raise productivity and increase living standards. But still lack of adequate infrastructure provision stand out to be one of the main problems experienced by these nations and where available is characterized by inefficiency. According to Briscoe and Garn (1995), both the number and proportion of people in developing countries who have access to water and sanitation facilities have increased dramatically. But in comparison to what is being expended and expected, these achievements are not withstanding. An estimated 1 billion people do not have access to clean water and 1.7 billion do not have access to sanitation. An estimated 2 million children die and billions become sick each year because of inadequate water and sanitation facilities (UN, 1995).

Lack of attention to the needs of users coupled with low operating efficiency, inadequate maintenance are identified as the main reasons for the evidenced weak performance of infrastructure investment in economic development (World Bank, 1994).

With rapid urbanization in developing countries, the lack of proper infrastructure provision is an enormous problem and is certain to become much higher. Tackling this problem would require massive investment schemes to be carried out by governments. But, budgets of central governments in developing countries suffer from heavily burdened and stretched financial sources, and high opportunity cost for the available funds. Accordingly, potentials of public participation and contribution towards infrastructure and services provision are still to be recognized by developing countries governments (Abdarbo, 1996).

Sanitation upgrading and expansion has been one of the main priorities in the agenda of many developing countries. But sanitation planning for the cities has not kept with the implications of demographic and financial changes. This has led to large number of unplanned urban expansion, which lacked basic services and infrastructure, causing considerable deterioration in living conditions in urban centers.

The standard argument for the massive funds allotted for such services is that such state involvement has been on public health grounds, that the health benefits obtained from a clean, sanitary urban environment accrue to all the city's inhabitants, and thus costs of such a public service should be shared by all citizens. This assumes that some level of government has the revenue potential to finance such services, and that citizens in

aggregate are able and willing to pay the taxes and fees necessary to provide them (Whittington et al, 1992). But the experience has proved quiet the contrary. These nations neither have the capacity to provide such services nor are able to assess their people's willingness to pay for the provision of these services. Eventually, the recipients of these services are almost always the middle and upper income classes. The poor are left to find individual solutions to their sanitation needs.

Sanitation services in the metropolitan Addis Ababa, is no exception from what is evident in many developing countries. According to the 1994 census, approximately 63% of the households use private and shared latrines while some 475,000 (25%) people having no access to any kind of sanitation facility at all.

The overall picture seems very scary when one recognizes the fact that living standards in the capital city are deteriorating with time. Scenes of increasing numbers of street dwellers and beggars, rising unemployment and inflation are common (Abbi, 1997). This will create aesthetic dissatisfaction from having unsanitary environment. It will also weaken the city's ability to attract investment opportunities (especially foreign) being the capital city.

According to the Addis Ababa Health Bureau (2000), water and sanitation related diseases are responsible for much of the morbidity in hospitals.[1] Approximately 66,618 numbers of cases in the year 2000 were caused by lack of these services. This figure could even be much higher if cases are reported from informal health centers (traditional

[1] The bureau has reported that, food poisoning, epidemic Typhus Trachoma, Tope worm, Ascariasas Guinea worm, hood worm, Trichuriasis are diseases related to water and sanitation.

medicine houses) and wide spread practice of self-treatment. And if the use of improved sanitation facilities is guaranteed with a safe method of excreta disposal and adequate hygiene there could be significant reduction in diseases.

It is in light of all these pertinent problems that the Addis Ababa Water and Sewerage Authority is undertaking various projects to improve the existing poor sanitation condition. In fact, it is part of the new master plan due to be finalized in the year 2003. According to the master plan, the authority has secured a grant from the European Union worth 83.5 million Euro for five years. However, it has been mentioned that it is not enough to alleviate the problem "…Therefore broadening the revenue base of the city, improving the city governments access to loans, adoption of cost recovery mechanisms, identification of projects for donor funding and enhancement of public private partnership are the strategies to be pursued…" (AAWSA: 2002, pp.8).

Though it has come to the recognition of the government that policy and planning should be established on the basis of a better understanding of what improvement in the sanitation service people need and willing to pay for, the current practice and the new master plan does not seem to sufficiently incorporate the effective demand of the majority of households in the city. Thus, this study will bridge the gap in information on household demand for improved sanitation.

In comparison to the intensity of the problem, it can be said that the issue is left untouched. Though some attempt should be credited to a consultant firm, Ernst and young, a real integrated work to estimate household demand for improved sanitation

service is still missing. So, this study will try to identify the determinants and willingness-to-pay for improved sanitation services of households in Addis Ababa, the result of which could have far reaching implications in designing appropriate policy environment for a better sanitation service in the city.

1.2. Objectives of the Study

The aim of this study is to estimate households' willingness to pay for improved sanitation services.

The specific objectives are to:

- Examine if households are willing to pay for improved sanitation services and identify the determinants;
- Establish suitability of the contingent valuation method to estimate household demand for such service in a developing country like Ethiopia;
- Estimate aggregate benefit that can be gained from the improved services;
- Evaluate the existing government policy on sanitation supply and investigate the possibility and extent of cost recovery policy options.

1.3. Scope of the Study

Due to the limited fund available and time constraint, the survey was conducted in the city of Addis Ababa covering some 440 households. The rationale for selecting this area is because it is one of the urban centers in the country with immense sanitation problems. There is also a growing demand for this service as the growth (expansion) of the city is

proceeding at an astonishing rate. The study will only be limited to obtain demand side estimates of improved sanitation service for domestic purposes for a cross-section of households at a given time.

1.4. Limitations of the Study

The study is hampered by two unavoidable constraints and acknowledges the following problems as a result. For a city populated with over half a million households, 440 sample households is too small. The other is the absence of published information stratifying households in Addis according to income groups has seriously debilitated the accuracy and speed of the survey. However, the aforementioned problems were not left to lessen the degree of acceptance of the paper to implicate policy issues. Rather previous studies were reviewed on how they handle these problems and were also adopted since they were found suitable.

Chapter Two

LITERATURE REVIEW

2.1. Theoretical Review

The role of infrastructure in economic development is the subject of many economic discussions. There are a number of suggestions on the role of infrastructure in economic development. Though theory doesn't flourish to furnish us with a complete guide as to the relationship between infrastructure and economic development, according to the World Bank (1994) report, the evidence indicates that there is high correlation between infrastructure capacity and aggregate output. It has been seen in the past that those countries that have tremendous infrastructure capacity have been scoring quiet rapid economic growth. Countries with high stock of infrastructure per capita (such as Japan and Norway) tended to be found on the high end of the GDP per capita scale. Similarly, countries with lower GDP per capita (like Chad and Mali) registered correspondingly lower infrastructure stock per capita.

As part of economic infrastructure, sanitation service is one element of the public utilities developing countries are striving to expand. The huge literature on CVM has focused on discussing methods of measuring environmental amenities while their further implications on economic development are implicit. So in this section the methods and rationale of methods of non-marketed goods are discussed with a special focus on the contingent valuation method. Also a number of empirical literatures, which used the contingent valuation method, are also reviewed.

2.1.1. Economic Valuation of Non-marketed Goods: The Rationale

It has been decades since the field of economics is immersed in the concept of value. The synthesis could date back to the founding fathers Adam Smith and David Ricardo but the theories are still far from being complete. The task of valuing resources is very demanding as its importance lies in the very notion of the discipline, allocation of scarce resources in an optimal way. But this needs, as it has come to consensus, an efficient system where prices are set through the market mechanism. There are conditions to suffice that economic resources (i.e. goods and services) should be responsive to market forces. If not, one shall not take the market system for granted.

Environmental resources are classic examples where market regulation is often decentralized. This is because of externalities, their public goods characteristics of non-excludability and non-depletability, and other factors. This is when government intrusion is inevitable to supplement the market forces and correct the deficiencies through its policies.

Public policy decision-making often involves balancing the costs of a policy with the benefits (R.J Kopp in Mitchell and Carson, 1993) .The effects are also visible from consumers' response to changes in prices and incomes. But this works only when goods and services are traded in a normal market. Everything will take on a different toe when we talk about policy effect on goods such as water, sanitation, national parks and numerous other environmental and natural resources. Freeman (1979) noted that a number of current environmental and resource policy issues involved in one way or another questions of economic values and trade offs. But how can one render policy

recommendations when its effects are not observed in price and income. It is evident that information should be inferred based on changes in consumer behavior on the values of non-marketed goods.

It is neo classical economics, which laid the foundations. In this school of economics we find assumptions like people have well defined preferences among bundles of goods and also know their preferences to include valuations of public goods and other non-marketed services such as environmental quality and health.

This relentless effort by economists has brought forth various methods to value non-marketed goods. According to Mitchell and Carson (1993), classification of methods for estimating values is based on two characteristics of the methods. The first characteristic is whether the data come from observations of people acting in real world settings where people live with the consequences of their choices; or come from people's responses to hypothetical questions of the form "what would you do if…" "Would you be willing to pay…?". The second characteristic is whether the method yields monetary values directly or whether values must be inferred through some indirect technique based on a model of individual behavior and choice.

Thus we have two popular ways (methods) of valuing non-marketed goods: indirect and direct approaches.

2.1.2. Indirect Methods of Valuation

In this category, basically one tries to infer the implicit values for public goods (non-marketed goods) from the values (prices) a person attaches for other marketed goods. The characteristics revealed to other surrogate markets are evidence for calculating the value of the non-marketed good under question. The two best-known methods are the travel cost method (TCM) and the hedonic pricing model (HPM).

Travel Cost Method (TCM)

In this method, typically, one tries to infer the value people place on outdoor recreational site through their expenditure on travel to the site. It is one of the oldest approaches to environmental valuation. In this approach a statistical relationship between observed visits and the cost of visiting is derived and used as a surrogate demand curve from which consumers' surplus per-visit can be measured.

Ableson (1996) showed that the method depends critically on accurate measure of travel costs based on individual perceptions of marginal travel costs, because it is these perceptions that influence behavior. The method has got several limitations including substantial data requirements and very limited applications. Even in the valuation of natural amenities, for which it is most appropriate, it does not provide estimates of existence values. In relation to this study its application is very limited.

Hedonic Pricing Method

First applied by Ridker and Henning (1967), the method identifies environmental service flows as an element of characteristics describing a marketed good, typically housing. One or more of these characteristics may be environmental. Many Hedonic prices are

concerned with air quality impacts on house prices. Garrod and Willis in Hanley (1997) consider also the effects of proximity to woodland.

For our particular purpose it may be possible to see the effect of sanitation as one variable in house price. But the main challenge of applying this method is the absence of competitive market for houses in developing countries. Besides, the model is accused of omitted variable bias, multicollinearity between some environmental variables and problems associated with choice of functional form.

2.1.3. Direct Method

Unlike the previous sections, in this part households' (peoples') direct preference is analyzed to value the good in question. The most common method is the contingent valuation method (CVM).

2.1.3.1. Contingent Valuation Method (CVM)-Theoretical Basis

The contingent valuation method enables economic values to be estimated for a wide range of commodities, which are not marketable. Ever since it was originally proposed by Davis (1963), it has gone through a great deal of theoretical and empirical refinements. Even now, there are debates inside and outside the field of economics around this method.

The essence of the method is to directly solicit sample consumers' valuation for a change in the level of environmental service flow, in a carefully structured hypothetical market. The traditional consumer surplus, which is the area underneath the Marshallian demand

curve, is impractical in such instances. This is because in almost all cases, environmental goods are found to be unpriced. Thus to come about a correct measurement for welfare change we have to compensate the income effect by holding the real income constant. This will give us what is called the Hicksian (compensated) demand curve.

The final aim of the contingent valuation method is to measure the compensating or equivalent surplus for the good in question. Asking individuals' willingness to pay and willingness to accept can derive both compensating and equivalent surplus.

Willingness to pay (WTP) is the amount that must be taken away from the person's income while keeping his utility constant:

$$\mathbf{V\ (y\text{-}WTP,\ P,\ q_1;\ Z) = V\ (y,\ P,\ q_0;\ Z)}$$

Where V denotes the indirect utility function, Y is income, P is vector of prices faced by the individual, Z is other socio-economic characteristics, and q_0 and q_1 are the alternative levels of the good or quality indexes (with $q_1 > q_0$, indicating that q_1 refers to improved environmental quality).

In the same manner, Willingness-to-accept (WTA) for a good is defined as the amount of money that must be given to an individual experiencing deterioration in environmental quality to keep his utility constant:

$$\mathbf{V\ (y+WTA,\ P,\ q_0;\ Z) = V\ (y,\ P,\ q_1;\ Z)}$$

Compensating variation (CV) asks what payment (that is, an offsetting change in income) is necessary to make the individual indifferent between the original situation and the change. For compensating surplus there is restriction in quantity. Equivalent variation

(EV) measure asks what change in income (given the original prices) would lead to the same utility change as the change in the price of the good. For equivalent surplus there is restriction in quantity

Thus in this framework we can have four welfare measures. When there is welfare gain, CV shows individuals willingness to pay to enforce the change while EV shows willingness to accept compensation if the given change is not going to happen. The reverse is the case for welfare loss.

We have to take note that instead of EV and CV, ES and CS are more relevant welfare measures since environmental goods in almost all cases are limited in quantity and consumers cannot adjust quantities. The following table clearly shows, how CVM and welfare measures are related.

Table 2.1 Welfare Change Measures and the CVM: A Summary

Proposed Change	Measure	Continuous Consumption Function	Non-continuous Consumption Function
Welfare gain	WTP to ensure that change occurs	CV_{WTP}	CpS_{WTP}
Welfare gain	WTA if gain does not occur	EV_{WTA}	ES_{WTA}
Welfare loss	WTA to avoid loss occurring	EV_{WTP}	ES_{WTP}
Welfare loss	WTA if loss does occur	CV_{WTA}	CpS_{WTA}

Source: Bateman and Turner (1997), Valuation of Environment, Methods and Technique: The Contingent Valuation Method

Theoretically, the two measures (WTP and WTA) should approximately be equal. Willig (1976) argued that the difference depend on the income elasticity of demand for the good in question and consumer surplus (CS) as a percentage of income. In most realistic cases, he noted that the difference appears trivial (i.e. a maximum of 2% difference).Thus he

suggested the use of consumer surplus as an approximation of the compensating variation or equivalent variation because the three measures are almost equal. However, a number of empirical studies have found that WTA is often much larger than WTP for the same commodity. In fact, the evidenced divergence could go over 40% in the case of environmental goods. Hanemann (1986) in Hanley (1997) refined Willig's work to justify why this was the case. He showed that if we account for the elasticity of substitution between the commodity to be valued and private substitutes, the accompanied divergence in CV studies is easy to explain for the case of environmental goods. Mitchell and Carson (1989) also expanded Hanemann's intuition.

The observed asymmetry, though seems a methodological glitch of the CV method, economists have successfully showed that it rather does rest on theoretical basis. One should thus expect such incidents when evaluating environmental goods, which are in some significant way unique, irreplaceable or lacking substitutability (Bateman and Turner, 1997).

So if the two measures by and large produce results, which are significantly divergent, then which one is the most appropriate measure of welfare? Mitchell and Carson's (1993) observation was that, WTA formats have resulted in flawed outputs ultimately affecting policy decisions negatively. Bateman and Turner (1997) stated that recognizing the strong theoretical backing for the empirical use of WTP scenarios to evaluate welfare changes, the use of WTA formats should be abandoned.

According to Hanley (1997), a CVM exercise can be split into five stages. (1) Setting up the hypothetical market, (2) obtaining bids, (3) estimating mean WTP and /or WTAC, (4) estimating bid curves, and (5) aggregating data. In the second stage we have several ways to administer a survey once the survey instrument is set up. Telephone interviewing, mail shot, and face-to-face interviewing are ways in which it can be done. Survey through the mail is the least preferred due to the high rate of non-response while face-to-face interview offers the most scope for detailed questions and answers. In this step a number of elicitation techniques are observed:

- Open-ended: Individuals may be asked to state their maximum willingness to pay with no value being suggested to them. As much as it's appealing nature that it gives a point estimate of respondents' WTP, this method is relatively abandoned nowadays for the fact that respondents often find it difficult to pick a certain value.
- Bidding game: This is the oldest and most widely used elicitation method in the 80s (Mitchell and Carson, 1993). Like most actual transactions (especially in developing countries), in this method, individuals bid amounts based on initial amounts until their maximum willingness to pay is reached.
- Payment card: Individuals are presented a card which lists a number of possible WTP values and asks the respondent to pick an amount that best represents his WTP.
- Closed ended: Individuals give a yes or no reply to a single price payment /referendum suggested

2.1.3.2 Challenges of the Contingent Valuation Method

The contingent valuation method involves directly asking people, in a survey, how much they would be willing to pay for specific environmental service. As this has been the strong hold of the method, ironically, the weaknesses also emanate from this point. The very fact that the method is based on a hypothetical scenario rather than actual behavior is the source of enormous controversy. Many economists as well as non-economists very much doubt that the value estimates that result from CV are valid.

The major area of criticism on CVM is since individuals are being given a hypothetical market their responses could be far from reality. Thus there will be biases, which systematically understate or overstate true values. There are a number of types of biases indicated in the literature, but the major ones are:

Strategic bias: arises when an individual consciously attempts to influence either his/her payment obligation or provision of the environmental good through his/her stated valuations.

Information bias: this occurs whenever respondents are forced to reflect their valuation to attributes with which they have little or no experience. In such cases, the amount and type of information presented to respondents may affect their answers.

Starting point bias: results when respondents' final bid is affected by the starting value suggested to them in the beginning.

Though these criticisms have cumulated through these periods, researchers haven't disregarded the method completely. Instead, it aroused their curiosity and suspicion to make several attempts where by these errors could be minimized to an acceptable level. The literature testifies that they are successful in this regard. Mitchell and Carson (1993) suggest that if we remove all outliers, stress that payment by others is guaranteed and make the environmental change dependent on the bid we will be able to minimize strategic bias. Besides by making respondents feel that the hypothetical market is realistic and credible, choose a payment vehicle that is not controversial; and avoid WTA formats (due to the limitations mentioned earlier) then we can remove information bias.

In an overall assessment, the evidenced literature reveals that CV is the most widely accepted method for estimating total economic value (use and non-use). In addition, the contingent valuation method is enormously flexible in that it can be used to estimate the economic value of virtually anything. These all, coupled with the great deal of research to improve the validity and reliability of the method has made it the most widely used valuation technique of all in the past two decades and at present.

2.2. Empirical Review

2.2.1. CVM Studies on Improved Sanitation

Whittington et al (1992) used the contingent valuation method to assess the willingness-to-pay for an improvement in the quality of sanitation service in Kumasi, Ghana. Respondents were allowed to consider hypothetical changes in sanitation services for four kinds of alternative modes of sanitary services. i.e. for the provision of a water closet (WC) and piped sewerage system or for a ventilated pit latrine which does not require piped sewerage.

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Households were selected using a two-stage stratified procedure, giving a sample of 1633 households. Usable interviews were completed for 1542 households. The researchers employed three kinds of multivariate analysis (i.e. OLS, Stewart maximum likelihood, ordered probit) by designing corresponding questionnaire formats. Housing characteristics, socio-economic conditions and the questionnaire design were the major variables included as determinants of households' WTP for the improved service. The findings from the study confirmed the hypothesis that high-income households are more willing to pay for improved sanitation supplies. Educational level also was found to have a positive relationship with WTP while gender and religion factors were found to be insignificant in influencing WTP for improved sanitation services.

The paper tried to envisage an interesting point by altering the conditions under which respondents were to make decisions about their WTP figures. The result showed that no systematic effects were associated with more or less time to think. The researchers also checked whether the presence of other household members altered peoples WTP, but

found no evidence of bias induced by the presence of other people present at the interview.

The conclusions were a subsidy of 60 million would be required for the provision of water closet but only 4 million if the ventilated pit latrine were provided. Therefore a strong balance of advantage for ventilated pit latrine was found. The authors pointed that the respondents' valuation could have increased if they were aware of the public health externalities of improved sanitation.

Abdarbo (1996) employed a CVM to examine households Willingness to pay for sewerage provision in Agami district, Alexandria. The principal hypothesis of the research work was that people would be willing to participate, financially, in development activities, which would directly benefit them. A total of 545 in person interviews were completed where 211 were open-ended questions while the rest (334) used payment card.

Accordingly, the results showed that all respondents were quiet aware of the absence of sanitary sewerage problems and its impacts and expressed their willingness to contribute towards the construction of a sanitary network for the area. The use of open-ended and payment card provided different results concerning the factors influencing WTP bids. Yet it was found that the average WTP bids obtained from both approaches were not significantly different.

Altaf et al (1994) measured the demand for improved urban sanitation services in Ouagadougou, Burkinafaso.Using a simplified two-stage stratified sampling technique 605 interviews were completed. Econometric formulation utilized the ordered probit model and found out that respondents were generally dissatisfied about available sanitation services. They concluded that although almost all households have a positive WTP for off-site sanitation, from financial point of view it is not feasible. However, on-site sanitation appears to be feasible.

Mani et al (1997) estimated WTP for sanitation and water in Ahmedabad and Bangalore, India. The authors employed the bidding – game format to elicit individuals WTP for the corresponding services. In this paper, they tried to explore whether WTP is affected by the long history of subsidy of the piped networks, and the alternatives used to augment or substitute piped supply in India's million plus cities.

Willingness to pay for sewerage closely followed the WTP for water. However, they found that, sewerage is not considered as essential as water supply and WTP for this service is lower. And remarked that, though the issue of increasing monthly charges for sewerage and water supply stand out to be contentious issue, sewerage charges should continue to be part of the water charges as lower WTP is expressed for the service.

Choe, Whittington and Lauria (1996) applied contingent valuation method to estimate benefits of sanitation and improvement in surface water quality in Davao, Philippines. From a two stage stratified sampling 1200 households were drawn. Respondents were being asked a single payment price followed by a final open-ended question to get their

maximum willingness to pay. Interval data estimation based on maximum likelihood was fitted with a further split-sample experimental investigation. The result revealed that WTP for improved sanitation and surface water quality was found to be rather low (both in absolute terms and as a percentage of income). This suggests that environmental quality is not a high priority for the residents of Davao.

2.2.2. CVM on Related Resources

Outdoor recreations, improvement of national water quality and air pollution are areas where contingent valuation surveys are repeatedly applied. White and Lovett (1999) applied CV method to assess public preferences and willingness to pay for nature conservation in the North York moors national park, UK. The results indicate that most visitors to the park would be willing to provide additional revenue to maintain and enhance the parks nature conservation. A study was conducted by, Hadker (1997), to survey the residents of Bombay and elicit their WTP for the preservation of Borivil national park (BNP), India. Despite India being a developing country with medium to low income levels, the evidence suggested that people are willing to pay for preserving environmental amenities. Besides, acknowledging the fact that CV is susceptible to biases, indeed it is possible to improve the quality of CV results for the purpose of realistic decision-making.

Alberini et al (1997) investigated valuing health effects of air pollution in Taiwan. The authors found that WTP increased with the duration of the illness, education and income. An almost similar kind of analysis was also undertaken by Chestnut et al (1998), in Bangkok.

Singh et al (1993) used CVM to study WTP for rural water supply in Kerala, India, in a quest to emerge from a low-level equilibrium trap. Their findings revealed that people have low WTP to connect to the piped water system since it is not reliable and the revenue is insufficient to cover improvements in the system. Whittington et al (1990) conducted CV survey to estimate WTP for water services in southern Haiti.WTP was found to be positively related to household income, occupation index, education and distance to alternate sources. This suggests that WTP does depend – as economic theory suggests- on the opportunity cost of alternative sources of water.

A number of CVM applications were also conveyed in Africa. Whittington (1991) studied water vending and willingness to pay for water in Ontisha, Nigeria. Based on their findings, the authors conclude that WTP for improved water consumption is high in Onitsha, and that households can afford to pay for the full economic cost of connecting, which in turn generates revenue sufficient to cover the costs. In their investigation, contrary to the findings in sanitation (presented in the previous section), WTP is lower in the group of respondents who were given time to think. This is in sharp contrast with the predictions of the theoretical result by Hoehn and Randall (1987) that WTP is non-decreasing in time. Navrud and Mungatana (1994) assessed recreation value of wildlife viewing around lake Nakuru National park, Kenya. The study used a random sample of park visitors, one –third of whom were residents and two – thirds of whom were foreign visitors. Both WTP and travel cost estimates were calculated separately. The conclusion was consistent with the large body of literature in developing countries, showing that CV

produces values similar to those obtained by the TC method or other approaches based on actual behavior.

2.2.3. Studies in Ethiopia

Fisseha (1997) estimated WTP for water on Meki town. Based on 264 households who were randomly selected, he found that substantial numbers of respondents are willing to pay a higher tariff if provided with an improved system. Assefa (1998) and Genanew (1999) tried to see the determinants and willingness to pay for improved water services in Addis Ababa and Harar town respectively. Their findings showed that WTP is significantly affected by income, education level, and attributes of the existing water supply system. They concluded that contingent valuation surveys could provide policy relevant information on the level and type of improved services required by households and how they should be paid for.

Dunfa (1998) also estimated willingness to pay for rural water supply by taking the case of Ada'-Liben district, central Ethiopia. Based on a cross section data collected on 228 households, his conclusion was similar to other studies in Ethiopia. That rural households are willing to pay for improved rural water at an affordable price. And implied that to sustain the service and save resources it is inevitable to put a price on safe water.

Terefe (2000) adopted the CV method and the travel cost models to estimate benefits from establishment of park around Tis Abay waterfalls. Using multiple linear regression, probit and Tobit models, the CV responses were analyzed. The results revealed that, for the visitors' benefits, the CV produced higher estimates than the TC estimates. The

author argued that since CV estimates consider also the non- use value of the commodity to be valued and TC estimates do not, the results obtained are in agreement with the theoretical underpinnings of the models. The finding showed that successfully conducted CVM and TCM surveys would give useful information on user demand for public services such as recreation.

Shimelis (1997) examined the application of the CV method for evaluating the opportunity cost of deforestation in Ethiopia. The result indicated that households' WTP for forest conservation is directly related to their income level. The income elasticity of WTP also showed forest conservation to be a "necessary" environmental good in the area. In addition, the finding of the study suggests that CV survey can actually measure values that are theoretically consistent and sufficiently reliable and valid to use in benefit-cost analysis.

Essey (2000) applied CV to estimate the benefits of reduced air pollution in Wonji town and identify the determinants. Using a sample survey of three hundred thirty two households and econometric investigation, the study revealed that most people are aware of emission problems and are willing to pay for its reduction. The benefits could help finance measures, which could reduce the pollution level.

Aklilu (2002) studied whether households are willing to pay for improved solid waste management taking the case of Addis Ababa. Using two-stage stratified sampling, a total of 430 households were interviewed. Econometric models are fitted to identify factors determining the willingness to pay and factors that determine it. For this purpose the

researcher used both the Tobit and probit models to analyze the data obtained from a closed-ended with open-ended follow-up questions.

The survey result showed that a great deal of the population is overwhelmingly dissatisfied with the existing service. They feel that households have to cooperate (including in financing) with the government to improve this condition.

Table 2.2 Summary of Some CVM Studies in Ethiopia

Name	Year	Commodity Valued	Location of the Study	Number of Obser-vations	Elicitation Method	Econometric Modeling
Genanew	1999	Improved water	Harar Town	270	Bidding-game	OLS;Ordered probit
Fisseha	1997	Willingness to pay for water	Meki Town	264	Bidding-game	Ordered probit
Assefa	1998	Improved water	Addis Ababa	217	Bidding-game	OLS;Ordered Probit
Shemelis	1997	Economic loss of deforestation	Wolmera Woreda	310	Open-ended; Bidding-game	OLS; Multivariate analysis
Terefe	2000	Economic value of a recreation site	Tis Abay water falls	300	Open-ended; dichotomous	OLS; Tobit; Probit
Essey	2000	Improved air quality	Wonji Town	300	Biding-game	Tobit;Ordered Probit
Aklilu	2002	Solid waste management	Addis Ababa	430	Dichotomous with open ended follow-up	Probit; Tobit

Source: own compilation

General Comment

CVM is a survey-based technique of valuing non-marketed goods. It has been widely used to estimate economic values for all kinds of ecosystem and environmental services

in both developed and developing countries. However, it has been under a lot of criticism due to the possible biases that could emanate from its nature (i.e. that it derives values based on a hypothetical scenario). The literature presented showed that on both grounds (theoretical and empirical) the method has resulted in plausible and valid results, which can directly be imputed to policy decisions. Especially in developing countries the need is more pressing. As Whittington (1998) stated, CVM techniques are very much feasible and desirable in developing countries due to the low cost of obtaining the benefit information and the large marginal value of additional information. Thus it is all these realities that necessitate the use of CVM in this study.

Chapter Three
METHODOLOGY

3.1. Data Source and Type

The study mostly relies on primary cross-sectional data that is obtained from a contingent valuation survey. Using stratified sampling from three income groups (low, middle and high), 440 face-to-face personal interview using CV questionnaire were conducted, out of which 434 of them were found usable. The bidding game format was applied for the elicitation part, as it is the most widely used elicitation method in Ethiopia and other developing countries. Besides, the fact that market transactions in Ethiopia quiet resemble the aforementioned format, households will easily be able to state their true willingness to pay amount for the proposed sanitation improvement. Thus using bidding game elicitation format has the advantage of giving better information on households' maximum willingness to pay. The study has also used secondary data from the Addis Ababa Water and Sewerage Authority, Addis Ababa Health Bureau and other relevant organizations /bureaus.

3.2. Sample Design[1]

[1] This part heavily draws on the sample design followed by Aklilu (2002) for his M. Sc thesis on "Solid waste management in Addis Ababa: a contingent valuation study".

The sample for the study was drawn from-areas covering the new administrative rearrangement made by the government. As the first concern was to ensure sample representativeness of the population, the strategy adopted for the study was to stratify households by income categories. But this was very difficult since there is no published material available from relevant government organizations. So we search for previous studies, which are largely unpublished but managed to accomplish a similar task. What is there to our avail is Aberas' (1997) work. He used house ownership as a major criterion to determine whether a certain kebele belonged to high, middle or low-income category. In his undertaking kebeles with the highest privately owned houses are classified as high-income kebeles and those kebeles with relatively less of these attributes as middle-income kebeles. Kebeles with the majority of the houses owned by the kebele are treated as low-income. Moreover, he tried to substantiate the above classification by looking at the concentration of public agencies and the availability of infrastructure in the aforementioned categories.

Based on these six kebeles from low-income, four kebeles from middle income and three kebeles from high-income were randomly selected. Then households were randomly selected from each drawn kebeles by picking the house numbers from the lists obtained from the respective kebele offices. And the total number of households from each group was based on CSA (1996) report on household income, consumption and expenditure, where 32.9 %(less than 3399 birr/annum) of households in Addis Ababa belong to low-income group. While 49.9 %(3400-12,599 birr/annum) belong to the middle-income category and 17.2 %(greater than 12,599 birr/annum) are high-income households.

3.3. Questionnaire Design and Administration

The CV survey questionnaire was developed in accordance with Mitchell and Carson's techniques, basically consisting four main sections:

- Household characteristics and income
- Existing sanitation practices
- Willingness-to-pay questions
- Attitude towards administration of sanitation services

Upon drafting the English version, the most difficult part was to categorize the respective sanitation technology and formulate the willingness-to-pay questions. Based on AAWSA data three sanitation facilities (flush toilet, pit latrine, and public toilet) were selected, which were believed to represent the sanitation facilities available in the city (A.A).

After thorough discussions with experts from Water and Sewerage Authority who have participated in designing the master plan, the hypothetical scenarios for the three sanitary facilities were formulated. This was very helpful in making the Willingness- to-pay elicitation part very realistic. In fact, most of the ideas reflected in the questionnaire are those ideas proposed by the office to improve the existing sanitation service. For households currently with flush toilets, the willingness-to-pay elicitation was whether they would be willing or not to pay for the improved system (i.e. sewer connection) and the maximum amount to connect to a sewer system. The mode of payment proposed was a monthly sewerage payment, which will be presented with the monthly water bill. And for households with pit latrine, the next best improvement proposed was the maximum willingness-to-pay if the government comes up with a better sludge disposal system

where more cars will provide fast and reliable services than the current one. Since in this system, the service is needed when the tank is full, the mode of payment proposed was payment per trip. And households were further inquired to state the frequency by which they empty their tank.

A number of households were found to use rivers, road side, back yard, and even some disgusting methods of excreta disposal around "Atobis Tera" where they defecate in the house on a plastic material and dump it in the street early in the morning or late at night. All these were asked their willingness-to-pay if a public toilet is constructed and opened for service.

Before going to the fieldwork we meticously translated the questionnaire in to Amharic, then four interviewers and one-supervisor were employed based on their educational qualification and their previous work experience. Two were college graduates and all have previous experiences in both urban and rural surveys. Before going to pre-testing the questionnaire, a day and half long training was conducted. Areas that were thought to lead to misspecification biases by the interviewer were heavily discussed.

A pilot study was made for three consecutive days. From the three income clusters 56 respondents were interviewed. In this phase all four interviewers, the supervisor and the researcher himself have participated. The pre-test has a paramount significance in making appropriate modifications in the content of the questionnaire. In addition, the main purpose of the pilot survey was to set the starting price of the bidding game in the elicitation part of the questionnaire. During the pilot survey, the willingness to pay part

was open ended. Majority of the respondents revealed that they currently use pit latrine (26 respondents) and 13 respondents use flush toilet while the rest 17 respondents have no in-house facility. Of the observed different answers, we took the first quartile, median (second quartile), and third quartile as starting points of the willingness-to-pay bidding game.

The observed prices in quartiles (1^{st} , 2^{nd} (median), 3^{rd}) for the corresponding sanitary facilities were:

Sanitary facility	1st quartile	2nd quartile	3rd quartile
Flush toilet (per month)	4 birr	10 birr	15 birr
Pit latrine (per trip)	30 birr	60 birr	100 birr
Public toilet (per year)	10 birr	20 birr	50 birr

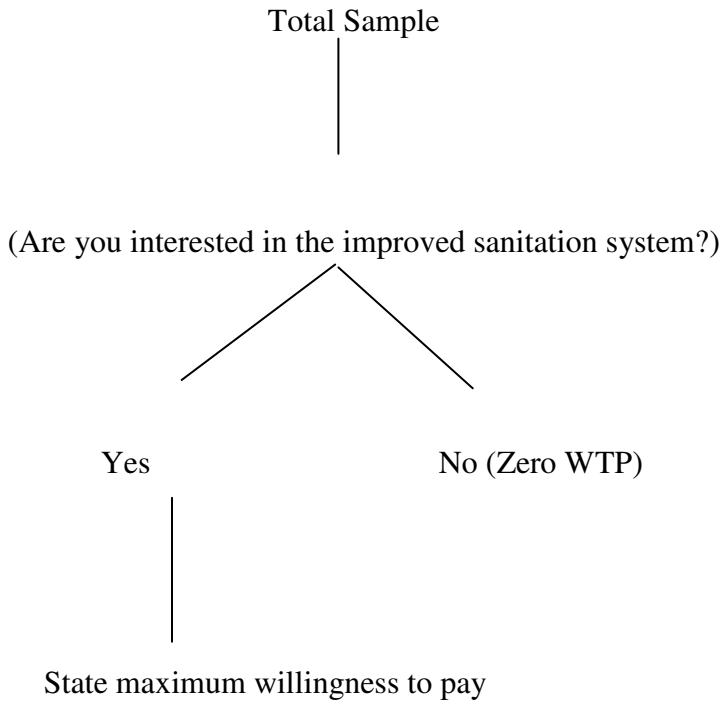
After carefully observing the trend of the data obtained from the pilot study, a quarter of the starting price was made to increase or decrease (it was a rough quarter interval) uniformly for all the given sanitation technologies. This was again tested for a full day whether it was shocking for the respondents in the three clusters. It was found to be reasonable and not shocking. Then the questionnaire was finalized with only a few modifications in the other parts.

The three starting points were randomly distributed on equal basis and all questionnaires were checked on a day-to-day basis. Those respondents who have been interviewed in the

pilot survey were not included in the final work; the data was coded and prepared for analyses using SPSS statistical software.

3.4. Model Specification

In this study, the respondent is asked at first whether he/she is interested in the suggested improvement or not. This is going to be analyzed with binomial probit model. The next inquiry is if the person is interested in the improvement, then what is the maximum amount that he/she will be willing to pay.



But a problem arises if the two decisions are correlated (i.e. the decision that the person is interested in the system and the maximum amount he/she is willing to pay), separate estimation leads to inconsistent estimates. For example, if the OLS estimation is done to see the factors affecting maximum amount the person is willing to pay, using only those

households who are interested in the improved sanitation system, the result will be inconsistent. This is because selection was made at first in which households who are not interested are taken out in the process. According to Greene (1993), not accounting for the selectivity bias will lead to specification error of an omitted variable. Heckman (1979) suggested a two-stage estimation, which takes care of the problem of selectivity bias. Amemiya (1985) suggested that the Heckman proposition could also be used in the standard Tobit model because all the basic features of the model can be revealed in this model.

In the basic procedure of the Heckman model, two estimations are conveyed. One is a qualitative choice model (probit in our case), which addresses individual preferences between the old and the anticipated new system. This probit analysis yields the marginal effects of the independent variables on the dependent variable directly, which provide clear image of the significant effects of the explanatory variables on the dependent variable. To analyze the factors, which determine the amount a person is willing to pay once he is interested in the improved system OLS estimation is conveyed.

According to Greene (1993), Heckman's two-step estimation procedure is as follows:

1. Estimate the probit equation (equation 1) by maximum likelihood to obtain estimates of Z_i and compute the selectivity term (λ) from these probabilities.

2. Estimate β by least squares regression of WTP on X andλ.

Accordingly, the following two-equation model can be satisfied as:

$$\mathbf{PROBWTP_i = \alpha' Z_i + n_i \text{ - - - - - - - - - - - (1)}}$$

$$\mathbf{WTP_i = \beta' X_i + \varepsilon_i} \text{ - - - - - - - -- - --- - - (2)}$$

Where:

$PROBWTP_i$ = dependent variable of the selection model; not observed but represents the probability of a household to be interested in the improved system

α'= a 1 x K vector of parameters of equation (1)

$\mathbf{Z_i}$ = a 1 x K vector of explanatory variables (shown in section 3.5)

β'= a 1 x L vector of parameters of the willingness-to-pay equation

$\mathbf{X_i}$ = a K x 1 vector of explanatory variables equation (2) (specified in section 3.5)

$\mathbf{n_i}$ = is error term of equation (1)

$\boldsymbol{\varepsilon_i}$ = is error term of equation (2); and

When a household is faced with a choice between whether he is interested in the improved system or not, the response will be either yes or no. If the household says yes, the dummy variable ($\mathbf{PROBWTP_i}$) will assume the value one and zero otherwise. And WTP of equation (1) is observed only when $\mathbf{PROBWTP_i = 1.}$

$\boldsymbol{\varepsilon_i}$ **and** $\mathbf{n_i}$ have a bivariate normal distribution with zero mean and correlation ρ.

$$\text{Prob } (\mathbf{PROBWTP_i = 1}) = \varnothing (\alpha' \mathbf{Z_i})$$

$$\text{Prob } (\mathbf{PROBWTP_i = 0}) = 1 - \varnothing (\alpha' \mathbf{Z_i})$$

$$\text{E [Yi / } \mathbf{PROBWTP_i = 1] = \beta x + } \rho \sigma \lambda (\alpha' \mathbf{Z_i})$$

$$\boldsymbol{\lambda_I} = \varnothing (\alpha' \mathbf{Z_i}) / \Phi (\alpha' \mathbf{Z_i})$$

Where:

$\boldsymbol{\lambda_i}$ is a selectivity correction term

$\varnothing$ (.) Is the standard normal density function.

Φ (.) Is the normal distribution function.

σ Is the standard deviation.

We introduceλ, also called the inverse Mill's ratio, in equation (2). Thus it will look like:

$$WTP = \beta x_i + \theta \lambda_i + \varepsilon_I$$

Where:

θ is the coefficient of the lambda term λ and measures bias due to non-random sample selection,

ε_i is the error term.

The lambda (λ) is used as an additional regressor with the view to controlling for selectivity bias. If the coefficient is statistically significant, the null hypothesis of <no bias> will be rejected.

3.5. Definition of Variables and Hypothesis

Demand for improved sanitation is expected to be affected by households' income, housing characteristics, socio-economic conditions and the like. As most of the independent variables have theoretical basis, most of them rest on few empirical testimonials. The definition of the variables used and their expected signs are presented below.

RESX: The sex of the respondent. It is assumed that women would express more preference for improved sanitation services and would be more willing to pay than men for the reason that women are often around the house with a higher burden of cleaning the environment caused by poor sanitary facilities. A dummy variable for sex will be specified as 1 for female and 0 for male with a positive expected sign.

REED: The educational level of the respondent. It is expected that, households with higher educational level are more aware of the health and environmental benefits that could be gained from improved sanitation services thus a positive relationship is expected.

REAG: Age of the respondent. This is a continuous variable with a negative expected sign. This is because older people have the traditional belief that services like sanitation should be provided by the government and are less willing to pay.

REIN: Monthly income of the household. This continuous variable is a sum of the head's income and the income of other members of the family. The available literature suggests that there is a positive relationship between income and improved sanitation service. Theory also supports this intuition that income and quantity demanded are positively related in the case of normal goods. But in the case of willingness to pay for public toilets, we hypothesize that households will be more interested in having a sanitation facility in their house as their income increases. Thus, the reverse sign is expected.

REMS: Respondents' Marital Status. This is a dummy variable taking 1 if the respondent is married; 0 otherwise. In this study it is expected that a positive relationship will dominate since married people are more cautious of the risk (environmental and health) involved in poor sanitation situation as they envision a larger family in the future than the single ones.

REDC: Respondents occupational status. This is a dummy variable taking 1 if the respondent works in the formal sector; 0 otherwise. There is no prior expectation in this case and it is included to test its effect.

REFS: Respondents family size. One study by Abdarbo (1996) on sanitation provision in Alexandria (Egypt) has shown that as the family size increases, willingness-to-pay for improved services will also increase. The rationale given by the researcher was that, as the number of members increases in a given household, households will be more aware of the risk involved with unsanitary situation thus crave for a better service by giving high willingness-to-pay. But in our case with very limited job opportunities in Addis, increase in family size will also increase the number of unemployed members in the family. Thus it will increase household's expenditure and a growing need to match with one's income. Thus a negative relationship is expected to dominate.

REHC: Respondents housing characteristics. This is a dummy variable taking 1 if the household owns his house; 0 otherwise. It is expected that, households who own their house would be more willing to pay for the improved sanitation

services than those who are paying rent. This could be credited to the fact that private ownership creates the incentive to make certain investments, which have environmental benefits. Besides, For rent paying households, since a huge part of their income goes to house rent they would be more averse to extra costs emanating from improved sanitation services.

RESP: Respondents sanitation expenditure. According to Whittington et al (1992), households with high expenditure on sanitation will be willing to pay a higher amount if improved. In this study also we expect the same relationship.

RESL: Respondents level of satisfaction. Without any theoretical a priori, if households are very satisfied with the current system then there will be no incentive for them to prefer the improved system. A dummy variable 1 will be specified for households very satisfied with current sanitation system and zero otherwise.

REAS: Respondents' attitude about the responsibility of sanitation supply. Households who believe that it is the government's task to supply adequate sanitation supply are less willing to pay than households who think otherwise. A dummy variable 1 is given for households who think it is the governments responsibility to provide sanitation service; 0 otherwise with a negative expected sign.

REYS: Respondents years of stay in the area. It is hypothesized that the more households stay in a particular area the more they would be willing to pay for the proposed improvements since they will know more about the benefits. In addition, there

will be sentimental attachments to that area. A positive relationship is thus expected.

REST: Status of the Respondent: This is a dummy variable taking 1 if the respondent is the head of the household; 0 otherwise. A positive sign is expected as other representative of the household may not be willing to pay as much as the head.

SVOB: Starting value of bidding game. This is done to see if households' responses are very much affected by the starting value. The relationship is due to be known in the course of the study.

LSS: Location of the sample study. This is included to see the effect of clustering since our sample is stratified by income. A dummy variable 1 is given for respondents from high-income area, 2 for middle-income area and 3 for those from low-income area.

Chapter Four

EMPIRICAL RESULTS AND DISCUSSIONS

This chapter deals with the empirical findings and discusses the results obtained. The data from the contingent survey is analyzed in two ways. The first part used descriptive analyses with the help of cross tabulation between WTP and socio-economic characteristics of the respondents. Besides, frequency distribution is imputed to analyze responses. Then the Heckman two-step estimation technique is used to see if the corresponding results are consistent with theoretical and empirical literature and implicates reliability and accuracy of the WTP bids.

4.1. Descriptive Analyses

4.1.1. Characteristics of Household Members

A total of 440 households were interviewed, where 434 questionnaires were found usable. Of these, 275(63.2%) of the respondents are male. Two hundred twenty one (50.8%) respondents are heads of their households.139 (62.9) are male heads and 82(37.1) of them are female-headed households.

The average family size is 6.49 with a minimum of 1 household member and a maximum of 16 household members. The data on age reveals a wide range of responses where the average is found to be 38.48 years. The minimum age is 20 years while 80years is the highest age.

The education figure reveals that 21.8% cannot read and write while 26%have attended primary level education, which includes those respondents that can read and write up to those who have attended sixth grade. The majority of the interviewed respondents 35.9% have attended secondary level where 16.3% have attended higher education.

Table 4.1 Socio-demographic Characteristics of Respondents

Variables		High Income	Middle Income	Low Income	Total
Sex (%)	Male	52.3	72.8	62.8	63.2
	Female	47.7	27.2	37.2	36.8
Age (average)		36.43	40.39	38.48	38.39
Marital Status (%)	Single	52.3	39.0	42.4	43.8
	Married	47.7	61.0	47.7	56.2
Education (%)	Illiterate	3.7	31.6	40.8	21.8
	Primary	15.9	24.3	17.3	26.0
	Secondary	39.6	29.4	35.6	35.9
	Post Sec.	40.8	14.7	6.3	16.3
Occupation (%)	Own Business	20.9	11.0	8.3	25.4
	Government Employee	10.9	12.2	5.8	9.0
	Private sector Employee	14.5	14.5	19.4	19.0
	Others	53.7	60.3	66.6	46.7
Family Size (average)		5.62	5.79	6.06	6.49
Status of Respondent (%)	Head	49.9	49.3	55.5	50.8
	Non-head	55.1	50.7	44.5	49.2

Source: survey result

Using cross-tabulation, household characteristics in the respective income clusters were analyzed. To start from the high-income category, the data shows that, the average family size in this area is 5.62.The majority (52.3%) of the interviewed respondents are male respondents. The marital status figure reveals that 47.7% of the respondents are married while the rest are not. The average age is found to be 36.43.The educational qualification of the respondents indicates that, 3.7% of them have no exposure to formal education, 15.9% have at least attended primary level education while the majority (more than 60%) have secondary level and above educational qualification. Concerning the employment structure in the area, 20.9% run their own business, 10.9% are government employees, and 14.5% are employed in private companies, while the rest reported that they are unemployed, housewives or students.

Accordingly, the evidence for respondents in the middle-income class quiet resembles the previous category. Whilst some of the figures are almost the same for this section of the city, still slight variations are visible. More than 40% of the questionnaires show that these respondents have not received any formal education at any level. And also, those who are at or above secondary education level have decreased to 44.1%. The occupational status shows that 11% are engaged in their own private business, government employees' account only for 12.2% and private sector employees are 14.5% of the survey sample in the area. The rest are students, housewives and unemployed.

A pretty different demographic and household characrtestics is envisioned in the low-income category. The average family size is 6.5 and males constitute 62.8% of the response. More than fifty percent (55.5%) of the sample households interviewed are head

of their family and 47.7% are married. The average age is 38.4. More than 40% of the respondents are without any formal education. Looking at the occupational status, the majority of the respondents are housewives or unemployed. Generally, the figures seem to worsen as we go from high to low income areas. Large family size, low-educational qualification and poor occupational status largely characterize low-income areas.

4.1.2. Housing Characteristics and Household Income

The housing characteristics, concerning ownership and attributes such as lighting, monthly rent, and other assets to a large extent approximate the wealth of a household. The survey result on house condition is summarized in the table below.

Table 4.2 Housing Characteristics

Ownership	Number of HHs.	% age
Own House	249	57.2
Kebele	142	32.6
Rental Houses Administration	6	1.4
Private	28	6.4
Other	9	2.4

Source: survey result

The average rental expense is 207.23 birr per month that ranges from 5 birr per month to 7000 birr/month. In relation to the years of stay by a specific household, a number of responses were observed. From one-month stay up to 70 years of stay in a particular house were seen. The average year of stay is 22.26 years.

The most difficult was the inquiry on the level of income the household earns. Most respondents living in the “high income” areas were not keen to state their earnings; most

respondents in “low-income” areas don’t really know their average monthly income. But due emphasis was given in the training session to this part and the enumerators were able to come up with a fair estimate of households’ average monthly earnings. The corresponding income figure shows that more than fifty percent of the respondents earn not more than 500 birr per month. While around 40% earn between 501 birrr per month to 2000 birr per month. The rest earn more than 2000 birr per month. Households, not many which are living in “old airport” area, have reported their monthly income from 15,000 to 20, 000 birr per month by renting their villa to embassies.

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To cross check the income figure, respondents were asked to state their major average expenditures in a month. The data shows that, food expenditure constitute the major expenditure share, then comes housing and expenditure on education.

Table 4.3 Household Monthly Expenditure

Expenditures	Average Monthly Expenditure (Birr)
Housing expenditure	112.32
Food	205.02
Electricity	89.68
Transportation	87.13
Education	136.67
Health	56.11
Telephone	67.96
Water	36.07
Clothing	32.17
Others	26.95

Source: survey result

Comparing the average income (1070birr/month) with major expenditure that a household spends, it is found that they are very close showing that households have revealed a fair estimate of their income.

To begin with data on main attributes of a given house, almost all (98.2%) of the households do have electricity in the house, 1.8% households reported that they use kerosene in their houses. With regard to their main source of water for domestic uses, 67% of households responded that piped water is their main sources of water. The remaining 32.8% use public tap, springs (or wells) or other sources like private vendors for their water needs. The survey sample shows that 91.3% of the respondents have radio while only 8.7% said that they do not have one.

Table 4.4 Household Ownership of Infrastructure and Durables

		Income Category			Total
		High-income	Middle-Income	Low-income	
Electricity (%)	Electricity	100	97.1	97.4	98.2
	Others	0	2.9	2.6	1.8
Water (%)	Pipe water	96.20	62.50	54.50	67.30
	Others	3.80	37.50	45.50	32.70
Radio (%)		98.10	93.30	86.90	91.30
Tape Recorder (%)		94.40	89.60	75.90	84.40
Television (%)		88.80	54.10	34.00	53.60
Telephone (%)		90.70	45.20	22.00	46.70
Refrigerator (%)		79.40	26.70	11.00	32.80

Source: survey result

Tape recorder is owned by 84.4% of the respondents' household while 13.3% do not have this facility. Data for possession of television show that 53.6% of the respondents own TV set. Some of the households, even with a visible antenna on rooftop of their compartment, said that they do not have a TV set. The reason is they are very skeptic about the confidentiality of the information they give, and may be required to pay taxes for the government. Thus the above percentage figure is believed to be an underestimate. Of the interviewed respondents 46.7% have access to telephone in their house while almost equal percentage of the sample households are without any telephone facilities.

Refrigerator seems to be the least owned by households. Of the interviewed households only 32.8% have refrigerator.

4.1.3. Rank for Various Social Services

To explore households' preferences for social services in terms of priority, they were required to rank different services in accordance to their needs. Seven different social services were listed: education, health, water, sanitation, electricity, road and telephone. The survey result shows that, 32.7% of the respondents reveal health as their first priority. Then comes sanitation with 31.3% of the interviewed respondents saying that it is their first need.19.7% said that water supply is their prior need. Education, road, electricity, and telephone were ranked from fourth to seven respectively.

Table 4.5 Households' Rank for Social Services

Variable	Rank	Income Category (%)			Total (%)
		High-income	Middle-income	Low-income	
Health	1st	49.50	36.10	20.90	32.70
Water	1st	29.00	22.60	12.60	19.70
Sanitation	1st	7.50	30.10	45.50	31.30
Road	1st	0.90	3.00	7.30	4.40
Education	1st	10.3	3.80	2.60	4.90
Electricity	1st	1.90	3.80	6.30	4.30
Telephone	1st	1.90	0.80	4.70	2.80

Source: survey result

Regarding the data on the corresponding income categories, we will find almost the same result. For the high-income group, health is ranked the first by 49.5% of the respondents. Water supply and education are ranked second and third with 29% and 10.3%. Sanitation is their fourth choice with only 7.5% of the respondents choosing it their first priority. For the middle-income group, health, sanitation and water are ranked from one to three,

with 36.1%, 30.1% and 22.6% respectively. As for the responses from low-income group, 45.5% said that sanitation is their first need. Health and water is their second and third need, for which 20.9% and 12.6% is their corresponding figure.

In an overall assessment, we can clearly see that, the people respondents in Addis have consistently ranked sanitation as one of their four priority services. And also, comparing the three income groups, the data indicate that as the income level decreases the need for services like sanitation seems to be magnified.

4.1.4. Existing Sanitation Attitudes and Practices

This section is dealing mainly with the existing sanitation practices and household attitudes improved sanitation technologies. The survey collected from three income clusters, shows that, six different kinds of sanitation practices are eminent. The data seems to support the information we have from AAWSA that the majority of the city's population is currently using pit latrines for their sanitation needs. Table 4.6 summarizes the existing situation.

Table 4.6 Existing Household Sanitation Practices

Type of Sanitation	Existing Sanitation Technology	Number of HHs.	Percentage
On-Site	Flush	126	29
	Pit Latrine	169	38
Off-site	Public	46	10
	Forests	25	5.8
	Rivers	45	10
	Others*	23	5.2

*Others include roads, backyard and the like

Source: survey result

The data obtained from the three income categories shows that, as the level of income increases households seem to use better forms of sanitation facilities. The table below reveals that flush toilets dominate high-income areas where as middle–income areas largely use pit latrines. Households residing in low-income areas, by and large, do not seem to own any on-site sanitation facility.

Table 4.7 Existing Household Sanitation Facilities by Income Categories

Location facility	High Income (%)	Middle Income (%)	Low Income (%)
Flush	85.0	18.8	5.2
Pit Latrine	11.2	56.4	36.7
Public	2.8	10.5	15.2
Others	1.0	14.3	42.9

Source: survey result

To assess their perception on the existing sanitation system, respondents were asked to rate their existing sanitation facility according to several attributes. This followed the UNDP standard of rating a certain sanitation technology. In terms of privacy, cleanliness and convenience; very few (8.4%) feel that their existing sanitation system is "poor" in terms of any of these three, characteristics. However, for households using pit latrine, 31.5% only rated their sanitation system to be "good" in terms of privacy while the rest (62%) reported that either it is fair or poor. Concerning cleanliness and convenience, 40% said that their system is "poor" in terms of these attributes, while more than 55% feel that either its "good" or "fair".

The results show clearly that respondents judge the public latrines to be the worst of these three measures. More than eighty percent (84.4) of the respondents using public toilets

rated them “poor” in terms of privacy, 86.4% judged them to be “poor” in terms of convenience, and 88.9% rated them “poor” in terms of cleanliness.

The data shows that, 78% of the respondents currently using flush toilet, do not share their toilet, while 13.6% do share with one to two households. Only 10% of the respondents share their flush with three or more households. The corresponding figure for users of pit latrine somewhat appear surprising. In the survey we have found, not few in numbers, households who share their toilet with more than eleven households. The maximum could even go to 19 households, where the average is calculated to be 3.2 households for a single pit latrine.

The majority of the respondents, from both pit and pour flush owners (48%), testified that the landlord takes the role of emptying the tank when it’s full. For flush users, 38% prefer the government service to empty their tank while the majority (more than 50%) is using the service provided by private companies. When it comes to pit latrine, more than sixty percent prefer the government service.

Households were asked to state the frequency (the number of times) they oftenly empty their tank. For flush users 69.4% respondents say that they have never emptied their tank. From the various reasons forwarded we were able to see that most households have connected their tank to the nearby river. Especially, in “bole” area, a number of households are flowing their sanitary disposal to the river and when asked about the pollution and social danger that could emanate from such type of construction, most said that since the government is aware of this and said nothing so they see no problem in it. The survey also revealed that some households in “old airport” area have illegally

connected their septic tank to the nearby pipeline. We further noted during the interview that since the government is not thinking of building a sewer line in the foreseeable future, they were forced to illegally connect their tank to a pipeline that is not built for sewer disposal. The rest of the households responded that, 27.1% on average emptied their tank once a year and only 3.5% stated every two years and more.

For owners of pit latrine, 14.4% said again that their tank was never emptied. In some areas, we observed many full tanks, which are still used by households. The reasons were mixed. Households around "keranio" have little or no information about sludge disposal facility by the government or private companies and happen to build another tank whenever the tank is full. Around "Yeka" a very large part of the respondents said that, since the service by the government is very poor they have no option but to stay with a full tank. We told them that there are private companies involved in giving the same service; many said that they have no information about their bill for the service and afraid that it's going to be very costly. Apart from this, 65.4% frequently empty their tank on a yearly basis. While 10.6% of the respondents empty their tank once every two years. Ten respondents empty their tank every three or four years. And the mean frequency by which pit latrine owners empty their tank is 1.0385 years.

Table 4.8.Households Existing Sanitation Costs, Level of Satisfaction, and Number Using a Sanitation Facility

Type of Sanitation Facility	Level of Satisfaction			Existing Sanitation Cost (Average in Birr)	Average Frequency of Emptying their Tank Yearly	Average No. of households using the facility
	Very satisfied (%)	Satisfied (%)	Not satisfied (%)			
Flush	58.9	33.1	8.1	55.45	0.34	0.49

Pit Latrine	13.8	32.3	53.9	42.63	1.03	3.2
Public	4.5	2.3	93.2	0	----	---

Source: survey result

Concerning the cost a household bears for sanitation, flush users pay 55 Birr/year on average and the corresponding figure for pit latrine users is 42.63 Birr/year. For public toilet users, the service is provided for free. So households who use this service do not incur any cost related to sanitation.

Public toilet users have revealed that they have to travel a long way to use the facility. The average distance from home is 102 meters. In an effort to minimize the existing problem, some initiatives are being taken by some non-governmental organizations in some areas (The most notable is the “gash Abera Molla” project, which is building movable toilets, and about to give service by collecting entrance fees but hasn’t started operation during the commencement of the field survey).

All respondents were also asked their overall satisfaction with their existing sanitation system. Their answers are consistent with the attitudes on cleanliness, privacy, and convenience. Only 4.5% of the respondents using public toilets reported that they are "very satisfied”. The majority more than 90% said that they are "not satisfied" at all. On the other hand, the level of satisfaction with the existing pit latrines was a bit high with 46% either "satisfied" or "very satisfied". Again, not surprisingly, more than 90% of flush toilet users said that they are "satisfied" or "very satisfied" with their system.

4.1.5. Willingness to Pay for Improved Sanitation Services

In this study, three valuation questions were set: Valuation questions for sewer connection, for improved sludge disposal and public toilet service. And since the WTP responses are different in the respective cases, we treat each of them separately.

Willingness-to-pay for Sewer Connection

For the 126 respondents who own flush toilet, they were asked to state their willingness-to-pay for a sewer connection. The average (mean) WTP obtained is 20.48 birr per month. This ranges from 0 to 100 birr per month.

The frequency distribution shows that, 37% are willing to pay between 0 and 10 birr per month, 32.3%between 11 and 20 birr per month, 17.3% between 21 to 30, 0.8% between 31 to 40, 7.1% between 41 to 50, 3.1% between 51 and 60 and only 2.4% are willing to pay more than 60 birr per month. The correlation coefficients reveal that, income is positively related to WTP and is found to be significant (see section 3.4). Range, frequency and mean of some selected variables are presented in Table 4.9.

Table 4.9 Willingness to pay for Sewer Connection

WTP	No.	Percent	Average Income	Sex[1]	Marital Status[2]	Average Family size	Family Head[3]	Average Age
0-10	47	37.0	4190.89	0.43	0.40	5.49	0.36	34.33
11-20	41	32.3	4401.37	0.40	0.46	5.37	0.39	33.74
21-30	22	17.3	6239.19	0.43	0.43	6.00	0.43	36.00
31-40	1	.8	7500.00	1.00	0.00	4.00	0.00	20.00
41-50	9	7.1	4768.75	0.50	0.75	5.38	0.75	44.00
51-60	4	3.1	3550.00	0.25	0.75	4.50	0.75	46.50
61 & above	3	2.4	12666.67	0.67	0.00	8.00	0.00	31.67

[1] 1=female, 0=male, as the figure approaches 1, it means females are willing to pay that range of WTP amount

[2] 1=married, 0 otherwise, as the figure approaches1, it means that married are more willing to pay that range of WTP amount

[3] 1=family head, 0 otherwise, as the figure approaches 1, it means that family heads are more willing to pay that range of WTP amount

Source: survey result

Willingness to pay for Improved Sludge Disposal

As described earlier, the majority of interviewed respondents (i.e. 169) are pit latrines users. They were inquired to state their willingness to pay amount for a proposed improved sludge disposal by the government. The mean willingness to pay is found to be 45.66 birr per trip, which ranges from 0 birr to 200 birr per trip.

Table 4.10 below shows that as the average income of a household increases, the willingness to pay for the improved sanitation service also increases. There is also a positive relationship between education and willingness to pay. The table below relates mean of some variables with range and frequency of willingness to pay.

Table 4.10 Willingness to Pay for Improved Sludge Disposal

WTP	No.	Percent	Average Income	Sex[1]	Marital Status[2]	Average Family	Family Head[3]	Average Age

						size		
0-20	56	33.1	519.43	0.32	0.52	5.98	0.45	39.50
21-40	39	23.0	610.77	0.31	0.57	7.11	0.46	36.83
41-60	40	23.6	765.05	0.28	0.57	6.93	0.55	40.25
61-80	12	7.1	1224.45	0.40	0.60	8.50	0.50	44.50
81-100	17	10.0	583.28	0.13	0.50	5.94	0.50	31.60
101 & above	5	2.9	1650.00	0.20	1.00	7.60	1.00	50.20

[1] 1=female, 0=male, as the figure approaches 1, it means females are willing to pay that range of WTP amount

[2] 1=married, 0 otherwise, as the figure approaches1, it means that married are more willing to pay that range of WTP amount

[3] 1=family head, 0 otherwise, as the figure approaches 1,it means that family heads are more willing to pay that range of WTP amount

Source: survey result

Willingness to pay for Public Toilet

Those 136 households who are currently using public toilet and with out any sanitation facility (those using rivers, forests, roads and the like) were asked to state their maximum willingness to pay for public toilet service. The mean willingness to pay is 22.86 birr per year. The minimum willingness to pay is zero while 100 birr is the maximum willingness to pay.

Correlating income with willingness to pay, the spearman's correlation coefficient is positive and significant. Education is also positively related. Table 4.11 shows the relationship between willingness to pay and mean of some selected variables.

Table 4.11 Willingness to Pay for Public Toilet

WTP	No.	Percent	Average Income	Sex[1]	Marital Status[2]	Average Family	Family Head[3]	Average Age

						size		
0-10	42	31.3	220.74	0.40	0.64	5.86	0.64	40.79
11-20	45	33.5	387.07	0.36	0.78	6.07	0.67	41.02
21-30	23	17.1	309.27	0.36	0.55	6.27	0.36	39.27
31-40	8	5.9	385.00	0.38	0.50	4.88	0.63	45.88
41-50	12	8.9	341.08	0.67	0.50	5.58	0.50	34.08
51 & above	4	2.9	511.75	0.25	0.50	4.75	0.75	37.25

[1] 1=female, 0=male, as the figure approaches 1, it means females are willing to pay that range of WTP amount

[2] 1=married, 0 otherwise, as the figure approaches1, it means that married are more willing to pay that range of WTP amount

[3] 1=family head, 0 otherwise, as the figure approaches 1, it means that family heads are more willing to pay that range of WTP amount

Source: survey result

4.1.6. WTP and Starting Bids

In the final survey, three starting bids for the corresponding three valuation questions were given. These were set following what we have obtained from the pilot survey. Starting from respondents who were asked for willingness to connect to sewer system, the data reveals that 57.9% have said "yes" to the first price that they have been given and the rest have refused and gave a lower bid than the initial price. More than 70% of pit latrine users have said "yes" to the initial price and 89% said "no" to the price they have initially been given. And the data on respondents on willingness to pay for public toilets, more than 50% of them have said "no" to the initial bid. Looking at the percentage share of the three starting prices, it is inconclusive to see the effect of the starting bids on the final stated price. Thus further result will be presented in the regression part whether or not households were biased with the price that they have been given.

4.1.7. Zero Willingness to Pay Responses

In this study 17 zero responses were observed (6 from WTP for sewer connection, 4 from WTP for improved sludge disposal and the rest 7 from WTP for public toilets). To identify whether these responses are protest zero responses, a follow-up question was raised to the respondents. Most have responded that they are satisfied with the current system (especially those who own flush toilets) and others (mostly the willingness to pay for public toilet part) said that they do not have enough income to pay for the improvement. Thus none of them were considered as protest answers.

4.1.8. General Attitudes of the Respondents

Regarding the attitude of the respondents on the responsibility of managing sanitation supply for the city, 72% of the respondents think that it is the government's task to provide sanitation service while 14.4 percent said that the community should take the role of administering sanitation service and the rest (13.8%) said it should be given to NGOS or the private sector.

The majority of the respondents believe that, the administrative body doesn't give enough attention to the problems related to the provision of improved sanitation and all have said that they are in dire need of a better administrative authority. Concerning the issue of sanitation as a point worth to discuss about, 82.6% of the respondents said that it is a critical problem and should be discussed.

4.2. Regression Results

As we have described earlier, in addition to the descriptive analysis, multivariate econometric analysis puts us in a broader framework, as to which factors are responsible for the willingness to pay for improved sanitation services.

But before estimation was done, data exploration is an important step. To start with, to check whether multicollinearity is present or not a simple correlation coefficient matrix was conveyed. Gujarati (1995) establishes a rule of thumb, which says that multicollinearity is a serious problem when the correlation coefficient is 0.8 or above. Thus though correlation is present, multicollinearity is not a serious problem in our data. (See annex 1)

Using hettest in Stata 7.0 version, heteroscedasticity was detected. The cook-Weisberg output shows that, there is in fact heteroscedasticity problem inherent in our data (See annex 2). To minimize such problem, STATA software computes robust estimation and we have followed the mentioned procedure. Greene (1993) states that the possibility of disturbance distributions with thicker tails than the normal, particularly in microeconomic data has led to numerous proposals of robust estimators. As most of these are designed to reduce the weight attached to extreme observations, Amemiya (1985) remarked that most of them are very difficult to apply. In STATA 7, the Huber-white<sandwich> estimator is applied. It has a similar essence with other robust but since it is convenient to apply, it is used in many micro-level analyses and also in this study.

In this section three willingness to pay scenarios (cases) are estimated. The questionnaire is formatted in such a way that, first the respondent is asked whether he/she is interested

in the improved system or not, and if yes, he/she is asked to state maximum willingness to pay in a bidding format. So the first decision could affect the forthcoming one and thus the error terms could be correlated. Thus Heckman's selection model, which takes in to account the selectivity bias that could emanate is employed.

Thus, the probability of being willing to pay for the improved sanitation service or not is first estimated by employing probit estimation and computing the selectivity correction term (lambda) from these probabilities. Second, lambda (λ) is used as an additional regressor in the OLS equation with a view to controlling for selectivity bias.

The LR test for independent equations also showed that the two equations are correlated. The null hypothesis which shows rho (coefficients which shows that the error terms of the two equations are correlated) is zero is rejected at 1% level of significance for all the three cases.

4.2.1. Determinants of WTP for Sewer Connection

In this section determinants of WTP for sewer connection for respondents who are using flush toilets are analyzed. The Heckman selection model has two parts, which are presented simultaneously (probit and OLS). The pseduo R^2 for the estimated equation is 0.29. According to Mitchell and Carson (1993), if a CV study failed to show an R^2 greater than 0.15 the result is open to question. So we can see that our model has passed this criterion. The chi-square test shows that the model is significant at 1 percent level of significance showing that the overall model is a good fit.

From table 4.13 we can see that the lambda measuring the presence of selectivity bias is significant. This shows that there is selectivity bias in our model.

Table 4.12 Heckman Selection Model for WTP1

No. of observations = 126
Wald chi2 (10) = 35.85
Log likelihood = -389.974
Prob > chi2 = 0.0001
Pseudo R2 = 0.2918

Variable	Coefficient	T-Value
PROBWTP1 (marginal effects after Heckman)		
Income	0.000039	4.65***
Mstat♣	0.1907	1.40
Edu	0.2416	6.00***
Occ♣	0.1122	0.83
Fsize	0.5673	2.74**
Age	0.1460	1.35
Sex♣	0.1843	1.92*
Expenditure	0.0123	0.92
Fhead♣	0.1253	1.80*
Housing♣	0.1877	3.05**
WTP1 (OLS)❖		
Income	0.0003	2.34*
Edu	0.2500	6.39***
Sex	0.5843	0.37
Age	0.282	4.18***
Fsize	0.1287	4.73***
Occ	0.1162	0.82
Starting price	0.1266	4.87***
Year stay	0.312	1.32
Mstatus	0.7176	2.96**
Fhead	0.1296	1.84*
Housing	0.3690	5.80***
Lambda ((λ)	-0.810	15.5***
Cons	3.0946	7.71
/athrho	-15.17365	-0.14
/lnsigma	-0.210232	-3.28**
rho	-1	
sigma	0.810396	
LR test of indep. eqns. (rho =0):chi2(1) =11.95 Prob >chi2 = 0.0005		

*** Significant at 1%, ** Significant at 5%, * Significant at 10%

♣ Is for discrete change of dummy variable from 0 to 1

❖ 6 zero observations are excluded for the OLS

The variable income is significant at 1% level of significance as expected which is consistent with economic theory that says income is positively related with demand in the case of normal goods.

Education is highly significant at 1% level of significance. It has also got the expected positive sign. This suggests that education increases the awareness of the health dangers involved in unsanitary environment and thus lead to higher WTP.

The other significant variable is age. It is inconsistent with our prior expectation that there will persist a negative relationship. The result shows that the older the respondent is the higher the amount he/she is willing to pay. As people get older, they would be able to secure accumulated wealth, which will increase their ability to pay for sanitation services. The results also testified a possible change of attitudes. This could be a result of a number of movements by the government and some non-governmental organizations, which are exerting efforts to bring about changes with the motto of <a cleaner Addis>. These movements have focused on changing the attitudes of the people towards improving the existing sanitation service. This could also be augmented by the current policy directions of the government to impose payment schemes in other services like education, increased tariff in water services and the like which were previously believed to be the government's responsibility.

The variable family size is found significant at 1% level of significance. It is positively related to WTP, which is contrary to our expectation. Our hypothesis was that since increase in family size will also increase the need to match one's income with expenditure, households would be less willing to pay for services like sanitation. In other words increase in the family size will increase the burden of providing food and other necessities by the family, thus the household will be unable to pay for services like sanitation. But from the descriptive analysis we have seen that the majority of households

who currently own flush toilets are those in high-income areas. Since they are financially better off they are not going to worry about what they are going to pay for food or other related expenditures. So, in this class of service, it shows that rather than worrying about the increasing financial obligation that increasing family size brings, households are more concerned about the health and well being of their family members as family size increases.

The starting price, which is used to test for the existence of starting point bias, showed that it is significant at 10% level of significance with positive sign. This implies that, their willingness to pay amount is upwardly biased. This is mostly expected from CV survey that has used bidding-game format. Whittington et al. (1993) also found similar result on Kumasi, Ghana.

The variable marital status of the respondents is positive and significant at 5% level of significance. As expected, married people are more concerned about the health and well being of their family and thus willing to pay higher amount than those who are not married.

The variable status of the respondent is found to be significant at 10%. Its positive sign shows that, household heads are willing to pay more than respondents who are not head of their family. This is consistent with prior expectation and also previous studies on sanitation and water. Aklilu (2002) also found this variable to be positive and significant showing that respondents who are the head of their households are willing to pay more for solid waste management in Addis Ababa.

The last variable, housing characteristics, is also positive and highly significant at 1% level of significance. As expected, owners reveal high willingness-to-pay since as hypothesized they are more concerned about the environmental and health effects that could be gained from improved sanitation services. Private ownership of a house by itself motivates individuals to invest for improvements in their resource. Besides; renters of houses will be obliged to pay monthly rent which is at most times a huge fraction of their income. This will make them to state less willingness-to-pay amount for services like sanitation.

The probit estimate in the Heckman model determines the factors that explain the probability that a household chooses the improved sanitation service. As most of the variables are also the same variables, which are found significant in the OLS part of the Heckman model and thus discussed, the rationales quiet resemble one another. But in this section, we talk of the marginal effect on the probability that a household will connect to the new improved system.

The variable income of the household is positive and significant at 1% while the reason is mentioned in the OLS part, the marginal effect shows that a 1% increase in income will increase the probability of being willing to pay (connect) by 0.39%, citrus paribus. This figure is very small showing that in making a decision by a household as to connect to the improved system or not the role of income is minimal. As described in the descriptive part, a number of high-income households have illegally connected their flush toilet with a nearby river or an underground line that is not intended for sewer system. And when

asked whether they are interested in the improvement suggested they said no since they are satisfied with what they have. This may have reduced the marginal effect.

The education level of the respondent is highly significant at 1% level of significance. This indicates that as people get more educated their awareness for the environment and health impacts of improved sanitation system will also increase.

Family size has the inverse sign of our expectation which was mentioned earlier and significantly affects the decision a household makes, whether he/she is willing to pay or not, at 1 % level of significance. The result indicates that an additional household member will increase the probability of willingness to pay by 5.6% while all other factors remain the same. Abdarbo (1996) also found similar result in his study on willingness to pay for sewer system in Alexandria, Egypt.

The coefficient for the variable sex is positive and significant at 10%. As hypothesized, female household members are mostly around the house with the burden of cleaning the environment. Thus they have more desire to see a better sanitary environment. Looking at the marginal effect, being female will increase the probability of WTP by 18.4%.

The variable status of the respondent is positive and significant at 10% level of significance. Being the head of the household will increase the probability of being willing to pay for sewer connection by 12.5%. The rationale is given in the previous probit section.

The variable housing characteristics is again positive. It is significant at 5% level of significance. As the reason is given above, here the marginal effect reveals that owning a house by itself will increase the probability of WTP by 18.7% while the other factors are held constant.

4.2.2. Determinants of Willingness-to-pay for Improved Sludge Disposal

The chi square test shows that it is significant at 1% showing the model is a good fit. The pseduo R^2 for this model that is 0.411 (41.1%) implies that this percentage of the variation in willingness to pay amount is explained by variables included in the model. We can see that lambda (λ), which shows the presence of selectivity bias, is significant, showing the presence of selectivity bias.

Table 4.13 Heckman Selection Model for WTP2

No. of observations = 169
Wald chi2 (10) =19.23
Log likelihood = -1073.093
Prob > chi2 = 0.0003
Psedo R2 = 0.4110

Variable	Coefficient	T-Value
PROBWTP2 (marginal effects after Heckman)		
Fsize	0.1151	4.07***
Age	0.2315	2.00*
Fhead♣	0.164	1.68*
Administration♣	-0.2814	-1.11
Income	0.0016	2.10*
Year stay	0.00014	0.27
Sex♣	-0.0015	-0.01*
Mstatus♣	0.1410	0.15
Occ♣	0.1398	1.51
Edu	0.1152	3.12***
WTP2 (OLS) ❖		
Fsize	0.1149	4.08***
Age	0.1596	2.67**
Sex	-0.0063	-0.03
Fhead	0.4662	1.77*
Administration	-0.2816	-1.41
Starting price	-0.0001	-0.23
Edu	0.2294	3.85***
Income	0.0036	2.40*
Mstatus	0.0407	0.15
Expenditure	0.111	5.89***
Lambda (λ)	0.9906	16.30***
Cons	-1.240	-2.34
/athrho	13.82317	0.28
/lnsigma	3.392135	56.9
rho	1	
sigma	29.72936	
LR test of indep. eqns. (rho = 0): chi2(1) = 12.83 Prob >chi2 =0.0003		

*** Significant at 1%, ** Significant at 5%, * Significant at 10%

♣ is for discrete change of dummy variable from 0 to 1.

❖ 4 zero observations are excluded for the OLS

The variable family size is highly significant at 1% with expected positive sign. The same result is also found for willingness-to-pay sewer connection. Again from the descriptive part we have noted that the majority of households that are currently using pit latrine are households living in middle- income areas. This shows that, as household size increases there is an increasing concern reflected for members' health and well being rather than worrying about the possible increase in expenditure of the household coming with increased family size.

The variable age has unexpected positive sign and also is highly significant at 1% level of significance. For the reasons that older people have the greater possibility of accumulating more wealth, they will be more willing to pay for sanitation services. Besides the current movements by the government and the NGOs could have a role in changing the attitudes of people.

The variable income is positively related to willingness-to-pay with 10% level of significance. As expected and theoretically justified as income increases the willingness to pay for the improvement also increases. This shows that improved sludge disposal is a normal good.

The variable status of the respondent is found to be positive with 10% level of significance. It implies that respondents who are heads of their family are more willing to pay than those who are not head of their family.

The variable education is significant at 5% level of significance. As expected it affects willingness to pay in a positive direction. This shows that, once again, education has a role in changing attitudes and increasing awareness with regard to the health benefits that improved sanitation bring forth.

The other variable, which is highly significant at 1% level of significance, is current expenditure on sanitation. Whittington et al (1992), Abdarbo (1996) have all found that there is positive relationship between current sanitation expenditure and willingness-to-pay. Our result also got the same direction. That if a person currently spends more for sanitation (to empty tank and the like) he/she will be willing to pay a higher amount.

Concerning the probit estimates obtained to analyze the factors responsible for a household to be willing or not for the proposed improvement in sludge disposal, six factors were found significant.

Age is found to be significant at 5% level of significance with positive sign. The reason is mentioned in the previous part. Looking at the marginal effect, an increase of one year will affect the decision to be willing or not by 16%, all other factors being held constant.

Family size is found significant and positive. As the rationale is given in the OLS part, the marginal effect shows that, as the family size increases by one more member, the probability of WTP increases by 11.5%, while other things are held constant.

The other variable, which is highly significant at 1% level of significance, is current sanitation expenditure. It has a positive sign showing that a 1% increase in sanitation expenditure will increase the probability of willingness to pay by 11.1%.

Income of the household is positive and significant at 10% level of significance. This implies that a 1% increase in income will increase the probability of deciding to pay for the improved service by 1.6%, citrus paribus.

The variable status of the respondent is found to be positive and significant at 10% level of significance. As expected being head of the family will increase the probability of willing to pay by 16.4% where everything is held as it is.

The other last variable found to explain the probability of willing or not to the proposed improvement is education. It is highly significant at 1% level of significance and found positive. This shows that, ceteris paribus, as the education level increases the probability of willing to pay also moves in the same direction while other things are held constant.

4.2.3. Determinants of Willingness-to-pay for Public Toilets

The chi-square computed to test the fitness of the model is significant at 1% showing that it is good. The pseudo R^2 is 0.33 (33%) revealing the fact that there are other factors, not included, which could also explain the model. The lambda, which is there to check the presence of selectivity bias, is significant. This shows that there is bias in our model due to selection.

Table 4.14 Heckman Selection Model for WTP3

No. of observations = 134
Wald chi2 (11) = 2129.82
Log likelihood = .2727629
Prob > chi2 = 0.0000
Psedo R2 = 0.3334

Variable	Coefficient	T-Value
PROBWTP3 (Marginal effects after Heckman)		
Income	0.0011	6.79***
Year stay	0.1251	1.31
Edu	0.1097	1.81*
Fsize	-0.1289	-4.24***
Fhead♣	0.248	2.46*
Sex♣	0.134	1.75*
Age	0.0171	3.50***
Occ♣	0.091	1.52
Administration♣	-0.2314	-3.20**
Mstatus♣	0.108	1.34
WTP3 (OLS) ❖		
Fsize	-0.3875	-1.11
Administration	-0.2445	-3.21***
Mstatus	0.3163	1.34
Edu	0.5276	6.76***
Year stay	0.1246	0.81
Income	0.0006	2.09 *
Starting price	0.2215	1.02
Fhead	0.2007	0.93
Age	0.0180	3.51***
Lambda (λ)	0.8329	14.49***
Cons	6.04	11.9
/athrho	-13.811	-0.21
/lnsigma	-0.18274	-2.65**
rho	1	
sigma	0.8329791	
LR test of indep. eqns. (rho =0):chi2(1) =12.75 Prob >chi2 = 0.0004		

***Significant at 1%, ** Significant at 5%, * Significant at 10%

♣ Is for discrete change of dummy variable from 0 to1

❖ 7 zero observations are excluded for the OLS

The educational level of the respondent again as in the previous two cases is positive. It is highly significant at 1% level of significance implying that the more educated a person is the more he/she would be avert to the health and environmental dangers of poor sanitation facility and be willing to pay a higher amount.

Attitude toward the administration of sanitation services is found to be significant at 5% level of significance with a negative sign. This is in accordance with prior expectation, which argues that, as people believe that it is the government task to administer sanitation services they are prepared to pay less amount for the improvement.

The variable age is highly significant at 1% level of significance again with positive sign. As in the previous two cases, it shows that the greater possibility of accumulating more wealth with old age. Besides, there could be a possible change of attitude by older people as a result of the on-going current effort by the government and non-governmental organizations to improve the current condition of Addis Ababa.

The final variable, which is found significant at 10% level of significance, is income. We hypothesized that willingness-to-pay will negatively be affected by income since we thought public toilets is an inferior good. That people will be moved to other sanitation facilities as their income increases. But what is being found is a positive relationship. One possible explanation is that, in the course of data collection, quite a large number of respondents who use forests, rivers, public toilets and the like expressed that if not for certain conditions they would have a sanitation facility in their house. The most important factor they mentioned is the house arrangement in which they live. Living in very densely

populated areas the housing condition could be characterized as very compressed rooms that in most cases couldn't accommodate the whole family. Besides since houses are very much close to each other building a sanitation facility is a far-fetched dream. Some even added even if they have a plot of land to build a certain facility, emptying the tank is not possible since in many of these areas there are no roads where cars could enter. So they said that, in the long-run they will think of several ways of improving this condition but at least for the short-run they are willing to pay very much for the proposed sanitation facility, which they have said, is viable and very good given the housing structure and conditions of these areas.

The probit estimates in this section identified seven variables to be significant ones in making the decision of willing or not for the proposed improvement.

For the first time contrary to the previous sections, family size is negative and highly significant at 1% level of significance. As expected in this section of the society (it has been seen in the descriptive analysis that willingness-to-pay for public toilets is dominated by respondents from low-income areas) the living standard is very poor. So the explanation is that, for them the need to match ones revenue with income is more important than the growing fears for the health dangers that come with increased household members. As family size increases, households are more concerned with the increasing burden of providing basic necessities to the household members. The marginal effect shows that if one member is added to the household the probability of willing to pay decreases by 12.9%

.

The variable sex is also highly significant at 1% level of significance. In accordance with prior expectation, it has a positive sign showing that being female will increase the probability of willing to pay by 13.4%, ceteris paribus.

The variable education is found to be also significant at 1% level of significance. Citrus paribus, it shows that a level increase in education will increase the probability of willing to pay, implying a positive relationship. The rationale is given in the OLS part.

The variable income is found to be is significant at 10% level of significance. The reasons are given above for its sign, the marginal effect reveals that, a 1% increase in income will increase willingness to pay by 1.1 percent, other things remaining the same.

The other variable found to be significant is the status of the respondent. As hypothesized this variable is positive and significant at 10%. The probability of being interested in the improved system will increase by 24.8% if the respondent being asked is head of the family. This is while other things are kept as they are.

The variable administration shows that when people think that it is the government duty to supply sanitation service, the probability that they will be willing to pay for the improvement will decrease by 23.1%. It is also found to be significant at 5%.

The last variable, which determines the decision to be interested in the improved system, is age. It is significant at 1% and consistent in sign with the previous parts. The marginal

effect reveals that as the person is one year older the probability of willing to pay increases by1.7%.

4.3. Validity Test

To assess the plausibility of the WTP bids that were obtained, construct validity test is carried out. Basically the test is to see if there is significant correlation between WTP and income of households. According to Mitchell & Carson (1993) the purpose of undertaking construct validity test is to assert the accuracy of CV results. It involves assessing the degree to which the findings of a CV survey is consistent with theoretical expectations. Forsythe (2001) and Whittington et al (1992) conducted construct validity tests. They argue that if people overbid without giving enough thought to their economic status, the correlation between income and WTP would be very small or non–existent. To check whether this is the case in our data, a correlation test between income and WTP were conducted for all the three WTP scenarios. The correlation coefficients show that the variables are significantly correlated (see Table 4.12). Thus, according to this test, it asserts the validity of the CV survey we conducted. That people are taking due consideration to their economic situation when they state their willingness-to-pay for the proposed improvement.

Table 4.15 Spearman's Correlation Coefficient between WTPs and income

WTP	Spearman's Correlations Coefficient	P-value
WTP1	0.101	0.062*
WTP2	0.220	0.005**
WTP3	0.200	0.021*

** Significant at 5%, * Significant at 10%

Source: Survey result

4.4. Total Willingness-to-pay and Total Revenue

In the previous section we have seen the factors that are influential for willingness-to-pay if there is improvement in sanitation service. So theoretically, what comes next is aggregation, which is the last part of the CV survey. In this section, total willingness to pay and total revenue at various prices that households in Addis Ababa are willing to pay is calculated for the three sanitation facilities. It shows, if improvements are underway the possible benefits that could accrue.

To start aggregation we segregated the city's population to the respective sanitation categories. According to the CSA (2002) report, the population of Addis Ababa is around 2,646,000.And the average family size is 5.06. Dividing the population by average family size and after rounding, we found that there are 522,924 households in Addis Ababa.

The Addis Ababa Water and Sewerage Authority (2000) report shows that 12% of the population is currently using flush toilets, 63% pit latrines and the rest 25% is using other sanitation means like public toilet, rivers, forests and the like. Thus based on this figure the respective revenue and total willingness to pay is calculated for the three scenarios under consideration.

4.4.1. Estimating Total Willingness to pay and Revenue for Sewer Connection

From the above percentage distribution, 62,750 households are using flush toilets. These are the potential households that could connect to a sewer system if installed. So to get the estimated number of households in each WTP interval we multiply the sample proportion in that boundary by the total number of households using flush toilets. And the

total willingness-to-pay is obtained by multiplying the mid point willingness to pay by the number of households. Summing up the total willingness to pay amount of each category, the grand total willingness to pay (aggregate benefit) is found to be 1,138,242 birr per month if sewer line connection is constructed and provide for service. The expected revenue that can be collected from charging a price first increase with low prices reaches a maximum and declines then after when prices are increasing. This is due to the decrease in the number of households that are willing to pay as price increase. The table below provides the aggregate benefit and total revenue with the willingness to pay category.

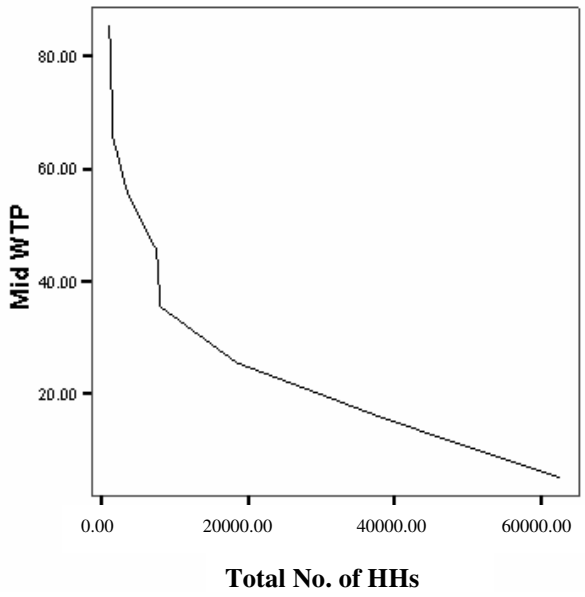
Table 4.16 Total WTP and Total Revenue from Sewer Connection

WTP interval (1)	Frequency dist. (sample)		Mid WTP (4)	Total No of HHs (5)	Total WTP (6) [1]	Sample HHs WTP at least that amount (cumulative)		Total HHs WTP at least that amount (Cumulative) (9)	Total Revenue (10) [2]
	(2) No.	(3) (%)				(7) N0.	(8) (%)		
0-10	47	37.3	5	23406	117030	126	100	62750	313750
11-20	41	32.5	15.5	20394	316107	78	61.9	38842	602051
21-30	21	16.7	25.5	10479	267215	37	29.4	18449	470450
31-40	1	.8	35.5	502	17821	16	12.7	7969	282899
41-50	8	6.3	45.5	3953	179862	15	11.9	7467	339748
51-60	4	3.2	55.5	2008	111444	7	5.6	3514	195027
61-70	1	.8	65.5	502	32881	3	2.4	1506	98643
71-80	0	0	75.5	0	0	2	1.6	1004	75802
81-90	0	0	85.5	0	0	2	1.6	1004	85842
91-100	2	1.6	95.5	1004	95882	2	1.6	1004	95882
Total	126	100		62750	1138242				

[1] computed by multiplying (4) by (5)
[2] computed by multiplying (4) by (9)
Source: survey result

The information also permits us to derive the demand curve for the suggested improvement. As can be seen, the relationship is plotted in such a way that mid-point WTP is measured along the vertical axis and the number of households willing to pay that amount of birr per month along the horizontal axis.

Figure 4.1 estimated demand for sewer connection



4.4.2. Estimating Total Willingness-to-pay for Improved Sludge Disposal

When we multiply the percentage figure by the population in Addis Ababa 329,442 number of households are using pit latrines. For the suggested improvement, we estimated total willingness to pay for the aforementioned households by:

1) Multiplying the proportion of sample households for the WTP interval by the total number of households using pit latrines
2) Then multiply the number of households in that interval by the mid-point WTP

The table below shows that the total benefit that is going to be gained if improved sludge disposal is operational is 13,729,973 birr per trip. From the descriptive description we found that the mean frequency that a household empty its tank is once in a year. So the above figure is the total benefit that is going to be gained in a year.

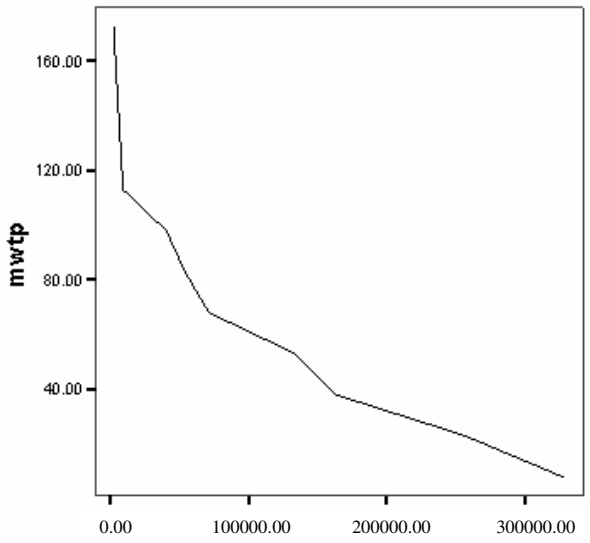
Table 4.17 Total Willingness to Pay and Total Revenue for Improved Sludge Disposal

WTP interval (1)	Frequency distribution (sample)		Mid WTP (4)	Total No of HHs (5)	Total WTP (6) [1]	Sample HHs WTP at least that amount (cumulative)		Total HHs WTP at least that amount (Cumulative) (9)	Total Revenue (10) [2]
	(2) No.	(3) %				(7) N0.	(8) %		
0-15	36	21.3	7.5	70171	526283	169	100	329442	2470815
16-30	48	28.4	23	93561	2151903	132	78	256325	5895475
31-45	15	8.9	38	29320	1114160	84	49.6	162764	5045032
46-60	32	18.9	53	62265	3300045	69	40.7	133444	7072532
61-75	9	5.3	68	17460	1187280	37	21.8	71179	4840172
76-90	7	4.1	83	13507	1121081	28	16.6	53709	4457847
91-105	16	9.5	98	31297	3067106	21	12.5	40212	3940776
106-120	0	0	113	0	0	5	3	8915	1007395
121-145	4	2.4	133	6918	920094	5	3	8915	1185695
146-200	1	.6	173	1977	342021	1	.6	1997	345481
Total	169	100		329442	13729973				

[1] computed by multiplying (4) by (5)
[2] computed by multiplying (4) by (9)
Source: survey result

Below the demand curve is sketched. The negative relationship shows the disincentive effect of increasing price on the demand for the proposed improvement, while other things are kept constant.

Figure4.2 estimated demand for improved sludge disposal



4.4.3. Estimating Total Willingness to Pay for Public Toilets

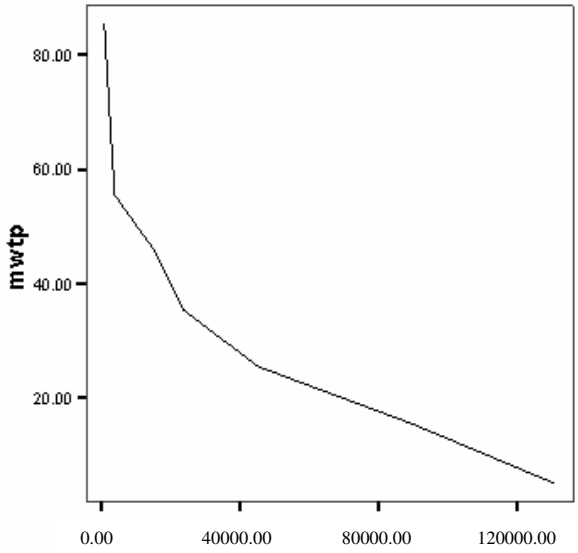
Following the same approach as for the previous two cases, the calculated total willingness to pay for 130,731 households who have no on-site sanitation facility is presented in the table below. The total benefit is 2, 541,576 birr per year if public toilets are constructed and open for service. Below table of total revenue and demand curve is given respectively.

Table 4.18 Total Willingness to pay and Total Revenue for Public Toilets

WTP interval (1)	Frequency distribution (sample)		Mid WTP (4)	Total No of HHs (5)	Total WTP (6) [1]	Sample HHs WTP at least that amount (cumulative)		Total HHs WTP at least that amount (Cumulative) (9)	Total Revenue (10) [2]
	(2) No.	(3) %				(7) N0.	(8) (%)		
0-10	42	31.6	5	41311	206555	134	100	130731	653655
11-20	45	33.8	15.5	44187	684899	91	78.6	89418	1385979
21-30	22	16.5	25.5	21571	550061	46	44.8	45231	1153391
31-40	8	6	35.5	7843	278427	24	18.3	23660	839930
41-50	12	9	45.5	11765	535308	16	12.3	15817	719674
51-60	1	.8	55.5	1046	58053	4	3.1	4052	224886
61-70	2	1.5	65.5	1960	128380	3	2.3	3006	196893
71-80	0	0	75.5	0	0	1	.8	1046	78973
81-90	0	0	85.5	0	0	1	.8	1046	89433
91-100	1	.8	95.5	1046	99893	1	.8	1046	99893
Total	134	100		130731	2541576				

[1] computed by multiplying (4) by (5)
[2] computed by multiplying (4) by (9)
Source: survey result

figure4.3 estimated demand for public toilets



4.5. Matching Costs and Benefits[1]

The AAWSA have estimated the corresponding cost figures for a possible sanitation improvement. This is separately done for the respective sanitation facilities. To start with the sewer connection, the bureau reveals that 83.3 Birr per month is expected from households in Addis Ababa using flush toilets to guarantee hundred percent cost recovery. And the report on the new master plan (2002) states that, projects that ensure full cost recovery are the ones (and the only ones) that are going to be pursued. The survey result attest that should this be the governments policy, only 2% of current flush users are the ones that are willing to pay the stated amount. Further this price produces the lowest revenue collection of the prescribed estimates. If we take the mean willingness to pay per month, 20.48 Birr per month, it is calculated that only 24.6% of the cost has the possibility of being recovered. The rest 75.4% (or 62.82 Birr/month) of the cost is the subsidy amount that is expected to be covered by the government.[2]

Coming to improved sludge disposal, information from the bureau shows that 196 Birr per trip is the amount needed to cover the cost for the improvement. When this is calculated the bureau has found that the average frequency of emptying a tank by a household is once in a year. This is what is also testified by our sample survey. According to our results, households who are willing to pay the aforementioned price do not even reach 1%. The mean willingness to pay is 65 birr per trip per year. Thus it is

[1] Since cost estimates for sewer and sludge disposal are the only ones that are available, affordability analysis is only computed for only sewer connection and improved sludge disposal.

[2] A majority of households using flush toilets are residing in high income areas thus affordability analysis in the different income categories doesn't give much difference. Therefore the possibility of cross subsidy between different income categories in this case is very mimic.

evident that the government is expected to cover the rest (more than 120 birr) through subsidy for the proposed improvement.

The above simplistic affordability analysis shows that none of the proposed improvement could meet cost recovery basis. As mentioned in earlier sections, the hypothetical scenarios are reflecting what is going to be implemented in the coming five years by the government. Thus, the result poses a question of warning in the policy design that has left out a huge part of policy planning, demand (WTP) side analysis.

In the course of the inception of this survey, people have expressed a number of views about the existing sanitation service. It was stated that, almost all were opting for a change. This very much supports what the government is trying to do in the supply side. But when laying down strategies for sustaining efficient services with strong equity basis, realistic knowledge on households WTP should be of high priority. If not, the current poor sanitation services could be aggravated.

4.5.1. Policies and Institutions on Sanitation Service: A Brief Review

It was in 1997 that the environmental policy of Ethiopia was approved by the council of Ministers. The policy is fully integrated and compatible with the overall long-term economic development strategy of Agricultural Development Led Industrialization (ADLI) and other key policy issues on population and women. The environmental policy's overall goals can be summarized as follows:(a) improvement and enhancement of the health and quality of life of all Ethiopians, (b) promotion of sustainable social and economic development through the adoption of sound environmental management principles.

In this policy framework we also find the conservation strategy of Ethiopia. The strategy attempts to provide an overall comprehensive and rational approach to environmental management by incorporating rational and regional strategies; sectoral and cross-sectoral policies, action plans and programmes. It recognizes the importance of considering environmental factors at the initial stage of planning developmental activities. This approach enables planners to take in to account environmental issues as integral components of economic, social and cultural development. Hence, Environmental Protection Authority was finally established in 1995 to oversee the successful implementation of the above-mentioned policies and strategies. Under this umbrella organization both AAWSA and Addis Ababa city administration environmental protection bureau jointly enforce quality and health standards criterion with the aim of improving sanitation services of the city of Addis Ababa.

Generally, the policy and institutional framework seem to give due consideration to environmental issues and concerns are directed to this end. Concerted effort by both parties in the undertaking is directed towards the realization of this objective. All these have paramount significance in minimizing environmental hazard and improving living standards. In a broader framework, the overall environmental policy directions are very comforting for sustainable and efficient sanitation services. But it should also be emphasized that this strategy has to be backed up (supported) by appropriate proclamations and directives. A number of proclamations have been issued in the past but very little attention is given to the demand side and to people's preferences and choices. Ironically enough it is the household who will finally be paying for the service that is

supplied by the government. So, if the city administration does not know the needs and the paying ability of the households the policies remain inefficient.

As indicated above, the government has tried to formulate clear policies in relation to environmental matters, but existing directives and legislations are not inkeep with the policy framework. In the legislation issued by the state to direct the duties and responsibilities of AAWSA and related offices we find very clear instructions how sewer systems are constructed, how improved sludge disposal improvements can be made and how these services should be paid for. The policy document stipulates that the households should pay any expenditure incurred by the city administration to improve the services. This shows a total neglect to the demand side. And it is this kind of oversight that has made developing countries expending too much to upgrade their services but not getting what they expect in return. We believe policies are for the people. And it is not enough to put polished policies. If policies are not to be supplemented with appropriate legislations we will be confronted with bottlenecks at grassroots level to achieve the policy objectives. It is therefore high time that we set legislations, which promote sanitation services based on people's preferences, and willingness to pay and evolve from the traditional supply dominated strategies.

4.6. Establishing Suitability of CVM

One objective of this paper is to establish the suitability of CV method for sanitation service in Ethiopia. From the literature that is reviewed we can see that, CV method is still going through a number of debates within and outside the field of economics about its suitability. This by and large emanates from its nature that it is based on direct people's valuation. And people may not give true answers for various reasons and thus

we cannot confidently use their statements for a policy implication is the main criticism of the method. It is this fact that initiates various CVM applications to include the suitability issue as one of their objectives. Every successful CV empirical undertaking is a testimony that indeed the method is applicable for a number of environmental services. Infact, what was seen in the late 80s and throughout the 90s is a bountiful CVM application in wide range of services. Whittington et al (1992) stated that, in order for a CV survey to be suitable the results brought forth have to be in conformity with theoretical expectations and previous empirical works. With this caveat in mind, they stated based on their findings that CV method is very appropriate for studies in sanitation services in Ghana and other developing countries. Assefa (1998) and Genanew (1999) also established that CV is suitable to derive demand for water services in Ethiopia using the same argument.

In this study the overall results demonstrate that the WTP responses from the CV survey using bidding game elicitation technique are not ad hoc but they are systematically related to independent variables found in theory and empirical litrature. Besides, the validity check on the WTP figures shows that they are valid according to construct validity test. Hence, it is possible to suggest the CV survey as a suitable (feasible) method for estimating WTP for improved sanitation services in Ethiopia.

Chapter Five
CONCLUSION AND POLICY IMPLICATIONS

Most developing countries are entangled by acute shortage of basic infrastructure facilities. Especially, urban centers of these nations are facing multi-dimensional problems due to the immense population pressure and poor urban planning. As supply side problems are in fact eminent, demand side issues has revealed of much significance. Lack of knowledge about people's preferences and WTP for public services has been deemed a major obstacle. Coming to sanitation service in Addis Ababa, capital city of Ethiopia, again the above-mentioned problem is highlighted. The alarmingly increasing population coupled with the increasing urban poverty and poor living standard shows that the current deteriorated condition will be even unbearable in the future. Recognizing the poor current condition of sanitation service, the government of Ethiopia (through AAWSA) is finalizing a new sanitation master plan. As supply side features seem to be overdone, demand side issues are not properly addressed. Therefore, this paper is intended to bridge the gap in information for policy initiatives.

This paper analyzed the determinants of WTP for improved sanitation service in Addis Ababa. For this, the study undertook a contingent valuation survey of 440 households. Three willingness-to-pay scenarios were formulated. In fact, most of the hypothetical willingness-to-pay questions are reflecting what is going to be undertaken by the government in the near future. WTP for sewer connection, WTP for improved sludge

disposal and WTP for public toilets were hypothesized as an improvement for those owning flush toilets, pit latrines and those with out any on-site sanitation facility respectively. The questionnaire was administered through face-to-face personal interview using bidding game elicitation format.

The information from the CV survey was analyzed in two ways: descriptive analysis and multivariate analysis. The descriptive analysis shows that 29% of the respondents use flush toilets, 38% pit latrines, 10% public toilets and the other 23% use forests, rivers, and roads and the like for their sanitation needs. As the attribute of each sanitation facility is very different from one another, the problems observed are also distinct to each class of service. Flush toilet users have shown a general desire for the suggested change though they said the current system is good. Surprisingly, it has also been evident that many households have illegally connected their flush toilets to rivers and underground pipelines that are not intended for sewer use. Pit latrine users have disclosed a general lack of fast and reliable sludge disposal mechanisms as their main problems. Respondents using public toilets said that, they couldn't say that they are getting any service at all. Most of the toilets are in a far distance to use for their daily sanitation needs; besides most of them are out of service and those currently in use are out of order. And those respondents without any facility rated their problem as very critical. But they said that the government has not given it much attention. Form the 434 usable questionnaires only 17 zero willingness-to pay responses were given where none of them were treated as protest zeros.

Response to the valuation questions revealed that, the mean WTP for sewer connection is 20.48birr/month. 45.66 birr/trip is the mean WTP for improved sludge disposal.

Correspondingly since both the mean and modal frequency by which households empty their tank is once a year the WTP amount could be taken as WTP per year. The mean WTP is 22.86 birr/year if public toilets are constructed and opened for service.

The construct validity test, which according to Mitchell and Carson (1989) implicates the consistency of WTP bids with theoretical expectations, was conveyed. Accordingly, the WTP bids were highly correlated with income, showing they are valid in our study.

Multivariate analysis using Heckman two-step selection model was done for the three WTP scenarios. In summary; income, education, sex, family size, and age were found to be significant in almost all cases. But there is a contradiction to what family size is expected to affect WTP in the case of WTP for sewer connection and WTP for improved sludge disposal. This was explained from the descriptive part that, those who use the two facilities are from high and middle-income areas. Thus relatively speaking, since they are financially better off instead of worrying about the increasing financial obligation coming with increased family size, they are more concerned about their members' health and well-being. So for the two cases a positive relationship was found. Age is unexpectedly positive with WTP for all the three cases. This shows the possibility of accumulating wealth besides a possible attitudinal change by elders, which could be credited to the current movement by the government and others to improve the current situation. Starting point bias was only found in WTP for sewer connection.

A simplistic matching between supply and demand shows that households in Addis Ababa are unable to pay for the proposed improvements except for public toilets where supply side data is not yet available. For the sewer connection, only 2%of current flush users are able and willing to pay if improvements are underway. And for the improved sludge disposal it doesn't even reach 1%. Generally, if the proposed changes are to be implemented on the ground, none could satisfy cost recovery criterion. In a glimpse look at the policy framework, the government has formulated clear policies but hasn't give enough thought to legislations and corresponding laws to go in-line with the objectives of the policy. The main problem we found is lack of demand side policies.

Based on the findings that we have, we can draw the following ***policy implications*****:**

- Cost recovery policy is a very good one in ensuring sustainable public services. Especially, for a country like Ethiopia, it is even much more appealing, since the government by itself is unable to finance such investments. But, it should be underlined that this shouldn't overlook people's preferences and willingness to pay. As mentioned at the start of this paper, the government has stated that it will only be engaged in projects that ensure full-cost recovery. From our finding, this is a far-fetched dream. For the two proposed changes (SW systems and improved sludge) where cost per household is calculated for cost recovery analysis, none of them could meet this criterion. In fact, there is a large subsidy amount that is expected from the government. Thus, instead of arguing that cost recovery is the only way out, the government should think of ways by which it could minimize cost, increase aggregate revenue and there by decrease subsidy amount if change has to come.

- The strong positive relationship between education and willingness to pay for improved sanitation services shows that indeed investments on education are very crucial. So there is a need to educate people about the benefits associated with improved sanitation services.

- Improving sanitation could not be done alone rather it has to go hand in hand with improvements in other infrastructure provisions. Especially, road facilities and adequate water supply has to be secured. Therefore when thinking of improving sanitation services, it has to be done in a broad urban development framework of the city. If not it will inhibit effective and efficient improvements in sanitation service since one facility complements the other one.

- It has been seen from the empirical investigation that the three sanitation facilities have different attributes and serve different class of population. The regression result showed that, the determinants of WTP for the three sanitation services are different. So in policy formulations, one should duly recognize the inherent differences and design integrated strategies for the respective class of services.

- The research has witnessed not few non-governmental initiatives to circumvent the apparent poor sanitation situation. Especially, in low-income areas, a number of public toilets were built by these non-governmental organizations. So, this promising effort has to be supported by the government.

- Finally, the WTP bids could be used to predict the level and types of sanitation demanded by households. This information is vital for relating standards of services (sewer system, preference for improved sludge system and public toilets) and design criteria. This will undo what may come from misuse of resources by over design or unsatisfied demand by under designing schemes. Therefore, it is suggested that the relevant authority could use approaches such as CVM to emanate information on the level of demand especially in the design of the master plan. The possibility could help to get out of the current supply dominated policy and set out design criteria for improved sanitation projects and programmes.

Annex 1

Correlation Matrix for WTP1

	sex	fhead	fsize	mstat	age	edu	occ
sex	1.0000						
fhead	0.0813	1.0000					
fsize	-0.1024	0.0680	1.0000				
mstat	-0.0338	0.5740	0.1713	1.0000			
age	0.0866	0.6783	0.1820	0.6692	1.0000		
edu	0.0824	-0.0962	-0.1128	-0.0833	-0.0143	1.0000	
occ	0.1381	-0.0966	0.0266	-0.1408	0.0235	0.0618	1.0000
yrstay	0.0405	-0.0055	0.2099	-0.0155	0.2032	-0.1100	0.0246
housi	-0.0140	0.0644	-0.2824	0.0372	-0.0602	0.0490	0.0725
stapr	-0.0023	0.1237	0.1961	0.1398	0.0358	0.1459	0.0955
WTP1	0.0644	0.0618	0.0787	0.0231	0.1109	-0.0429	0.2418
Adm	0.0234	0.0104	-0.1327	0.0727	0.0157	0.1083	0.0879
levosatf	0.1076	0.0102	0.0245	-0.0525	-0.0228	0.1156	0.1178
loca	-0.0244	-0.0927	0.1738	-0.0621	-0.0551	-0.0178	0.0765

| yrstay housing stapr WTP1 adm levosatf loca
---|---
yrstay | 1.0000
stapr | -0.0191 -0.1234 1.0000
WTP1 | 0.0652 -0.0046 0.3096 1.0000
Adm | -0.1489 0.1832 -0.0681 -0.1853 1.0000
levosatf | -0.0285 0.1101 0.1492 0.1324 0.0630 1.0000
loca | 0.1509 0.2952 -0.0154 -0.0564 -0.1457 0.0960 1.0000
housing | -0.4202 1.0000 -0.1234 -0.0046 0.1832 0.1101 0.2952

| housing
---|---
housing | 1.0000

.

Correlation Matrix for WTP2

| fsize age yrstay strprice WTP2 income housing
---|---
fsize | 1.0000
age | 0.0305 1.0000
yrstay | 0.1169 0.4820 1.0000
strprice | 0.1488 -0.0353 -0.0303 1.0000
WTP2 | 0.0813 0.0269 0.0216 0.2534 1.0000
income | 0.1743 0.0030 0.0560 0.1677 0.3155 1.0000
housing | 0.1199 0.0173 0.1346 -0.0540 0.0054 0.2659 1.0000
levosatf | -0.0136 0.0821 0.0752 0.1066 0.1970 0.2499 0.2066
adm | -0.0316 0.0381 0.0989 0.0728 -0.0257 -0.0117 -0.1151
gender | 0.1988 -0.1059 -0.0526 0.0453 -0.0968 -0.0083 0.1174
fhead | -0.1915 0.4169 0.0398 0.0774 0.1301 -0.0572 -0.2301
mstatus | -0.1451 0.4080 0.0412 0.0543 0.0766 0.0158 -0.1956
housing | 0.1199 0.0173 0.1346 -0.0540 0.0054 0.2659 1.0000
edu | 0.0264 -0.4461 -0.1452 0.0650 0.1306 0.2641 0.2318
loca | 0.1052 -0.0987 -0.0842 0.1172 0.0714 -0.1514 -0.0916

| levosatf adm gender fhead mstatus housing edu
---|---

```
   levosatf |   1.0000
      adm   |   0.1064   1.0000
     gender |  -0.0502  -0.0518   1.0000
      fhead |   0.0261    0.0276   -0.0414   1.0000
    mstatus |  0.0408     0.1373  - 0.1305   0.6036   1.0000
    housing |   0.2066   -0.1151    0.1174  -0.2301  -0.1956   1.0000
        edu |     -0.0056  - 0.0342   0.2013  -0.2324  -0.3152   0.2318   1.0000
       loca |       -0.0047  -0.0457   -0.0424   0.0032  -0.0158  -0.0916  -0.0635

            |     loca
------------+---------
       loca |   1.0000
```

.

Correlation Matrix for WTP3

```
            |        Sex     fhead      fsize    mstatus       age         edu      occ
------------+------------------------------------------------------------------------
        sex |    1.0000
      fhead |    0.0788   1.0000
      fsize |     0.0024  -0.1264   1.0000
   mstatus |  -0.0730   0.6379     0.0356   1.0000
        age |    -0.1159   0.5297   0.0602   0.6642   1.0000
        edu |     0.1396  -0.4309   0.0808  -0.5135  -0.6303   1.0000
        occ |     0.0917  -0.2032   0.0317  -0.2610  -0.1755   0.2774   1.0000
     yrstay |   -0.0829   0.0649     0.1256   0.1873   0.4431  -0.1881  -0.0308
     stprice |     0.0877   0.1173  -0.1274   0.0713   0.0069  -0.1191  -0.0597
     Income |   0.0627   0.0413      0.2025  -0.0284   0.0049  -0.0022   0.0694
WTPPUB |     0.0384  -0.0602  -0.0968  -0.1536  -0.0944   0.0658   0.0873
    housing |    0.1330  -0.1503     0.1920  -0.0908  -0.0727   0.1641  -0.0302
   adm          |   -0.0302   0.0568      0.0739   0.0487  -0.0084   0.1265   0.0231
   levosatf |     -0.1006  -0.0236   - 0.0983  -0.0379   0.2017  -0.1188  -0.1230
```

loca	0.0341	0.0468	0.0336	-0.1049	-0.0534	-0.0023	-0.1359

	yrstay	stprice	income	WTP3	housing	adm	levosatf
yrstay	1.0000						
stprice	-0.1058	1.0000					
income	-0.1734	0.0092	1.0000				
WTP3	-0.1024	0.1267	0.2498	1.0000			
housing	0.1165	-0.0484	0.0149	0.2040	1.0000		
adm	-0.0367	-0.0470	0.0657	-0.1362	-0.1357	1.0000	
levosatf	0.0814	-0.0952	-0.1062	-0.1030	-0.1070	-0.0721	1.0000
loca	-0.0098	-0.1958	-0.0611	0.0982	0.1858	-0.2516	-0.0515

	loca
loca	1.0000

Annex 2

Cook-Weisberg test for heteroskedasticity using fitted values of WTP1
Ho: Constant variance
Chi2 (1) = 35.00
Prob > chi2 = 0.0000

.

Cook-Weisberg test for heteroskedasticity using fitted values of WTP2
Ho: Constant variance
Chi2 (1) = 14.84
Prob > chi2 = 0.0001

Cook-Weisberg test for heteroskedasticity using fitted values of WTP3
Ho: Constant variance
Chi2 (1) = 33.93
Prob > chi2 = 0.0000

Annex 3

Addis Ababa University
Department of Economics
A Contingent Valuation Survey Questionnaire

Code: _____

Place of Interview: _____ (Write Woreda and Kebele Number)

Interviewer: _____

Duration: _____ minutes

Supervisor: _____

Interviewer: Read the Following Before You Start Interviewing.

Hello. My name is _____. I am assisting an on-going research by Mr. Biruk Gezahegne, in partial fulfillment of his M. Sc degree at Addis Ababa University. We are talking to selected sample households in Addis Ababa city about demand for improved sanitation services. As most of the questions have to do with your attitudes and opinion, there are no right or wrong answers.

Your opinions will be used as an input in policy decision-making.

This interview is completely confidential. Your name will never be associated with your answers. Therefore, feel free to express your view with at most honesty.

We start the interview by asking you about you and your family members personal characteristics.

1) Sex of the respondent **(Observation)** _____
    a. Female
    b. Male
2) Are you head of the family?
    a. Yes **(go to Question No. 4)**
    b. No **(go to Question No. 3)**
3) What is your relationship with the head of the family? _____
4) How many people (including you) live in this house?
    _____ Numbers.
5) Marital Status?
    a. Married
    b. Single

6) Please describe (including yourself) your family member's age, educational qualification and occupational status.

Interviewer: Please fill out the table according to the instructions (encircle the respondent)

***For the Sex Column:**
-Write 1 if female
0 if male

***For Education Column:**
-Write 1 for illiterate
2 for primary
3 for secondary
4 tertiary and above.
(Encircle the level completed for 2,3, and 4)

***For Occupation Column:**
-Write 1 if trade
2 if housewife
3 if student
4 if unemployment

***For the Remark Column:**
-Write 1 if self employed
2 if employed in private companies
3 if government employed
4 if unemployed and specify if any other.

No.	Name	Sex		Age	Educational Level	Occupation	Remark
		Male	Female				

I. Housing Characteristics and Household Income.

7) Who is the owner of this house?

   a. Your own house
   b. Rented for Kebele
   c. Rented from Government
   d. Rented from Private owners
   e. Others (specify) _____

8) If rented how much is the monthly amount of rent? _____ Birr\month

9) How long have you been staying in this house? _____Years.

10) Does this house have electricity?

   a. Yes
   b. No

11) What is the main source of water supply for this household?

   a. Private Pipe
   b. Public tap (Bono)
   c. Springs
   d. Others

12) Do you have the following in your house?

   a. Radio_____ 1. Yes 2. No
   b. Tape_____ 1. Yes 2. No
   c. Television _____ 1. Yes 2. No
   d. Telephone _____ 1. Yes 2. No
   e. Refrigerator _____ 1. Yes 2. No

13) Main monthly expenditures of the household (on average in Birr)

   a. Housing _____
   b. Food _____
   c. Consumption (electricity, diesel, charcoal, firewood, etc) _____
   d. Transportation _____
   e. Education (monthly fee, pencils, exercise books, etc)_____
   f. Health _____
   g. Telephone _____
   h. Water _____
   i. Clothing _____
   j. Other Expenses (Ekube Edir, etc) _____

14) Monthly income of the head of the family (in Birr) _____.

15) Other monthly income of the household from other members and other sources (in Birr)

_____.

16) Please list the following services in order of importance (list as first, second, etc.)

1) School _____ 2) Health _____
3) Water _____ 4) Sanitation _____
5) Road _____ 6) Electricity _____
7) Telephone _____

II. Existing Household Sanitation Practice.

17) What type of sanitation system does this household most frequently (i.e. usually) use?

a. Facility in house
   a.1. Flush toilet **(go to question 18)**
   a.2. Pit latrine **(go to question 26)**
   a.3. Other (specify)

b. No facility in house **(go to question 34)**

   b.1. Use public latrine
   b.2. Bush
   b.3. Streets
   b.4. Other (specify)

For the Households Using Flush Toilet.

18) How would you describe the condition of the flush toilet in this house in terms of:

a.	Privacy	1. Good	2. Fair	3. Poor
b.	Cleanness	1. Good	2. Fair	3. Poor
c.	Convenience	1. Good	2. Fair	3. Poor

19) Do you share the flush toilet with other households?

a. Yes
b. No

20) If yes, how may households use the toilet facility?

_____Number of households

21) Who arranges for the septic tank to be emptied?

a. Landlord
b. Self
c. Other (specify) _____
d. Never been emptied

22) Who emptied the tank oftenly?

a. Government Service
b. Private Companies
c. Other (specify)

23) How often is the tank emptied?

_____Times _____Years or others (Please specify).

24) What is the share of cost for this household for emptying the tank?

_____ Birr/year

25) How satisfied are you with the flush toilet you now have?

a. Very satisfied
b. Satisfied
c. Not satisfied at all

For Households Using Pit Latrine

26) How would you describe the condition of the pit latrine in this house in terms of

a.	Privacy	1. Good	2. Fair	3. Poor
b.	Cleanness	1. Good	2. Fair	3. Poor
c.	Convenience	1. Good	2. Fair	3. Poor

27) Do you share the pit latrine with other tenants in the house?

a. Yes
b. No

28) If yes, how many households use the pit latrine?

_____ Number of households.

29) Who arranges for the septic tank to be emptied?

a. Landlord
b. Self
c. Other (specify) _____
d. Never been emptied

30) Who emptied the tank oftenly?

a. Government Service
b. Private Companies
c. Other (specify)

31) How often is the tank emptied?

_____Times _____Years or others (Please specify).

32) What is the share of cost for this household for emptying the tank?

_____ Birr/year.

33) How satisfied are you with the pit latrine you have?

a. Very satisfied
b. Satisfied
c. Not satisfied at all

For the Households Using Public Latrines

34) How would you describe the condition of the public toilet your households use in terms of:

a.	Privacy	1. Good	2. Fair	3. Poor
b.	Cleanness	1. Good	2. Fair	3. Poor
c.	Convenience	1. Good	2. Fair	3. Poor

35) How far is the public latrine from your home?

_____ KMs (Meters).

36) Is the public latrine usually on service?

a. Yes
b. No

37) Do you pay any amount to get the service?

a. Yes
b. No

38) If your answer to question 37 is 'Yes', how much do you pay?

_____ Birr/month (other specify)

39) How satisfied are you with the public latrine you use?

a. Very satisfied
b. Satisfied
c. Not satisfied at all

III. Willingness to Pay

Interviewer: Please read the following instruction to the respondent before starting the interview.

When we say 'improved sanitation' we mean among other things,

a) Providing a toilet facility which is convenient, clean and private for those without any in-house sanitation facility
b) Ensuring better sludge disposal mechanisms for households who are currently using dry pit latrines
c) Connecting water flushed toilet with a sewer system.

40) Which of the following sanitation facilities does this household frequently use?
    a. Flush toilet (Please refer to Question No. 41)
    b. Pit Latrine (Please refer to Question No. 46)
    c. Public toilet and others (Please refer to Question No. 50)

41) Assume that it is possible to connect the waste disposal of your flush toilets with underground pipelines by the roadside near your house. This waste disposal method is known as '***sewer***'. This disposal method enables us to drain the waste that comes out of the toilet directly to the pipes that are installed by the roadside. By so doing, the water will not clog up or overflow. And there will be no tank to be emptied. Assume further that the government will cover all the expenses initially and collect it little by little over long-term amortization. The payment can be built-in the monthly water bill (It can come along with the monthly water bill).

42) Have you ever come across such sewerage system in the past?
    a. Yes
    b. No

43) Are you interested in the proposed system?
    a. Yes **(go to Question No. 44)**
    b. No. **(go to Question No. 45)**

44) Are you willing to pay _____ Birr per month, if your toilet is connected to the sewer system?

a. Yes
b. No

If the reply is "Yes" please inquire the willingness to pay by increasing ¼ of the pledged amount until the respondent says he cannot pay no more

If the reply is "No" please inquire the willingness to pay by decreasing ¼ of the requested amount.

Maximum Willingness to Pay _____ Birr/Month.

45) You are not interested in the system

a. Because you believe that the existing system is adequate
b. It is very expensive
c. It is the government's responsibility
d. Other (if any) _____

46) If the government in any attempt to improve waste disposal method of existing dry pit latrines by bringing in new and additional vehicles which can provide fast and reliable service; will you be interested in the system?

a. Yes **(go to Question No. 47)**
b. No **(go to Question No. 49)**

47) Are you willing to pay _____ Birr annually for the proposed improvement?

If the reply is "Yes" please inquire the willingness to pay by increasing ¼ of the pledged amount until the respondent says he cannot pay no more

If the reply is "No" please inquire the willingness to pay by decreasing ¼ of the requested amount.

Maximum Willingness to Pay _____ Birr/Year.

48) In the past, how many times in the year do you empty the tanker?

_____ Times _____(Year or other specify)

49) You are not interested in the system.

a. Because you believe that the existing system is adequate
b. It is very expensive
c. It is the government's responsibility
d. Other (if any) _____

50) Are you interested in the construction and expansion of public toilets?

a. Yes
b. No

51) If your answer is "Yes", assume that better public toilet is constructed and opened for services. These toilets facilities can be constructed in such a way that they are convenient, and clean. If such toilets are constructed and opened for service, are you willing to pay _____Birr per year.

If the reply is "Yes" please inquire the willingness to pay by increasing ¼ of the pledged amount until the respondent says he cannot pay no more

If the reply is "No" please inquire the willingness to pay by decreasing ¼ of the requested amount.

Maximum Willingness to Pay _____ Birr/Year.

To All Types of Respondents.

52) Who do you think should be mainly responsible for the provision of sanitation services?

a. The government
b. Individual
c. The community
d. Others (specify)

53) How do you measure the effort made so far by the city council to provide sanitation facilities?

a. Very Good
b. Good
c. Fair
d. Poor

54) How much do you think sanitations an issue worth discussion?

a. Very Serious
b. Serious
c. Not an issue to discuss about

55) What is your opinion for improved sanitation services in the future?

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