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Influence of governance institutions on households' willingness to pay for improved solid waste management in the peri-urban settlements of Matsapha, Swaziland

By

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DECLARATION

I hereby declare that this dissertation which I submit for the degree of MSc Environmental Economics at the University of Pretoria is my own work and it has not been previously submitted by me for a degree at this or any other higher education institution.

Signature…….

Nonduduzo Ndlovu

Date……

Approved by:

Signature…….

Prof E. D. Mungatana

Date……

DEDICATION

This dissertation is dedicated to my mom for all the sacrifices she has made to give me a better future. It is also dedicated to my amazing brothers, Morris, Mpendulo, Sandile and Sikhumbuzo, for all the support they have given me. To God, my Father, for His endless provision for strength: I could have not made it without Him.

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ABSTRACT

INFLUENCE OF GOVERNANCE INSTITUTIONS ON HOUSEHOLDS' WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT IN THE PERI-URBAN SETTLEMENTS OF MATSAPHA, SWAZILAND

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This study uses the double-bounded willingness to pay (WTP) bid elicitation format to test whether the institution providing improved solid waste management (SWM) services in the Matsapha peri-urban area of Swaziland significantly influences households' WTP. Matsapha was purposely selected on account of its well-documented human health and environmental impacts of poor SWM, arising from the lack of a proper SWM system. The WTP for improved SWM by households was thus elicited and compared when the service provider was an independent public agency (the Matsapha Town Council), a traditional community development agency (the Kwaluseni Inkhundla), and a private contractor. Purposive and simple random sampling methods were used to collect survey data from 180 households, using structured questionnaires and face-to-face interviews.

Overall, households display a high level of knowledge about the risks associated with poorly managed household solid waste, and have attitudes and perceptions that are receptive to a policy that improves the current status of SWM. Mean WTP for improved SWM was highest when the service provider was the Matsapha Town Council (mean E47.71, with upper bound (UB) E56.29 and lower bound (LB) E13.33), followed by the private contractor (mean E43.71, with UB E42.50 and LB E11.67), and finally, the Kwaluseni Inkhundla (mean E36.49, with UB E50.83 and LB E12.14). Additional analysis showed that the mean WTP did not statistically differ when the SWM service was provided by the Matsapha Town Council or the private contractor ($t = 1.52$, $p = 0.1331$), which was unexpected, given that the latter is generally viewed as more efficient and cost effective. Mean WTP was, however, significantly higher when the service provider was the Matsapha Town Council, in comparison with the Kwaluseni Inkhundla ($t = 4.28$, $p = 0.0001$). Finally, the mean WTP was

significantly higher when the service provider was the private contractor, in comparison with the Kwaluseni Inkhundla ($t = 2.90$, $p = 0.0053$). This allows us to conclude that the institution providing improved SWM services significantly influences households WTP, and that households rank the Matsapha Town Council as the most-preferred service provider.

The study further established that in areas where SWM services are currently provided at a fee, households have a WTP for improved services that is much higher than current charges. For example, in areas where private collectors currently provide SWM services, households pay a monthly charge of E30.00, while our analysis shows they have a mean WTP of E43.71. The study additionally showed that in areas where no SWM services are currently provided, households would be willing to pay a positive monthly fee, if such services were to be provided. This allows us to conclude that the provision or improvement of SWM practices in the Matsapha peri-urban area of Swaziland, at a fee, would result in a Pareto improvement.

Ordered Probit models, differentiated by SWM service provider as defined above, were used to determine the factors that influence households' WTP for SWM services. The results, overall, show that households' WTP significantly increases with the following variables: income, gender (e.g. WTP for females was significantly higher than for males), number of rental units in a compound, marital status (e.g. WTP for married people was significantly higher than for the singles) and number of tenants in a compound. On the other hand, WTP was found to significantly decrease with age, household size, attitude and perceptions of respondents.

Following from the above, the study recommends that the Matsapha Town Council should consider improving the quality of SWM practices in areas where they are currently provided at a fee, and also consider providing such services in areas where they are not currently provided at a fee. Our analysis suggests that the Matsapha Town Council could levy a monthly fee that ranges between E13.33 and E56.29 per household. The actual value of the monthly fee should, however, be determined through a stakeholder engagement process.

Keywords: solid waste management, improved services, willingness to pay, contingent valuation method, double-bounded dichotomous bid elicitation, peri-urban areas, Swaziland.

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ACRONYMS

DPMO – Deputy Prime Ministers Office

CVM – Contingent Valuation Method

CV – Contingent Valuation

EV – Equivalent Variation

KI – Kwaluseni Inkhundla

MHUD – Ministry of Housing and Urban Development

ML – Maximum Likelihood

MRS – Marginal Rate of Substitution

MRT – Marginal Rate of Transformation

MTC – Matsapha Town Council

NGO – Non-Governmental Organisation

NDDC – National Data Development Centre

PC – Private Contractor

OECD – Organisation for Economic Cooperation Development

RUM – Random Utility Model

SEA – Swaziland Environmental Authority

SNL – Swazi Nation Land

SWM – Solid Waste Management

TDL – Title Deed Land

UNEP – United Nations Environmental Program

USEPA – United States Environmental Protection Agency

WTP – Willingness to pay

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

The Organisation for Economic Cooperation and Development (OECD, 2007) defined solid waste management (SWM) as controlling, monitoring and regulating the production, collection, transportation, treatment and disposal of waste. According to the United States Environmental Protection Agency (USEPA, 2002), appropriate SWM includes waste prevention, consistent collection, recycling, composting, burning and landfilling. The main objective of SWM should be to produce direct health benefits, improve the environment, provide safe, dignified and secure employment, and support economic productivity (Rouse, 2008:2). It follows that SWM is an essential environmental health service that is a fundamental element of basic urban services (Oteng-Ababio, 2011:412; Ahmed & Ali, 2004:468). The United Nations Environment Programme (UNEP, 2015) regards SWM as a basic human need and right, implying that it should be simple, affordable, unbiased by reaching both urban and peri-urban households (also known as informal settlements), and sustainable environmentally, socially and financially (e.g. see Rouse, 2008:2). Banga *et al*., (2011:429) further observes that to ensure an environment that is favourable to the well-being and productivity of people, SWM services need to be effectively provided.

Proper SWM helps protect the environment and human health while at the same time conserving natural resources (USEPA, 2002). It can be a solution to many global problems such as poor human health, poverty, lack of employment, climate change, shortage of resources and food, and unsustainable production and consumption (UNEP, 2015). In most developing countries, poor human health can be linked to a number of diseases related to inadequate and improper SWM. Inadequate and improper methods of solid waste disposal can attract insect and rodent vectors that can spread diseases like dengue fever and cholera, as well as other infectious diseases (UNEP, 2015; Yalew, 2012:3; USEPA, 2002; World Bank, 1999). It can also disrupt complex ecosystems resulting in water, air and land pollution which eventually affect people's living standards and development (Sterner 2003, Subhan *et al*., 2014:124). Given all these adverse impacts attributed to improper SWM, authorities are compelled to deliver adequate SWM services.

The rate of waste generated per day in many developing countries is increasing driven by high population growth, increasing urbanisation, increasing per-capita incomes, and changing consumption and production patterns. There is thus a pressing need for appropriate SWM infrastructure and technology to deal with the substantial waste generated each day (Banga *et al*., 2011:428). Despite this need, there exist many challenges that constrain the ability of developing countries' authorities to deliver adequate SWM. To begin with, most authorities lack the financial, technical, institutional and infrastructural capacities to deliver adequate SWM. For example, Abdrabo (2007:2504) reported that in Egypt, municipal SWM services are inadequately provided due to insufficient financial, managerial and technical resources. Similarly, Othman (2002:3) observed that in Malaysia lack of infrastructure, ineffective institutional arrangements, and limited financial and technical resources have resulted in insufficient and ineffective provision of SWM services. In addition, the provision of SWM services is usually considered responsibility of local authorities (Vidanaarachchi *et al*., 2006:920) to the exclusion of any other potential institutional arrangements for SWM. Local authorities are also constrained by lack of proper government legislation and policy in SWM (Vidanaarachchi *et al*., 2006:420). Lack of awareness about proper SWM strategies by authorities and the public has also been identified as a constraint to improved SWM (Khattak *et al*., 2009:2).

Following from such challenges, the SWM system in many developing countries is characterised by lack of skilled personnel with the required technical expertise for solid waste planning, operation, monitoring, landfill design and operation (Boadi & Kuithinen, 2003:216). SWM services are also not sufficient to cover peri-urban settlements and inaccessible neighbourhoods, since standard compactor trucks are not suitable for small, untarred, or inaccessible roads found in many parts of peri-urban settlements (Boadi & Kuithinen, 2003:214). Many SWM workers in developing countries also earn very low wages, with little or no training in waste management (Vidanaarachchi et al., 2006). As a result, a typical SWM arrangement in a developing country would be characterised by poor SWM including insufficient and irregular collection, open disposal and burning (Eugene & Busch, 2011; Abdrabo, 2007: 2503). Stated otherwise, modern SWM arrangements in many developing countries are ineffective and disorganised (Pearce and Turner 1994, UNEP 2013).

Unfortunately it is those who live in peri-urban areas that suffer the most from poor SWM (Zurbruegg, 2003).

With specific reference to Swaziland, the majority of peri-urban areas have access to some public services regularly provided in urban areas like clean water and electricity, but not SWM. The current official institutional arrangement for SWM in peri-urban areas is the Tinkhundla government, which has no practical ability to manage household solid waste. The Matsapha peri-urban area where this study was conducted provides a compelling case where the adverse impacts of improper SWM on humans and the environment require urgent policy attention. In this peri-urban area, the local authority does not have funds to finance waste management, and residents do not even pay rates to cover basic municipal services. Residents thus end up improperly disposing household solid waste on their plots or on open spaces near their plots. This improper disposal is causing severe pollution in rivers nearby and along major roads, reflecting a poor image of Swaziland. Human welfare in such peri-urban areas will continue to be at risk, and environmental degradation will continue to intensify unless the outcomes associated with current SWM practices are urgently mitigated.

1.2 PROBLEM STATEMENT

Matsapha, located in the Manzini region, is Swaziland's largest peri-urban area (Ministry of Housing and Urban Development (MHUD), 2007). According to MHUD (2001), a peri-urban area is an area that is in the process of development and located adjacent to formal urban boundaries and jurisdictions. It may thus resemble an urban area. A peri-urban area is usually characterised by high population growth, unplanned settlements and lack of some services routinely provided in urban areas like SWM. An urban area on the other hand is any area within the formal boundaries of a city or town. Settlements in urban areas are planned, and their boundaries are clearly marked out. Matsapha is facing rapid population growth and urbanisation, increasing per-capita income, and changing consumption and production patterns, with the result that the rate of waste generated per day is massive and increasing. In Swaziland, urban and peri-urban areas have separate institutional and legal frameworks for SWM. Peri-urban areas are governed by the Tinkhundla government, which as stated in the preceding section does not have capacity for SWM, whereas Town Boards, Town Councils or Municipalities govern urban areas.

The Swaziland Environmental Authority (SEA) declared Matsapha urban area as a waste control area in 2002 due to the high generation of household solid waste. A waste control area is any non-urban area with a high population density, generating substantial amounts of waste and where no authority is responsible for SWM (SEA, 2002). Following this declaration, SEA conducted a pilot project in Matsapha with the objective of developing a National Solid Waste Management Strategy (NSWMS) for peri-urban areas declared as waste control areas. About 500 households were involved in the pilot project.

As part of the pilot project, structures were constructed as temporary waste storage facilities. According to the Matsapha Town Council (MTC), when the waste management system was first introduced, each household was required to pay E5.00[1] per month as a refuse collection fee. The money was used towards meeting fuel expenses, paying the fees at the landfill disposal sites, and wages for the driver and the labourers. However, after some time, residents failed to pay the waste collection fee resulting in pilot project failure. As a result, there was no money to finance waste collection, therefore waste was not collected from these facilities and it was stored for a lengthy periods of time and residents ended up not using them. SEA thus reported that the pilot project did not provide all the answers that are important in addressing the current SWM situation in peri-urban areas. Currently, in the same area, a waste collection service is provided by individuals using their private vehicles to willing households at a fee of E10 per household per month. However, this service covers a limited number of households in comparison to the time when the pilot project was conducted. It can be assumed that the households who use the private waste collection service are respondents who can afford to pay for them.

Therefore given the history of different institutions that have attempted to provide SWM services in Matsapha, a split-sample technique was used in the CVM to help identify the preferred service provider. Three potential service providers were used: the Kwaluseni Inkhundla (a traditional community development agency), the Matsapha Town Council (an independent public agency) and a hypothetical Private Contractor. The Kwaluseni Inkhundla was used because it is responsible for the management of household solid waste in Matsapha,

[1] The symbol E represents the Swazi Lilangeni (plural: Emalangeni). The Swazi Lilangeni (SZL) is pegged with South African Rand (ZAR) at par. By the date of compiling this thesis the exchange rate of the South African Rand to the US Dollar was as follows: USD/ZAR 14.6068565

in as much as it has no practical ability to provide this service. The Matsapha Town Council was used since it is often compelled to collect waste from the Matsapha peri-urban area, in as much as the peri-urban area is not under its jurisdiction. Currently, household SWM services are provided by individuals using their private vehicles indicating an opportunity for private contractors in providing services to peri-urban households. An additional justification for using the split-sample was to ascertain whether respondents' WTP was influenced by the size of the first bid they were asked in the survey. If split-sample test results show different answers, it can be concluded that the respondents were taking the CV scenario earnestly (Whittington, 2002).

In the pilot study presented earlier, the SEA (2003) reported that they were facing difficulties in determining the level of costs that would be satisfactory to residents given that they had failed to pay waste collection fees. This makes a careful and detailed assessment of residents' WTP for improved SWM services in peri-urban areas of Swaziland directly respond to SEA's National SWM Strategy discussed earlier. This study thus aimed to determine new knowledge, which will assist to connect economic policies to environmental results. It will also give decision makers a summary of peri-urban SWM problems and contribute to the design of new SWM policies. This study was never conducted in any peri-urban settlements of Swaziland.

1.3 SPECIFIC QUESTIONS

This study was guided by the following specific questions:

1. Do Matsapha peri-urban households have the right understanding, approach and awareness towards improved household SWM?
2. How much are Matsapha peri-urban households willing to pay per month for improved household SWM services when each provider (Matsapha Town Council, Kwaluseni Inkhundla, and Private Contractor) provides SWM services?
3. Do Matsapha peri-urban households prefer an independent public agency, a traditional community development agency, or a private agency to provide improved household SWM services?
4. What are the determinants that influence peri-urban households' WTP for improved household SWM services?

1.4 OBJECTIVES OF THE STUDY

This study was guided by the following three objectives:

1. To evaluate households' knowledge, attitudes and perceptions towards improved solid waste management in peri-urban areas of Swaziland.
2. To determine the WTP of Matsapha peri-urban households for improved solid waste management services when each provider (Matsapha Town Council, Kwaluseni Inkhundla, and Private Contractor) provides SWM services.
3. To investigate whether the institution providing improved solid waste management services significantly influences households' WTP.

1.5 STUDY HYPOTHESES

Based on the literature on SWM, the following hypotheses were formulated:

1. The socio-economic characteristics of respondents have no influence on households' knowledge, attitudes and perceptions towards improved household SWM in peri-urban areas of Swaziland.
2. The mean WTP of Matsapha peri-urban households for improved solid waste management services does not vary with service provider.
3. The agency managing improved household SWM services has no influence on respondents' WTP for improved household SWM services.
4. All socio-economic characteristics of respondents have no influence on respondents' mean WTP for improved household SWM services.
5. The initial value of the monthly fee presented to respondents has an influence on respondents' mean WTP for improved household SWM services.

1.6 ORGANISATION OF THE DISSERTATION

This dissertation consists of five chapters. Chapter One provides an introductory part which consists of background of the study, problem statement, objectives of the study, specific questions and study hypotheses. The rest of the thesis is organised as follows: Chapter Two covers the theoretical and empirical literature, including the conceptual framework for analysis. A description of the study area, sampling, survey instrument and development,

survey implementation, data analysis, variable description, and socio-economic characteristics of households are included under Chapter Three. Chapter Four presents results and discussion that consists both statistical test and econometric estimation results. Lastly, the conclusion, recommendations and limitations of the study and areas of further research are presented in Chapter Five.

CHAPTER TWO

THEORETICAL AND EMPIRICAL LITERATURE

2.1 INTRODUCTION

This chapter presents the theoretical and conceptual framework of the CVM behind the demand for improved household SWM services. It also discusses the model for analysing dichotomous contingent valuation (CV) responses. Lastly, this chapter reviews theoretical and empirical literature that has been published on CVM to determine households' demand for improved SWM.

2.2 THEORETICAL AND CONCEPTUAL LITERATURE

2.2.1 Concept of the Contingent Valuation Method

Many services which are provided by natural resources do not have a market where they can be bought and sold; however, they can be economically valued using stated preference method (Hoyos & Mariel, 2010). The stated preference method refers to any survey-based study in which respondents are asked questions that are aimed at revealing information about their preferences or values (Freeman, 2003). One type of question asked invokes the CVM, which involves asking questions about monetary values for a specified commodity or environmental change (Freeman, 2003). Contingent valuation is a technique used to obtain information about the WTP or preferences of respondents from a direct question (Haab & McConnell, 2003). It allows researchers to conduct studies to elicit stated preferences of households for attaining more or better goods and services.

According to Carson & Hanemann (2005), CVM is also the only method that can be used to obtain existence or passive use elements of the economic importance of environmental goods or services. Contingent valuation studies provide a solution to the absence of markets for natural resource services because it presents consumers with a choice situation in which they have an opportunity to buy or sell the services in question (Carson *et al*., 2003). A CVM is designed to estimate respondents' WTP for improvements in the quality of goods or services,

as well as to determine respondents' WTP determinants (Haab & McConnell, 2003). The most significant task of a CV analysis is the design of a questionnaire and the survey procedure (Haab & McConnell, 2003).

The questionnaire should consist of a CV scenario where there are questions that ask a respondent about monetary valuations of a service, being an improved household SWM service in this study, which is meaningful to the respondent. The second element of a CV scenario is the method, or vehicle, for paying for the service that connects the payment with the service such that without the payment, there would be no service. According to Haab & McConnell (2003), a common natural method is to connect the public good or services with tax payments, although other methods, such as payments on utility bills, can also be used. The final element of a CV scenario is the method of asking questions. This part of the questionnaire confronts the respondent with a given monetary amount, which in one way or the other induces a response.

Contingent valuation studies involve asking respondents about their WTP for the provision of a given good (Lopez-Feldman, 2012). A CV instrument is descriptive rather than explanatory, as it aims to determine the average WTP for a specific environmental improvement and it also asks respondents to state their reasons for selecting their choices (Arrow *et al.*, 1993). There are three ways in which WTP can be determined using CV. Willingness to pay can be elicited by using one of the following: open-ended questions, payment cards, or dichotomous choice models. In open-ended questions, the respondent is asked how much he or she is willing to pay for a service or good that has been earlier described in the hypothetical scenario (Lopez-Feldman, 2012). The second method is to use payment cards where the individual is offered different types of possible payments and asked to select the one that represent his or her individual valuation. However, Haab & McConnell (2003) stated that the other methods, open-ended CV and payment cards, have been criticised as suffering from incentive compatibility problems in which survey respondents can influence potential results by revealing values other than their true WTP. The last method is to use dichotomous choice questions, where, after receiving a description of the hypothetical scenario, the respondent is asked if he or she would be willing to pay X amount (Lopez-Feldman, 2012). Depending on the respondent's answer, the initial amount will be then iterated. This study employed the dichotomous choice approach.

2.2.1.1 The Dichotomous Choice Approach

The dichotomous choice approach includes both the single and the double bound formats. The single bounded format was first introduced by Bishop & Heberlein (1979) as a closed-ended format. The single bounded model comprises only one question, where each subject is presented with a single monetary amount, the amount being varied across respondents (Cooper *et al.,* 2002). The respondents can respond with either a "*yes"* to accept that they are willing to pay the proposed amount or a "*no"* which means they are not WTP the proposed amount. However, single bounded dichotomous choice provides less information about each respondent's (WTP) resulting in decreased efficiency in the estimates of WTP. Therefore, to improve the efficiency of the single bounded model, Carson *et al.,* (1986) developed the double bounded dichotomous choice format which consists of asking another yes/no response to the individual, where a higher or a lower amount is presented to the individual depending on the first response. In order to gather more information about the support of the true *WTP* distribution, the initial bids are varied among individuals.

Because of its statistical efficiency, the double bounded approach has gained in popularity and is now often favoured over the single bounded approach (Cooper *et al.,* 2002). However, studies have shown evidence that responses to the first price may sometimes be inconsistent with the responses to the second, therefore resulting to a lower WTP. Existing applications of the double bounded approach all use scenarios where the respondent is not told ahead of time that she will be confronted with a second price; the interview focuses mainly on the first price, and the second price comes as something of a surprise when introduced at the end. Thus, it is assumed that this surprise may be the main reason of the inconsistency in the responses to the two prices (Cooper *et al.,* 2002).

As a means to reduce the potential for response bias on the follow-up bid in multiple-bound discrete choice formats such as the double bounded model while maintaining much of the efficiency gains of the multiple bound approach, Cooper *et al*.,(2002) introduced the one-and-one-half-bound approach where the respondent is given two prices up front and told that, while the exact cost of the item is not known for sure, it is known to lie within the range bounded by these two prices. One of the two prices is selected at random, and the respondent is asked whether she would be willing to pay this amount; the respondent is then asked about

the other price only if doing so would be consistent with the stated price range. This method removes the surprise component, thus it has the potential to remove inconsistencies in the responses to the two valuation questions, but it comes at the cost of not always being able to ask the second valuation question: the second question will be applicable half the time, on average, but not the rest of the time. However, in this study the double bounded format was chosen over the one and half approach because the two upfront prices given to respondents were not known. Moreover, by using the double bounded format allowed us to use the double bounded method together with an open ended question which provided respondents' maximum WTP.

To implement the dichotomous choice model method, the researcher provides the respondent with a payment that must be made. The objective of estimating parametric models from dichotomous choice CV responses is to calculate WTP for the services described. Understanding how WTP responds to individual characteristics allows the researcher to obtain information on the reliability and validity of the CVM, and to determine sample responses to the overall population (Haab & McConnell, 2003). There are two different, but linked, parts to the task of estimating parametric models for the dichotomous choice CV questions: estimating the part of the preference function that allows the calculation of WTP, and calculating WTP, given the estimated parameters.

2.2.2 Theory of welfare measurement

2.2.2.1 Measuring Welfare changes

The theoretical basis for CV arises from welfare economics, the neoclassical theory of economic value based on individual utility maximisation that gives rise to an ordinary demand function (Hoyos & Mariel, 2010; Fonta *et al.*, 2007; Hanley *et al.*, 2001). This assumes that indicated WTP is associated with a respondent's fundamental preferences (Hanley *et al.*, 2001). Contingent valuation surveys are designed to directly determine monetary measures of welfare (Hicksian) related to a distinct change in the supply of environmental services or goods, by substituting one good for another or the marginal substitution of different attributes of an existing good (Hoyos & Mariel, 2010). There is a direct connection between economic theory and the survey instrument because a CVM study

gives information to explain WTP distribution for a proposed change in an environmental service or good. The CV survey combines economic theory related with the structure of the utility function and economic theory connected with the way that disturbances enter into the process (Hoyos & Mariel, 2010). The basic neo-classical structure for discussing the CVM begins with the description of an ordinal preference function or utility function (Fonta *et al*., 2007; Freeman, 2003).

$$u[x, q] \tag{1}$$

where x represents a vector of the quantities market services and q for a vector of non-market services, household SWM services in this case, whose quantities and qualities are fixed for each household (Freeman, 2003). The set of affordable alternatives is just the set of bundles that satisfy the consumer's budget constraint y and vector of prices $p = (p_x, p_q)$ (Fonta *et al*., 2007). Households maximise utility by choosing a level of x; however, the level of provision of household SWM services is not under the consumer's control. Therefore, the maximisation problem is as follows:

$$max\ u[x, q]\ s.\ t.\ px \leq y \tag{2}$$

Considering the nonsatiation assumption, Fonta *et al*., (2007) restated equation (2) as:

$$max\ u[x, q]\ s.\ t.\ px = y \tag{3}$$

The solution to this problem results in ordinary or marshallian demand function (Freeman, 2003):

$$x_i = h_i\ (p, q, y) \qquad I=1.....,n, \tag{4}$$

which is a single-valued function of prices, income and non-market goods, and also homogeneous of degree zero in prices and income. From the ordinary demand function, the indirect utility function that gives us the maximum utility achievable at given prices and income can be derived as follows:

$$v\,(p, q, y) = u\,[h_i\,(p, q, y)\,q] \tag{5}$$

The quality of service q improves from q^0 to q^1, as a result of an improved environmental quality that increases social welfare reducing the cost q^1, in response to price reduction, households utility also changes to:

$$u^1 = v\,(p, q^1, y) > u^0 = v\,(p, q^0, y) \tag{6}$$

where $u^1 > u^0$ and q^0 represents the status quo level, whereas q^1 stands for the hypothetical improved scenario. Two measures of utility improvements can be derived from equation (6), the Hicksian Compensating Variation and Equivalent Variation (EV) measures of welfare changes (Fonta *et al*., 2007).

$$v\,(y - WTP, p, q^1) = v\,(p\,, q^0, y) \tag{7}$$

$$v\,(y - WTP, p, q^0) = v\,(p\,, q^1, y) \tag{8}$$

Equation (7) represents the Hicksian Compensating Variation measure of welfare change. The Compensation Variation measure asks the amount of money that, if taken from an individual after the change in q from q^0 *to* q^1, the individual would be indifferent from the original situation and the new price set (Freeman, 2003). Equation (8) represents the Hicksian EV measure of welfare change. The EV uses the hypothetical improved scenario q^1 as its basis and asks an individual what income change at q^1 would be equivalent to the proposed change in terms of its welfare impact (Fonta *et al*., 2007). Equivalent Variation is the maximum amount households would be willing to accept (WTA) to avoid changes in prices, if the change in q from q^0 to q^1 makes them worse off, whereas Compensating Variation is the maximum amount households would be willing to pay for household waste collection services (Freeman, 2003). For the purpose of this study, Compensating Variation is the most applicable measure of welfare change, as it aims to measure WTP of households for solid waste collection services. The Hicksian demand curve and the Marshallian consumer surplus can be used to represent EV and Compensating Variation.

2.2.2.2 Pareto Optimal Provision of Public Goods

Household SWM is a public good, and if it were provided to Matsapha peri-urban residents it would benefit all the community residents, and therefore each of their marginal valuations for household solid waste must be accounted for when resource allocation is being decided. Samuelson's analysis of public goods shows that the Pareto-optimal provision of a public good requires that the following first-order condition be satisfied (Cornes & Sandler, 1996):

$$\sum_{i=1}^{n} \boldsymbol{MRS_{zy}} = \boldsymbol{MRT_{zy}} \quad (9)$$

where *n* is the number of community members and *z* represents household SWM services. Equation (9) is sometimes referred as the Samuelson's rule or Samuelson condition. Samuelson (1954) postulated that the Pareto-optimal provision of a public good occurs where the sum across all consumers of the Marginal Rate of Substitution (MRS) between good and other goods equals the Marginal Rate of Transformation (MRT) in production. In this study, ∑MRS will be the sum of individual valuations of improved household SWM services and MRT will be the opportunity cost of providing improved household SWM services. This first-order condition is derived by the utility levels of all the residents, the economy transformation's function, and the private goods production distribution constraint (Cornes & Sandler, 1996).

2.2.3 Econometrics of welfare measurement

This section focuses on modelling the elicitation method employed in this study, which is the double bounded dichotomous choice format. The random utility model (RUM) is the primary model for analysing dichotomous CV responses (Haab & McConnell, 2003). The section will first present the random utility model which describes an indirect utility function and the error component; then econometric estimation of the dichotomous model, the double-bounded model, and econometric estimation of WTP using the double-bounded model.

2.2.3.1 Random Utility Model (RUM)

The Random utility model was developed by Hanemann in 1984 (Hanemann, 1984), by employing the random utility structure that was developed by McFadden in 1974 (McFadden, 1974). Hanemann restructured responses to dichotomous CV questions, creating a framework that allows parameters to be estimated and interpreted (Haab & McConnell, 2003). Haab and McConnell (2003) stated that the indirect utility for respondent *j* could be written as:

$$u_{ij} = u_i (y_j, z_j, \varepsilon_{ij}) \quad (10)$$

Where *i=0* is the status quo and *i=1* is the state that results when the CVM is applied, that is, the final state. The determinants of utility are y_j, the j^{th} respondent's unrestricted income, $\boldsymbol{z_j}$, an m-dimensional vector of household characteristics and characteristics of the choice, including questionnaire variations, and the ε_{ij}, a component of preferences known to the individual respondent but not observed by the researcher. The $U_{ij} = u_i(y_j,\boldsymbol{z_j},\varepsilon_{ij})$ function is written with only the subscript indicator *i* and the random component of preferences changing. It is assumed utility will change, as there is a change from the status quo to the final state. For the purpose of this study, it assumed the change is a result of improved household SWM services, such that quality *q* could change from q^0 to q^1 so that the utility for the status quo would be $u_{0j} = u\ (y_j, z_j, q^0, \varepsilon_{0j})$ and the utility in the final state would be $u_{1j} = u\ (y_j, z_j, q^1, \varepsilon_{1j})$. Therefore, a household maximising its utility (respondent *j*) answers 'yes' to a necessary payment of p_j if the utility in the CVM, the remaining necessary payment, exceeds utility of the status quo as follows:

$$u_1 (y_j - P_j, z_j, \varepsilon_{1j}) > u_0 (y_j, z_j, \varepsilon_{0j}) \quad (11)$$

However, the random part of preferences is not known by researchers; therefore, they can only make probability statements about 'yes' and 'no'. The probability of a 'yes' response is the probability that the respondent thinks that he or she is better off in the proposed scenario, even with the required payment, so that $u_1 > u_0$ (Haab & McConnell, 2003). For respondent *j*, the probability is

$$Pr\ (yes_j) = Pr\ [u_1 (y_j - P_j, z_j,\varepsilon_{1j}) > u_0 (y_j, z_j, \varepsilon_{0j})] \quad (12)$$

Equation (11) presents an intuitive base for analysing responses, and can be used as the starting point for non-parametric approaches. Therefore, for the parametric estimation of two modelling choices must be made (Haab & McConnell, 2003). The functional form of $u\ (y_j, \boldsymbol{z_j}, \varepsilon_{ij})$ and the distribution of ε_{ij} must be specified. According Haab & McConnell (2002), all methods should start by specifying the utility function as additively separable in deterministic and stochastic preferences:

$$u_j\ (y_j, z_j, \varepsilon_{ij}) = v_i\ (y_j, z_j) + \varepsilon_{ij} \qquad (13)$$

With the additive specification in equation (13), the probability statement for respondent j becomes:

$$Pr\ (yes_j) = Pr\ [v_1(y_j - P_j, z_j) + \varepsilon_{1j} > v_0(y_j, z_j) + \varepsilon_{0j}] \qquad (14)$$

However, the probability statement in equation (14) is still too general for parametric estimation, but once utility is defined as the total of random and deterministic components, the changes in the random components between the status quo and the CV scenario cannot be identified.

2.2.3.2 Econometric estimation of the dichotomous choice model

Dichotomous choice models assist in acquiring information from households, through the application of a CV questionnaire. Given a previously determined amount (amount that various across individuals), respondents are asked questions that have "yes" or "no" dichotomous answers. If a respondent answers "yes", $y_i = 1$, and if a respondent answers "no", $y_i = 0$ (Lopez-Feldman, 2012). A dichotomous choice model allows the estimation of households' WTP, assuming that it is a linear function. The linear function can be only obtained when the deterministic of the preference function is linear in income and covariates (Haab & McConnell, 2003).

$$WTP_{ij}(z_i, \varepsilon_i) = z_j\beta_i + \varepsilon_i \qquad (15)$$

Where WTP_{ij} represents the j^{th} respondent's WTP and i=1,2 represents the first and second answers, $\boldsymbol{z_j}$ is an m-dimensional vector of variables associated to individual j and $\boldsymbol{\beta_i}$ is an m-dimensional vector of parameters. If a respondent answers "yes", it is assumed that his or her

WTP exceeds the suggested amount ($WTP_i > t_i$). Therefore, the probability of the *ith* individual answering "yes" to the dichotomous question is as follows:

$$\begin{aligned} Pr\,(y_i = 1|\, z_i) &= Pr\,(\, WTP_i > t_i) \\ &= Pr\,(z_j\beta + \varepsilon_i > t_i) \\ &= (Pr\,(\varepsilon_i > t_i - z_j\beta) \end{aligned} \tag{16}$$

Assuming that ε_i is normally, independently and identically distributed (IID) with a zero mean and a variance equal to σ^2 ($\varepsilon_i \sim N(0, \sigma^2)$), equation (16) can be estimated. The result is a Probit model, where the probability that the *i*th individual will pay the suggested amount P_i is as follows:

$$Pr\,(y_i = 1|\, z_i) = Pr\left[v_i > \frac{t_i - z_i'\beta}{\sigma}\right]$$

$$= 1 - \Phi\left[\frac{t_i - z_i'\beta}{\sigma}\right]$$

$$Pr\,(y_i = 1|\, z_i) = \left[z_i\frac{\beta}{\sigma} - \frac{1}{\sigma}t_i\right]\Phi \tag{17}$$

where $v_i \sim N(0,1)$ and $\Phi[.]$ is the cumulative standard normal. According Lopez-Feldman (2012), equation (17) is almost similar to a Probit model, although equation (17) has an extra explanatory variable (t_i) which is not there in a Probit model. Equation (17) can be estimated either by Maximum Likelihood (ML) estimation which solves β and σ using the singleb command in Stata, which was created by Alejandro Lopez-Feldman, or you can directly estimate equation (17) using the Probit command available on Stata (Lopez-Feldman, 2012). However, equation (17) can only be used to estimate WTP of single-bound dichotomous choice models where only a single dichotomous question is asked, and the offered amount is used as a starting point (Hanemann *et al.*, 1991). If an individual values SWM services more highly than the starting point amount, that individual answers "yes" or else "no". Hanemann *et al.* (1991) further stated that this is a simpler method for an individual as it is less efficient statistically and needs a larger sample to obtain a particular level of accuracy.

2.2.3.3 The Double-bounded Choice Model

The double-bounded model is sometimes referred to as a dichotomous question with a follow-up question. In double-bounded models, the respondents are given the first bid and asked if they are willing to pay it. Depending on the initial answer given by a respondent on the first question, a follow-up question is asked. A respondent is asked about his or her WTP for a higher bid if he or she answers "yes" to the first bid, whereas a lower bid amount is offered where he or she answers "no" to the first bid amount. According to Haab and McConnell (2003), the second follow-up question increases the efficiency of the double-bound model in three ways: firstly, the "yes–no" or "no–yes" answer order results in simple bounds on WTP, the "no–no" and "yes–yes" pairs result in efficiency improvement, and lastly, the sum of responses is improved, resulting in a function with more observations. The econometric estimation of WTP using the double-bounded model is as follows:

Let the first bid amount be t^1 and the second one be t^2, the WTP bounds are as follows

1. $t^1 \leq WTP < t^2$ for all the respondents who gave yes–no responses
2. $t^1 > WTP \geq t^2$ for all the respondents who gave no–yes responses
3. WTP $\geq t^2$ for all the respondents who gave yes–yes responses
4. $WTP < t^2$ for all the respondents who gave no–no responses.

If y^1_i and y^2_i represent the dichotomous choice variables that capture the answers to first and second questions, then the probability of a respondent will be $Pr\ (y^1_i = 1, y^2_i = 0|z_i) = Pr\ (s,n)$. Assuming that that $WTP_i\ (z_i,) = z'\beta + u_i$ ..... $(u_i \sim N(0,\sigma^2)$ and $Pr\ (s,n)$ excludes that the probability is conditional on the values of the explanatory variables, the probability of the four WTP bounds can be formulated as:

1. $y^1_i = 1$ and $y^2_i = 0$

$$Pr\ (s,n) = \Phi\left[\boldsymbol{z}_i'\frac{\boldsymbol{\beta}}{\boldsymbol{\sigma}} - \frac{\boldsymbol{t_i}}{\boldsymbol{\sigma}}\right] - \Phi\left[\boldsymbol{z}_i'\frac{\boldsymbol{\beta}}{\boldsymbol{\sigma}} - \frac{\boldsymbol{t^2}}{\boldsymbol{\sigma}}\right] \quad (18)$$

2. $y^1_i = 0$ and $y^2_i = 1$

$$Pr\ (n,s) = \Phi\left[\boldsymbol{z}_i'\frac{\boldsymbol{\beta}}{\boldsymbol{\sigma}} - \frac{\boldsymbol{t^2}}{\boldsymbol{\sigma}}\right] - \Phi\left[\boldsymbol{z}_i'\frac{\boldsymbol{\beta}}{\boldsymbol{\sigma}} - \frac{\boldsymbol{t^{21}}}{\boldsymbol{\sigma}}\right] \quad (19)$$

3. $y^1_i = 1$ and $y^2_i = 1$

$$Pr\ (s,s) = \Phi\left[z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right] \quad (20)$$

4. $y^1{}_i = 0$ *and* $y^2{}_i = 0$

$$Pr\ (n,n) = 1\text{-}\ \Phi\left[z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right] \quad (21)$$

To directly estimate β and σ using ML estimation, a likelihood function that should to be maximised to find the parameters of the model is constructed as follows:

$$\sum_{i=1}^{N}\left[\begin{array}{l} d_i^{sn}\,ln\left(\Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^i}{\sigma}\right) - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)\right) + d_i^{ss}\,In\left(\Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)\right) + \\ d_i^{ns}\,In\left(\Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right) - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^1}{\sigma}\right)\right) + d_i^{nn}\,In\left(1 - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)\right) \end{array}\right] \quad (22)$$

where indicator variables d_i^{sn}, d_i^{ns}, d_i^{ss}, d_i^{nn} can take the value of one or zero, conditional on the applicable situation for each respondent. Now WTP can be estimated using the doubleb command found in Stata. The doubleb command allows the direct estimation of β and σ using ML (Lopez-Feldman, 2012).

2.3 EMPIRICAL LITERATURE

2.3.1 Empirical comparative studies

2.3.1.1 Importance of Contingent Valuation Method (CVM) in Developing Countries

Although there has been much criticism of the CVM, the significance of the CVM in modern welfare economics cannot be underestimated. According to Carson (2012), there have been over 7 500 papers and studies conducted using the CV approach, with the biggest group focused on environmental evaluation. Thousands of CV surveys have been conducted in more than 130 countries focusing on environmental, health, transportation, cultural and many other aspects (Carson, 2012). The CVM has been able to attract further recognition from both policy makers and academics as being a resourceful and influential approach for valuing the monetary significance of environmental improvements (Hanley *et al*., 2001). Carson (2012) pointed out that the importance of conducting CV studies involves convincing engineers and

scientists to outline how a project would benefit the public. He further stated that the process of developing CV studies stimulates the earlier participation of policy makers to critically think about the costs and benefits of the project and consider decisions with greater benefits or lower costs to the public. Carson (2012) concluded that a CV study is a practical alternative when prices are not available, and therefore, since there is no market for environmental services like solid waste collection, CVM is the concrete solution. Many CV studies have been employed in many developing countries to solve environmental problems faced by those developing countries.

However, Whittington (2012) has pointed out that the findings of many CV studies carried out in developing countries are inaccurate and unrealistic, thus it is important to increase the quality of CV surveys done in developing countries. He further stated that CV studies have the capacity to provide high-quality information that can be used to inform policy, as long as CV surveys are well designed and carefully implemented. It is important that the information given in the CV scenario is consistent with professional and scientific knowledge, while still being understandable to an ordinary respondent who possibly has little or no knowledge of, or who knows little or nothing about, the service being estimated (Hoyos & Mariel, 2010). Whittington (2012) concluded that CV is the solution to many problems faced by developing countries, like sanitation and water services, soil erosion, urban air pollution, biodiversity, deforestation, ecosystem valuation, watershed management and vaccines for the poor, in which policy in these areas directly affects the lives of millions of people.

2.3.1.2 Addressing Solid Waste Management in Developing Countries

In developing countries, numerous CV surveys have been done to determine the demand for improving urban waste management. Hagos *et al*. (2012) conducted a CV study to determine the WTP of respondents for improved urban waste management, and to determine cost recovery approaches, in Mekelle City, Ethiopia. The key objective of the survey was to estimate average WTP and to determine a parametric model that included socio-economic factors that influence the WTP of respondents. Hagos *et al*. (2012) employed the Probit model to determine the socio-economic factors that influence WTP of respondents in Mekelle City and the results showed that household income and awareness of environmental quality

significantly influenced the probability of providing positive WTP values, whereas age of household head showed a negatively significant relation to WTP.

However, Adepoju and Salimonu (2010), who employed a CV study to determine the WTP for improved SWM in Osun state, Nigeria, found that only sex, monthly expenditure and education of households were statistically significant to influence the WTP for improved waste disposal. The positive relation of education to WTP for improved waste services showed that increasing the level of education will also increase the probability that a household would be willing to pay for an improved waste disposal service. The positive relationship between monthly income of households and WTP showed that increasing income will also increase the probability that households would be willing to pay for improved SWM (Adepoju & Salimonu, 2010; Hagos *et al*., 2012). Hagos *et al*. (2012) suggested that older people who are used to freely disposing their solid waste are less WTP for improved SWM, thus the negative relationship of age and WTP, although Adepoju and Salimonu (2010) found that age is statistically insignificant in influencing the WTP for improved SWM.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter presents the methodology that was adopted in this study. Section 3.2 provides a description of the study area; section 3.3 discusses sampling; section 3.4 discusses the survey instrument and development; section 3.5 describes how the survey was implemented; data analysis is presented in section 3.6; section 3.7 provides variable description; section 3.8 provides the description of the socio-economic characteristics of households; and lastly, section 3.9 describes general SWM practices of households in Matsapha peri-urban area.

3.2 STUDY AREA

The study was carried out in the Matsapha peri-urban area, mainly focusing on the Kwaluseni Inkhundla which incorporates most of the peri-urban areas of Matsapha and the Matsapha industrial site. Matsapha is located in the upper Middleveld of Swaziland and falls under the region of Manzini. It is situated on the western side of Manzini, along the Mbabane–Manzini road highway. It is located at about 7 km from Manzini City, which is the country's commercial capital, and 35 km from Mbabane, which is the capital city of the country. The Matsapha peri-urban area is approximately 792 hectares in area, making it greater than that of Manzini peri-urban, and thus the biggest in the country (MHUD, 2007). Matsapha peri-urban area includes the areas of Kwaluseni, Sigodvweni, Mbhuleni, Eteni, Logoba, Mhlane, Eteteni and Esibayeni (Matsebula, 2012).

The Matsapha industrial site, located within the urban area, is thus under the jurisdiction of the Matsapha Town Council, which provides all public services in the urban area of Matsapha, and the Matsapha industrial site is the main factor influencing the settlement pattern of Matsapha peri-urban areas. The creation of job opportunities by the Matsapha Industrial Estate has created a high housing demand which has resulted in the building of informal settlements in the Matsapha peri-urban area (World Bank, 2002). The informal settlements are characterised by a cluster of plots of households which are comprised of

residential houses and flats for rental accommodation, whose occupants may include families of landlords and tenants, and some formal and informal businesses such as shops, salons and workshops for welding (SEA, 2003). The population of the area was about 41780 people in 2007, with a density of 1 500 inhabitants/km^2, the highest density population in the country (National Data Development Centre (NDDC), 2009).

The reason this area was chosen for this study is because the peri-urban areas of Matsapha have serious waste management problems. All Matsapha peri-urban areas are located on Swazi Nation Land (SNL), thus they are administered through the Ministry of Tinkhundla Administration and Development. Therefore, the Deputy Prime Minister's Office (DPMO) is responsible for waste management in peri-urban areas, but unfortunately this office has no practical ability to control household solid waste at the moment (SEA, 2002). Mkhonta (2010) reported that most of the households in this area have access to public utilities, such as piped water and electricity, but there are no waste disposal and drainage facilities. According to SEA (2003), residents use the traditional way of disposing waste by dumping waste within their plots, with some burning it, while others dump it on open spaces nearby and along the roads. Therefore, Matsapha Town Council is often compelled to collect waste from the peri-urban area, more especially along the roads.

3.3 SAMPLING

The study used purposive and simple random sampling methods to collect survey data from the Matsapha peri-urban area, under the Kwaluseni Inkhundla. The Matsapha peri-urban area was purposely selected for this study not only because it was declared a waste control area by the Ministry of Tourism and the Environment, but also because it is the largest peri-urban area of the country that has no waste management system in place. Moreover, the Kwaluseni Inkhundla incorporates the Matsapha Industrial site which is main driver of urbanisation in Swaziland and which is also the main influencing factor for the settlement pattern of Matsapha peri-urban areas.

The population of the Kwaluseni Inkhundla is approximately 41 780 people which includes approximately 2089 property owners (landlords). The formula for calculating a sample size with simple random sampling (SRS) using a specified absolute precision approach is presented below.

$$\mathbf{n_{srs}} = \frac{\mathbf{1.96^2 \hat{p}_{srs} \hat{q}_{srs}}}{\mathbf{d^2}} \quad (23)$$

Where,

n_{srs} = sample size

$\hat{p}_{srs}$ = the estimated population

$\hat{q}_{srs} = 1 - \hat{p}_{srs}$

d = desired absolute precision, a value of 50% was used. The reason for selecting 50% is that, for a given level of precision, a p of 50% has the largest sample size.

When calculating the sample size a 95% confidence interval (the 1.96 value in the formula) was assumed. When the above formula was used, a sample size of 384 was found. However, a sample of 180 respondents was randomly selected from the sampling frame using a simple random sampling method. The 180 sample of respondents was used in consideration of the type of survey. For a CV study to produce high-quality results, it has to be administered properly. However, considering the time frame and the resources for this study, the sample size of 384 respondents could have resulted in a poorly administered CV survey. Moreover, the population of this area is homogenous, thus a sample size of 180 respondents is a good representation of the population. The simple random sampling was used because the population in Matsapha peri-urban area has homogenous characteristics; therefore, each unit in the population has the same probability of being selected. Respondents were interviewed from the three sub-chiefdoms of Kwaluseni Inkhundla, namely Kwaluseni, Logoba and Mhlane.

In order to achieve the objectives of the study, the household survey was designed and implemented with an aim to collect information on households for estimating households' WTP for improved household SWM services in the densely populated peri-urban settlements of Matsapha. To answer the specific questions, the survey provided information about WTP for waste collection services of peri-urban residents, the determinants that influence

households' WTP for waste collection services. When collecting information on households, only heads of households were interviewed, but in cases where heads of households were not available, the spouse or the eldest person in the household who was able to provide information on behalf of the household head was interviewed. Since Matsapha peri-urban area residents comprise landlords and tenants, for the purpose of this study. "households head" refers to landlords. Tenants were not interviewed because they are not household owners and sometimes tenants do not stay in the same place for very long, and thus were not used to ascertain information about Matsapha peri-urban area residents. On the supply side, information to determine the economic efficiency for providing waste collection services was obtained from the Matsapha Town Council.

3.4 SURVEY INSTRUMENT AND DEVELOPMENT

The survey instrument was a structured questionnaire consisting of five sections. The design of the questionnaire followed recommendations from the National Oceanic and Atmospheric Administration (NOAA) Panel CV, which has determined guidelines which are assumed to produce high quality, policy-relevant information in any CV study which follows them when designing and administering a survey (Arrow *et al.*, 1993). Section A focused on introducing the survey purpose, and the context for making decisions. Section B collected information relating to households' knowledge, attitudes and perceptions on household solid waste collection. Section C concentrated on the CV scenario. Section D asked about the socio-economic conditions of households, and lastly, Section E was the debriefing section.

The CV section that included the valuation scenario, the core of a CV study, was carefully designed. The valuation scenario presented the current situation (status quo) and the hypothetical scenario, describing the current environmental condition of Matsapha peri-urban areas, detailing the exact description of the services to be provided, the institutional context in which the service would be provided, how it would be financed i.e. the objective of the bill and how the bill would be implemented, and further explained how the environmental condition would improve after the implementation of the bill. In the CV scenario, two pictures were included. One picture presented the current situation and the other presented the proposed scenario. The pictures were used to make sure that before the respondents were asked about their WTP, they truly understood the scenario being presented. Furthermore,

follow-up questions were asked throughout the scenario as it was presented to make sure that respondents were following and that they understood the scenario presented.

Since the CV employed a double-bounded dichotomous choice format, double-bounded dichotomous questions were designed for this study. The respondent was given the first bid and asked if he or she is willing to pay that certain amount to improve the environmental quality. Arrow *et al.* (1993) further stated that a respondent who would not be willing to pay that certain amount has no reason to say "Yes" and a respondent who would be willing to pay that certain amount has no reason to say "No", as far as strategic reasons go. After the respondents answered the first dichotomous question, they were then asked about their WTP for a higher amount or lower amount, depending on the particular respondent's response to the first question. If a respondent answered "Yes" to the first question, then he or she was asked for a higher amount, whereas if the respondent answered "No or don't know" to the first question, he or she was asked about his or her WTP for a lower amount. For those respondents who answered "Yes" to both dichotomous questions "Yes–Yes" and those who answered "No" to the first dichotomous questions and "Yes" to the second dichotomous question ("No–Yes"), they were further asked about their maximum WTP.

After respondents had answered the dichotomous questions, they were then asked for their reasons for voting for or voting against the bill, based on their responses to the dichotomous questions. Respondents' reasons were used in the identification of invalid responses, which were the WTP responses that were excluded from the regression. Since split-samples were used in this study, six different questionnaires were designed. The six questionnaires were almost similar to each other; they only differed in the CV section where respondents were told about the service provider. There were three service providers in this study; therefore, 60 respondents were told that the service provider is the Matsapha Town Council, another 60 respondents were told that the service provider is the Kwaluseni Inkhundla, and the last 60 respondents were told the service provider comprises Private Contractors. In each of the three split-samples, the questionnaires also differed in the first dichotomous questions. There were three starting bids; thus, 20 respondents received a starting bid of E10.00, another 20 respondents received a starting bid of E20.00, and the last 20 respondents received a starting bid of E30.00. The three split-samples and the different starting bids were assigned to respondents randomly.

The purpose of the split-sample experiment was to ascertain if the WTP of respondents was influenced by the size of the first bid that they were asked about. If split-sample test results show different answers, then it can be concluded that the respondents were taking the CV scenario earnestly (Whittington, 2002). The split-samples also helped to identify the service provider that the respondents prefer in the study area. When designing the starting bids, consultations with the three service providers were held.

After the questionnaire was designed, pre-tests were conducted. In these pre-tests, the questionnaire was tested in the real survey close setting. Randomly, 20 respondents were selected and in-depth one-on-one interviews were conducted. The data obtained from the pre-tests was analysed. Based on the findings of the pilot tests, the questionnaire was carefully revised.

3.5 SURVEY IMPLEMENTATION

The survey instrument was a face-to-face, interviewer-administered questionnaire. Interviews were conducted by six enumerators. According to NOAA general guidelines, reliable estimates of values might be obtained with face-to-face interviews, although they are costly. In order to assure respondents about the confidentiality of the information they provided, before they were asked any question, they were provided with clear, objective information about the research project, and then they could choose if they wanted to participate in the survey or not, by giving their informed consent. Numerators were trained before they conducted the interviews. According to Whittington (2002), the training provides enumerators with skills to conduct lengthy and high quality, in-person interviews and ensures that they understand the objectives of the survey and the hypothetical scenario.

In order to obtain high quality CV results, enumerators were also supervised by the researcher. The researcher reviewed completed questionnaires for errors as soon as they were completed, assessing the quality of enumerators performance and ensuring that the enumerators were actually conducting the interviews they were supposed to conduct. To test for enumerator bias, the questionnaire included a question where enumerators wrote their details. Enumerators were instructed to interview the heads of household (landowners not

tenants) only, but in cases where heads of households were not available, their spouses were interviewed instead. Survey data was collected from the 4th to 10th of July 2015. Each enumerator conducted 4 to 5 interviews per day. Interviews took 15 to 65 minutes, with an average duration of 38 minutes per interview. Follow-up questions were used to test the validity and reliability of responses given by respondents. The debriefing section helped to test for internal consistency, to determine if respondents understood the questions and if their responses were reliable. Results showed that questions were clearly understood by respondents and their responses demonstrated to be quite reliable.

3.6 DATA ANALYSIS

This study employed dichotomous models to estimate respondents' WTP from the three sub-samples. The double-bounded dichotomous choice model for each split-sample was estimated on Stata using the doubleb command. The doubleb command incorporates the first bid, second bid, first answer and second answer to produce the WTP as a dependent variable in the model. To estimate average WTP, the nlcom command on Stata was used. The nlcom command estimates average WTP using average values for the explanatory variables.

3.7 VARIABLE DESCRIPTION

This section focuses on describing the main variables used in the analysis. Section D of the survey questionnaire collected information on the socio-economic characteristics of respondents. The socio-economic characteristics were used as main variables in the analysis. In this section, descriptive statistics are used to describe the main variables. The main output variable is WTP, which this study aims to estimate in order to determine the demand for improved household SWM services in Matsapha peri-urban area, with WTP being measured in Swazi currency[2]. Knowledge, attitudes and perceptions of respondents in household SWM are also assessed in this section using descriptive statistics. Most of the explanatory variables were used as categorical variables, except for knowledge, attitudes and perceptions variables, and they are described in Table 3.1.

[2] See footnote 1

3.8 SOCIO-ECONOMIC CHARACTERISTICS OF HOUSEHOLDS

Table 3.1 gives a summary of the variables used in this study. The explanatory variables are binary (i.e., either zero or one). For each category of variables, the omitted reference variable was purposely selected. Therefore, the interpretation of the results is comparative to the omitted reference variable for that category of question.

Table 3.1: Description and summary statistics of explanatory variables

Variables	Mean	Min	Max
Bid1	20	10	30
Age			
1=18-49 years,0 otherwise*	0.49	0	1
1=50 years and above,0 otherwise	0.51	0	1
Household size			
1= less than 6 people, 0 otherwise*	0.41	0	1
1= 6 people and above, 0 otherwise	0.58	0	1
Number of tenants			
1= less than 10 tenants, 0 otherwise*	0.59	0	1
1= 10 tenants and above, 0 otherwise	0.41	0	1
Number of rental units			
1= less than 8 units, 0 otherwise	0.59	0	1
2= 8 units and above, 0 otherwise*	0.41	0	1
Gender			
1=female, 0=male	01.57	1	2
Marital status			
1= single, 0 otherwise	0.18	0	1
1= married, 0 otherwise*	0.61	0	1
1= divorced/ widowed, 0 otherwise	0.20	0	1
Educational level			
1= none/primary/ secondary, 0 otherwise	0.46	0	1
1= technical/diploma, 0 otherwise	0.28	0	1
1= university degree, 0 otherwise *	0.25	0	1
Employment status			
1= formal employment, 0 otherwise*	0.42	0	1
1= informal/ self-employed employment, 0 otherwise	0.35	0	1
1= unemployed/ pension, 0 otherwise	0.23	0	1
Primary source of income			
1= wage employed, 0 = other	0.49	0	1
Monthly income			
1= less than E2000, 0 otherwise	0.22	0	1
1= E2000- E5000, 0 otherwise	0.31	0	1
1= above E5000, 0 otherwise*	0.46	0	1
Knowledge variable (Burning waste is bad for your health and that of others	1.04	0	2
It is not a problem when individuals improperly dispose their HSW on their own property	2.09	1	6
It is not a problem when individuals dump their trash on other people's property	1.59	1	6
The current indiscriminate dumping and management of HWS in Matsapha is a problem of public concern	4.53	1	6
In your opinion, should the public be educated about proper disposal of HSW	4.71	1	6
In your view, do people dispose waste improperly because there are no better means of disposing household solid waste in the peri-urban areas of Matsapha	3.93	1	6

Source: Own data

** Denotes variable was dropped during estimation.*

HSW: Represents household solid waste

Table 3.2 presents the socio-economic characteristics of households of the three split-samples. The results in Table 3.2 show that about 58 % of the respondents interviewed were from the Kwaluseni chiefdom; about 31 % of the respondents interviewed were from Logoba chiefdom, while only about 13 % of the respondents were from Mhlane chiefdom. Since respondents were randomly interviewed from the three chiefdoms, the results indicate that the Kwaluseni chiefdom is the largest chiefdom in Matsapha peri-urban area. The findings of the study show that the about 51 % of the respondents are 50 years old or above, while about 49 % of the respondents are between 18 to49 years old. Respondents in the study area are characterised by large household sizes, as the results show that about 58 % of the respondents have a household size of 6 people or more, and only about 41 % of the respondents have less than 6 people per household. Household size ranges from 1 to 18 people per household, with an average of 6 people per household. As the Matsapha peri-urban area is characterised by the presence of rental units, the results shows that about 41 % of the respondents have 8 or above rental units on their plots.

The study targeted household heads as respondents, and the observed gender distribution shows a nearly equal representation of males and females, with about 57 % households being headed by males and about 43 % being headed by females. The statistics show that about 62 % of the respondents are married, confirming Matsebula (2012) who reported that about 60 % of household heads in Matsapha peri-urban area are married. The results show that only 25 % of the respondents have received tertiary education. About 72 % of the respondents reported that they have formal employment, while 35 % of the respondents reported that they are either self-employed or in informal employment, as many of them own rental flats. The findings of the study show that about 46 % of the respondents earn above E5 000 per month.

Table 3.2: Demographic and socio-economic characteristics of respondents

Characteristics	Statistics			
	Matsapha Town Council	Private Contractors	Kwaluseni Inkhundla	Total
Total households	60	60	60	180
Chiefdom				
Kwaluseni	32 (53.3 %)	33 (55.0 %)	37 (61.7 %)	102(56.7 %)
Mhlane	15 (25.0 %)	6 (10.0 %)	2 (3.3 %)	23 (12.8 %)
Logoba	13 (21.7 %)	21 (35.0 %)	21 (35.0 %)	55 (30.6 %)
Age				
18-49 years	26 (44.8 %)	36 (60.0 %)	25 (41.7 %)	87 (48.9 %)
50 years and above	32 (55.2 %)	24 (40.0 %)	35 (58.3 %)	91 (51.1 %)
Household size				
Less than 6 people	27 (45.0 %)	27 (45.0 %)	21 (35.0 %)	75 (41.7 %)
6 people and above	33 (55.0 %)	33 (55.0 %)	39 (65.0 %)	105(58.3 %)
Number of tenants				
Less than 10 tenants	34 (56.7 %)	29 (48.3 %)	43 (71.7 %)	106(58.9 %)
10 tenants and above	26 (43.3 %)	31 (51.7 %)	17 (28.3 %)	74 (41.1 %)
Number of rental units				
Less than 8 units	33 (55.0 %)	31 (51.7 %)	42 (70.0 %)	106(58.9 %)
8 units and above	27 (45.0 %)	29 (48.3 %)	18 (30.0 %)	74 (41.1 %)
Gender:				
Male	33 (55.0 %)	34 (56.7 %)	35 (58.3 %)	102(56.7 %)
Female	27 (45.0 %)	26 (43.3 %)	25 (41.7 %)	78 (43.3 %)
Marital status				
Single	11 (18.3 %)	8 (13.6 %)	14 (23.3 %)	33 (18.4 %)
Married	39 (65.0 %)	36 (61.0 %)	35 (58.3 %)	110(61.5 %)
Divorced/ widowed	10 (16.7 %)	15 (25.4 %)	11 (18.3 %)	36 (20.1 %)
Educational level				
None/primary/ secondary	21 (35.0 %)	28 (46.7 %)	34 (56.7 %)	83 (46.1 %)
Technical/diploma	20 (33.3 %)	17 (28.3 %)	15 (25.0 %)	52 (28.9 %)
University degree	19 (31.7 %)	15 (25.0 %)	11 (18.3 %)	45 (25.0 %)
Employment status				
Formal employment	29 (48.3 %)	23 (38.3 %)	24 (40.0 %)	76 (42.2 %)
Informal/ self- employment	24 (40.0 %)	30 (50.0 %)	9 (15.0 %)	63 (35.0 %)
Unemployed/ pension	7 (11.7 %)	7 (11.7 %)	27 (45.0 %)	41 (22.8 %)
Primary source of income				
Wage employed	33 (55.0 %)	28 (46.7 %)	28 (46.7 %)	89 (49.4 %)
Other	27 (45.0 %)	32 (53.3 %)	32 (53.3 %)	91 (50.6 %)
Monthly income				
Less than E200	12 (20.0 %)	12 (20.0 %)	16 (26.7 %)	40 (22.2 %)
E2000- E5000	17 (28.3 %)	20 (33.3 %)	20 (33.3 %)	57 (31.7 %)
Above E5000	31 (51.7 %)	28 (46.7 %)	24 (40.0 %)	83 (46.1 %)

Source: Own data

3.9 GENERAL HOUSEHOLD SOLID WASTE MANAGEMENT PRACTICES IN MATSAPHA PERI-URBAN AREA

Respondents were asked to state how they currently dispose of household solid waste and their results are presented in Table 3.3.

Table 3.3: Current household solid waste disposal methods of respondents

Current Method of disposal	Number of respondents	Percentage
Garbage heap within the yard	35	19.4
Open space along the road	2	1.1
Temporary waste storage facility	4	2.2
Bury it within my yard	33	18.3
Big sacks	70	38.9
Burn it	12	6.7
Dump it in river	16	8.9
Private collector	5	2.8
Other	4	2.2

Source: Own data

Results indicate that the most commonly used method (about 39 % of respondents) of waste disposal in Matsapha peri-urban area is done by putting household solid waste in big sacks, which are similar to the ones used by sugar processing companies. These big sacks are mounted on poles and are used as temporary waste storage facilities. Unfortunately, respondents stated that these big sacks are not being collected from their households, and thus end up becoming over-full and spill all over the place. The sacks were put in place as a waste management system by the Kwaluseni Inkhundla with assistance from the Swaziland Environment Authority, which system unfortunately did not work out as expected. These results suggest that most households are willing to properly dispose of their household solid waste, as long as there is a sustainable waste management system in place. The results also indicate that about 19 % and 18 % of the respondents dispose of their household solid waste by dumping it on a garbage heap within their yards, and burying it within their yards, respectively, as there are no household solid waste collection services in Matsapha peri-urban areas. However, only about 3 % of the respondents reported that they hire private collectors

to collect household solid waste from their households. About 9 % of respondents revealed that they dump their household solid waste in nearby rivers, while about 1 % of respondents confirmed that they dispose of their household solid waste on open spaces along roads.

Respondents were also asked to rank the following public goods: improved water, improved solid waste collection, improved sewerage, and improved roads, in order of importance to them. Number 1 represents the most important public good that is needed in Matsapha peri-urban area and number 4 represents least important public good that is needed in Matsapha peri-urban area. Table 3.4 presents their rankings:

Table 3.4: Respondents' rankings

Public good	**Number of respondents who ranked it as number:**			
	1	**2**	**3**	**4**
Improved water	56 (31.1 %)	43 (23.9 %)	46 (25.65 %)	35 (19.4 %)
Improved solid waste collection	76 (42.2 %)	52 (28.9 %)	39 (21.7 %)	13 (7.2 %)
Improved sewerage	32 (17.8 %)	56 (31.1 %)	62 (34.4 %)	30 (19.7 %)
Improved roads	16 (8.9 %)	30 (16.7 %)	32 (17.8 %)	102(56.7 %)

Source: Own data

The results show that about 42 % of the respondents ranked improved solid waste collection as the most important public good that they need. This suggests that there is a high demand for household solid waste collection services in Matsapha per-urban area. Respondents stated that improper disposal of household solid waste is a big problem in Matsapha peri-urban area. They further revealed that they have suffered from cholera, which they think is caused by the improper disposal of household solid waste, as their yards and surroundings are very dirty. Respondents also stated that improperly disposed waste causes flies and mosquitoes in summer, and there were some diarrhoea outbreaks in the area. About 57 % of the respondents ranked improved roads as the least important public good needed, although they also indicated that the roads to their households are very poor, as they are full of potholes and become very muddy in summer. Therefore, this will cause difficulties in collecting household solid waste from their households. Their reason for ranking improved roads as the least important was that they are afraid that roads improvement will lead to the demolishing of some the houses that are near the roads.

3.10 EMPIRICAL MODELS

Since there were three split samples used in this study, the three function of the double-bounded model were specified as follows:

3.10.1 Empirical model when the service provider is the Matsapha Town Council

$$Y_i * = \beta_0 + \beta_1 X_{1i} - \beta_2 X_{2i} - \beta_3 X_{3i} - \beta_4 X_{4i} - \beta_5 X_5 i - \beta_6 X_{6i} \quad \beta_7 X_{7i} + \beta_8 X_{i\ 8} + \beta_9 X_{9i} - \beta_{10} X_{10i} \quad - \beta_{11} X_{11i} + \varepsilon_i$$

Where,

$Y_i *$ = Latent variable for WTP for improved household SWM services

β_0 = Constant

β = Coefficient of the X variable

ε_i = The error term

Female (X_1): it is expected that the coefficient of female will be positive as it is expected that the WTP for improved household SWM services of females be higher than that of males; traditionally, it is the responsibility of women to clean the house and dispose of the waste (Niringiye and Omortor, 2010)

Income (less than E200) (X_2): it is expected that the coefficient of this variable will be negative. As it is expected that the probability of WTP for improved household SWM services of respondents earning a monthly income of less than E2000 will be less than that of respondents earning a monthly income of above E5000. This is in line with economic theory, since solid waste services like waste collection are normal goods, and therefore it is expected that demand increases with income.

Income (E2000- E5000) (X_3): it is expected that the coefficient of this variable will be negative. As it is expected that the probability of WTP for improved household SWM services of respondents earning a monthly income of E2000 – E5000 will be less than that of respondents earning a monthly income of above E5000. This is in line with economic theory,

since solid waste services like waste collection are normal goods, and therefore it is expected that demand increases with income.

Marital status (single) (X_4): it is expected that the coefficient of this variable will be negative as it is expected that the WTP for improved household SWM services of single respondents will be lower than that of married respondents. Niringiye and Omortor (2010) stated that married respondents are more likely to be more responsible for household SWM than single respondents are, since they may have large families and thus face higher risks of hygiene-related diseases than single respondents do.

Marital status(widowed/ divorced) (X_5): it is expected that the coefficient of this variable will be negative as it is expected that the WTP for improved household SWM services of widowed or divorced respondents will be lower than that of married respondents.

Educational level (secondary education or less) (X_6): it is expected that the coefficient of this variable will be negative. As it is expected that the probability of WTP for improved household SWM services of respondents with no or primary or secondary education will be less than that of respondents with a tertiary education.

Educational level (technical/diploma) (X_7): it is expected that the coefficient of this variable will be negative. The probability of WTP for improved household SWM services of respondents with technical/diploma education is expected to be less than that of respondents with tertiary education.

Number of rental units(less than 8 units) (X_8): It is expected this variable will have a negative coefficient as it is expected that the probability of WTP for improved household SWM services of respondents with less than 8 rental units will be lower than that of respondents with 8 or more rental units. This is because respondents with 8 or more rental units gets more income than the respondents with less than 8 rental units; therefore, they are expected to be more willing to pay.

Knowledge (X_9): it is expected that this variable will have a positive coefficient, as it is expected that respondents with basic knowledge about improved household SWM will have

higher WTP for improved household SWM than those who do not. Respondents were asked if the know burning waste is bad for their health and that of others.

Attitude (X_{10}): The attitude variable is expected to have a negative coefficient. This variable is a question that was used to test respondents' attitude towards improved household SWM. Respondents were asked if it is not a problem when individuals dump their trash on other peoples' property. This question was asked in a negative tone. Therefore, it is expected that respondents with a negative attitude (those who answered yes) towards improved household SWM have lower WTP for improved household SWM services than that of respondents who believe (answered no) it is a problem when individuals dump their trash on other peoples' property.

Perception (X_{11}): The perception variable is expected to have a negative coefficient. Respondents were asked if people dispose of waste improperly because there are no better means of disposing of household solid waste in the peri-urban areas of Matsapha. This question was asked in a negative tone. Therefore, it is expected that respondents with negative perception (those who answered yes) towards improved household SWM have lower WTP for improved household SWM services than that of those who believed otherwise.

3.10.2 Empirical model when the service provider is the Kwaluseni Inkhundla

$$Y_i * = \beta_0 - \beta_1 X_{1i} - \beta_2 X_{2i} - \beta_3 X_{3i} - \beta_4 X_{4i} - \beta_5 X_5 i + \beta_6 X_{6i} + \beta 7 X7i - \beta_8 X_{i\ 8} - \beta_9 X_{9i} + \varepsilon_i$$

Where,

$Y_i *$ = Latent variable for WTP

β_0 = Constant

β = Coefficient of the X variable

ε_i = The error term

Marital status (single) (X_1): it is expected this variable will have a negative coefficient as it is expected that the WTP for improved household SWM services of widowed or divorced respondents will be lower than that of married respondents. Niringiye and Omortor (2010)

stated that married respondents are more likely to be more responsible for household SWM than single respondents are, since they may have large families and thus face higher risks of hygiene-related diseases than single respondents do.

Marital status (divorced/ widowed) (X_2): it is expected this variable will have a negative coefficient as it is expected that the WTP for improved household SWM services of widowed or divorced respondents will be lower than that of married respondents.

Income (less than E200) (X_3): it is expected that the coefficient of this variable will be negative. As it is expected that the probability of WTP for improved household SWM services of respondents earning a monthly income of less than E2000 will be less than that of respondents earning a monthly income of above E5000. This is in line with economic theory, since solid waste services like waste collection are normal goods, and therefore it is expected that demand increases with income.

Income (E2000- E5000) (X_4): it is expected that the coefficient of this variable will be negative. As it is expected that the probability of WTP for improved household SWM services of respondents earning a monthly income of E2000 – E5000 will be less than that of respondents earning a monthly income of above E5000. This is in line with economic theory, since solid waste services like waste collection are normal goods, and therefore it is expected that demand increases with income.

Household size (6 people and above) (X_5): it is expected this variable will have a negative coefficient, meaning that the larger the household size of respondents is, the less likely the respondents would be WTP for improved household SWM services (Yeung and Chung, 2014; Yusuf *et al.*, 2007).

Number of tenants (10 tenants and above) (X_6): it is expected this variable will have a positive coefficient, as it is expected that the probability of WTP for improved household SWM services of respondents with 10 tenants or more will higher than that of respondents with less than 10 tenants. This means that respondents with a higher numbers of tenants receive more income per month, as compared to those respondents with fewer tenants.

Therefore, respondents with more tenants are more WTP for improved household SWM services, as they have more income.

Source of income (wage employed) (X_7): it is expected that this variable will have a positive coefficient, as it is assumed that respondents who have a wage employed as a source of income will be more WTP for improved household SWM services of respondents than respondents who do not have it.

Attitude (X_8): The attitude variable is expected to have a negative coefficient. This variable is a question that was used to test respondents' attitude towards improved household SWM. Respondents were asked if it is not a problem when individuals dump their trash on other peoples' property. This question was asked in a negative tone. Therefore, it is expected that respondents with a negative attitude (those who answered yes) towards improved household SWM have lower WTP for improved household SWM services than that of respondents who believe (answered no) it is a problem when individuals dump their trash on other peoples' property.

Perception) (X_9): The perception variable is expected to have a negative coefficient. Respondents were asked if people dispose of waste improperly because there are no better means of disposing of household solid waste in the peri-urban areas of Matsapha. This question was asked in a negative tone. Therefore, it is expected that respondents with negative perception (those who answered yes) towards improved household SWM have lower WTP for improved household SWM services than that of those who believed otherwise.

3.10.3 Empirical model when the service provider is a Private Contractor

$$Y_i^* = \beta_0 - \beta_1 X_{1i} - \beta_2 X_{2i} - \beta_3 X_{3i} + \beta_4 X_{4i} - \beta_5 X_{5i} - \beta_6 X_{6i} - \beta_7 X_{7i} - \beta_8 X_{8i} + \varepsilon_i$$

Where,

Y_i^* = Latent variable for WTP

β_0 = Constant

β = Coefficient of the X variable

ε_i = The error term

Age (50 years and above) (X_1): it is expected that this variable will have a negative coefficient. As it is expected that the probability of WTP for improved household SWM services by respondents who are 50 years or above is less than that of respondents who are 50 years or less. Many studies have shown that older people who have been freely disposing of their household waste for many years are less willing to pay for improved SWM studies (Appiah-Adjei *et al*., 2015; Subhan *et al*., 2014; Hagos *et al*., 2012); Amfo-Out *et al*., 2012; Niringiye and Omortor, 2010 and Yusuf *et al*., 2007). Yusuf *et al*. (2007) further stated that the negative age coefficient indicates that the likelihood of households paying for improved household SWM services decreases as the age of the respondent increases.

Income (less than E200) (X_2): it is expected that this variable will have a negative coefficient. As it is expected that the probability of WTP for improved household SWM services of respondents earning a monthly income of less than E2000 will be less than that of respondents earning a monthly income of above E5000. This is in line with economic theory, since solid waste services like waste collection are normal goods, and therefore it is expected that demand increases with income.

Income (E2000- E5000) (X_3): it is expected that the coefficient of this variable will be negative. As it is expected that the probability of WTP for improved household SWM services of respondents earning a monthly income of E2000 – E5000 will be less than that of respondents earning a monthly income of above E5000. This is in line with economic theory, since solid waste services like waste collection are normal goods, and therefore it is expected that demand increases with income.

Number of tenants(10 tenants and above) (X_4): it is expected this variable will have a positive coefficient, as it is assumed that the probability of WTP for improved household SWM services of respondents with 10 tenants or more will be higher than that of respondents with less than 10 tenants. This means that respondents with many tenants receive more income per month, as compared with those respondents with fewer tenants. Therefore, respondents with more tenants are more WTP for improved household SWM services, as they have more income.

Educational level (secondary education or less) (X_5): it is expected this variable will have a negative coefficient. As it is assumed that the probability of WTP for improved household SWM services of a respondent with no or primary or secondary education will be less than that of respondents with a tertiary education.

Educational level (technical/diploma) (X_6): it is expected that the coefficient of this variable will be negative. As it is expected that the probability of WTP of a respondent with technical/diploma education will be less than that of respondents with a tertiary education.

Attitude(X_7): The attitude variable is expected to have a negative coefficient. This variable is a question that was used to test respondents' attitude towards improved household SWM. Respondents were asked if it is not a problem when individuals dump their trash on other peoples' property. This question was asked in a negative tone. Therefore, it is expected that respondents with negative attitude (those who answered yes) towards improved household SWM will have a lower WTP for improved household SWM services than that of those who believed otherwise.

Perception(X_8): The perception variable is expected to have a negative sign. Respondents were asked if people dispose of waste improperly because there are no better means of disposing of household solid waste in the peri-urban areas of Matsapha. This question was asked in a negative tone. Therefore, it is expected that respondents with negative perception (those who answered yes) towards improved household SWM have a lower WTP to pay for improved household SWM services than that of those who believed otherwise.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter presents the results and discussion of the study, which is organised into seven sections. Results and discussion for objective one are presented in section 4.2, section 4.3 presents results and discussion for the econometric estimation of the double-bounded models, and section 4.4 presents t-test results for objective three. Lastly, the summary of the results and discussion are presented in section 4.5.

4.2 RESPONDENTS' KNOWLEDGE, ATTITUDES AND PERCEPTIONS REGARDING IMPROVED HOUSEHOLD SOLID WASTE MANAGEMENT IN PERI-URBAN AREAS OF SWAZILAND

The first objective of the study was to evaluate respondents' knowledge, attitudes and perceptions regarding improved solid waste management in peri-urban areas of Swaziland. Thus, this section is organised into three sub-sections. Sub-section 4.2.1 will present respondents' knowledge, sub-section 4.2.2 will present respondents' attitudes, and sub-section 4.2.3 will present respondents' perceptions regarding improved solid waste management in peri-urban areas of Swaziland.

4.2.1 Respondents' knowledge of improved household solid waste management in peri-urban areas of Swaziland

The purpose of this section was to determine if respondents have sufficient knowledge about improved household SWM in peri-urban areas. Respondents' knowledge of improved household SWM in peri-urban areas is important when determining respondents' WTP for improved household SWM services. Respondents need to understand the necessity for improved household SWM services in their area before they decide if they are willing to pay for improved household SWM services or not.

To evaluate respondents' knowledge, they were given the following statements about the dangers of poorly managed household solid waste: The improper disposal of waste can cause diseases like malaria and cholera; burning waste is bad for your health and that of others; improper dumping of household solid waste can pollute rivers, streams and wells; improperly disposed waste can cause clogging of drainages and waterways, there is improper disposal of household solid waste going on here in the peri-urban areas of Matsapha. Respondents were asked to indicate the extent to which they agree or disagree with the statements by selecting from three options, "yes" if the statement is correctly, "no" if the statement is wrong, and "don't know" if they are unsure whether the statement is correctly or not. Table 4.1 presents the results for all the respondents from the three split-samples who chose the "yes" option, indicating their knowledge about improved household SWM in Matsapha peri-urban area.

Table 4.1: Respondents' knowledge about improved household SWM in Matsapha peri-urban area

	Percentage answering "yes"				
Split-sample Variable	**MTC**	**PC**	**KI**	**TOTAL**	**χ^2Tests (p-value)**
The improper disposal of waste can cause diseases like malaria and cholera	58 (96.7 %)	58 (96.7 %)	59 (98.3 %)	175 (97.2 %)	2.511 (0.643)
Burning waste is bad for your health and that of others	48 (85.0 %)	49 (81.7 %)	53 (88.3 %)	150 (83.3 %)	5.534 (0.237)
Improper dumping of household solid waste can pollute rivers, streams and wells	59 (98.3 %)	59 (98.3 %)	58 (96.7 %)	176 (97.8 %)	4.011 (0.404)
Improper disposed waste can cause clogging of drainages and waterways	58 (96.7 %)	60 (100 %)	60 (100 %)	178 (98.9 %)	4.045 (0.400)
There is improper disposal of household solid waste going on here in the peri-urban areas of Matsapha	60 (100 %)	59 (98.3 %)	60 (100 %)	179 (99.4 %)	2.011 (0.366)

Source: Author's elaboration

The results show that the majority of the respondents in all the split-samples have a high level of knowledge about improved household SWM in Matsapha peri-urban area. In the following two statements, "improper disposed waste can cause clogging of drainages and waterways" and "there is improper disposal of household solid waste going on here in the peri-urban areas of Matsapha", 100 % of the respondents answered "yes" in some of the split-samples. To test if there is equality in the distribution of responses in the three splits-samples, chi-

squared (χ^2) tests were used. The results of the χ^2 tests indicate that the null hypothesis of equality in the distribution of responses cannot be rejected.

The homogeneity indicated by the χ^2 tests allows the grouping of the three split-samples into one large sample for the analysis that further investigate the robustness of the sample results. Chi-squared tests were run on the entire sample with the aim of establishing the potential influence of the socio-economic variables, education, income, age and gender in this case. The results of this analysis are presented in Table 4.2, showing the magnitude of the χ^2 tests and the p-values in brackets.

Table 4.2: Influence of education, income, age and gender on the respondents' knowledge about improved household SWM in Matsapha peri-urban areas

Variable	Education	Income	Age	Gender
The improper disposal of waste can cause diseases like malaria and cholera	7.765 (0.457)	4.621 (0.969)	5.608 (0.691)	1.354 (0.508)
Burning waste is bad for your health and that of others	14.768 (0.064)*	22.051 (0.037)**	2.997 (0.935)	1.696 (0.429)
Improper dumping of household solid waste can pollute rivers, streams and wells	5.616 (0.690)	19.243 (0.083)*	3.224 (0.919)	1.416 (0.493)
Improper disposed waste can cause clogging of drainages and waterways	4.364 (0.823)	11.498 0.487)	2.061 (0.357)	4.586 (0.801)
There is improper disposal of household solid waste going on here in the peri-urban areas of Matsapha	8.045 (0.090)*	1.202 (0.977)	0.792 (0.939)	8.045 (0.375)

Source: Author's elaboration

*Note: *, ** denotes the statistical level of significance at 10 %, 5 %, respectively*

The results show that only education and income have an influence on the respondents' knowledge about improved household SWM. Education and income were both statistically significant for the question that asked respondents about the dangers of improper SWM (burning waste is bad for your health and that of others). As expected, the more educated an individual is, the higher the likelihood is that he or she will know that burning waste is bad for his or her health and that of others. This relationship is significant at the 10 % level for this variable. Moreover, education is also significant at the 10 % level for the variable, "There is improper disposal of household solid waste going on here in the peri-urban areas of

Matsapha". As also expected, the more educated a respondent is, the higher the likelihood is that he or she will be able to distinguish that there is improper disposal of household solid waste going on in the peri-urban areas of Matsapha. The results also show that there is a statistically significant relationship between income and the variables (burning waste is bad for your health and that of others). The relationship is significant at the 5 % level. This suggests that people with more income are able to invest in themselves by getting advanced education about improved household SWM. There was also a significant relationship between income and the variable designed to capture respondents' knowledge about improved household SWM, "improper dumping of household solid waste can pollute rivers, streams and wells". This relationship was at the 10 % significance level.

The positive relationship between income and the variable designed to capture respondents' knowledge about improved household SWM, "improper dumping of household solid waste can pollute rivers, streams and wells", implies that people with more money are able to finance their household solid waste disposal instead of using free methods of household solid waste disposal, like dumping waste in rivers, streams and wells. When respondents were asked how they are currently disposing of household solid waste, about 9 % of respondents revealed that they dump it in nearby rivers and streams. Age and gender did show any significant relationship with any of the variables used to cap the variable designed to capture respondents' knowledge about improved household SWM.

4.2.2. Respondents' attitudes towards improved household solid waste management in peri-urban areas of Swaziland

The purpose of this section is to determine respondents' attitudes towards improved household SWM in Matsapha peri-urban areas. Determining households' attitudes is important because they influence improved household SWM, and thus, respondents' WTP for it. Respondents were given the following statements to reveal their attitudes towards improved household SWM in peri-urban areas of Swaziland: improper dumping of household solid waste is a problem in Matsapha peri-urban area; it is not a problem when individuals improperly dispose their household solid waste on their own property; it is not a problem when individuals dump their trash on other people's property; it is not a problem when individuals dump their trash on open public spaces like roads; it is not a problem when

individuals burn their own trash in their backyards; the current indiscriminate dumping and management of household solid waste in Matsapha is a problem of public concern; I'm prepared to properly dispose my household solid waste for my own benefit and for the benefit of the people who live in my household; and I'm prepared to properly dispose my household solid waste for the benefit of all the people who live in Matsapha. Table 4.3 show questions codes used in Table 4.4.

Table 4.3: Codes for questions

Question (variable)	Question code
Improper dumping of HSW is a problem in Matsapha peri-urban area	1
It is not a problem when individuals improperly dispose their HSW on their own property	2
It is not a problem when individuals dump their trash on other people's property	3
It is not a problem when individuals dump their trash on open public spaces like roads	4
It is not a problem when individuals burn their own trash in their backyards	5
The current indiscriminate dumping and management of HWS in Matsapha is a problem of public concern	6
I'm prepared to properly dispose my HSW for my own benefit and for the benefit of the people who live in my household	7
I'm prepared to properly dispose my HSW for the benefit of all the people who live in Matsapha	8

Respondents were then asked their levels of agreement with the statements, which were used to assess their opinions towards improved SWM. The options were set on a six-point Likert scale, with 1 indicating "strongly agree", 2 "disagree", 3 "Not sure", 4 "Agree", 5 "strongly agree" and 6 "don't know". Table 4.4 presents results of the analysis.

Table 4.4: Respondents' attitudes towards improved household solid waste management in Matsapha peri-urban area

Variable	Split sample	Strongly agree	Agree	Not sure	Disagree	Strongly disagree	Don't know
	MTC	42(70.0 %)	16(26.7 %)	1(1.7 %)	0	1(1.7 %)	0
	PC	41(68.3 %)	16(26.7 %)	2(3.3 %)	0	1(1.7 %)	0
1	**KI**	41(68.3 %)	18(30.0 %)	0	0	0	1(1.7 %)
	Total	124(68.9 %)	50(27.8 %)	3(1.7 %)	0	1(1.1 %)	1(0.5 %)
	MTC	6(10.0 %)	6(10.0 %)	1(1.7 %)	24(40.0 %)	23(38.3 %)	0
	PC	6(10.0 %)	9(15.0 %)	4(6.7 %)	21(35.0 %)	19(31.7 %)	1(1.7 %)
2	**KI**	0	5(8.3 %)	1(1.7 %)	22(36.7 %)	31(51.7 %)	1(1.7 %)
	Total	12(6.7 %)	20(11.1 %)	6(3.3 %)	67(37.2 %)	73(40.5 %)	2(1.1 %)
	MTC	5(8.3 %)	1(1.7 %)	0	23(38.3 %)	31(51.7 %)	0
	PC	1(1.7 %)	0	0	23(38.3 %)	36(60.0 %)	0
3	**KI**	1(1.7 %)	2(3.3 %)	1(1.7 %)	21(35.0 %)	35(58.3 %)	0
	Total	7(3.9 %)	3(1.7 %)	1(0.5 %)	67(37.2 %)	102(56 %)	0
	MTC	1(1.7 %)	3(5.0 %)	0	19(31.7 %)	37(61.7 %)	0
	PC	1(1.7 %)	0	1(1.7 %)	28(46.7 %)	30(50.0 %)	0
4	**KI**	2(3.3 %)	1(1.7 %)	1(1.7 %)	21(35.0 %)	35(58.3 %)	0
	Total	4(2.2 %)	4(2.2 %)	2(1.1 %)	68(37.8 %)	102(56.7 %)	0
	MTC	10(16.7 %)	11(18.3 %)	11(18.3 %)	15(25.0 %)	12(20.0 %)	1(1.7 %)
	PC	8(13.3 %)	14(23.3 %)	10(16.7 %)	18(30.0 %)	7(11.7 %)	3(5.0 %)
5	**KI**	8(13.3 %)	9(15.0 %)	11(18.3 %)	17(28.3 %)	10(16.7 %)	5(8.3 %)
	Total	26(14.4 %)	34(18.9 %)	32(17.8 %)	50(27.8 %)	29(16.1 %)	9(5.0 %)
	MTC	41(68.3 %)	16(26.7 %)	1(1.7 %)	0	1(1.7 %)	1(1.7 %)
	PC	32(53.3 %)	23(38.3 %)	2(3.3 %)	1(1.7 %)	0	2(3.3 %)
6	**KI**	36(60.0 %)	19(31.7 %)	0	3(5.0 %)	2(3.3 %)	0
	Total	109(60.5 %)	58(32.2 %)	3(1.7 %)	4(2.2 %)	3(1.7 %)	3(1.7 %)
	MTC	40(66.7 %)	18(30.0 %)	0	1(1.7 %)	1(1.7 %)	0
	PC	38(63.3 %)	21(35.0 %)	1(1.7 %)	0	0	0
7	**KI**	36(60.0 %)	22(36.7 %)	1(1.7 %)	0	1(1.7 %)	0
	Total	114(63.3 %)	61(33.9 %)	2(1.1 %)	1(0.5 %)	2(1.1 %)	0
	MTC	38(63.3 %)	19(31.7 %)	0	2(3.3 %)	1(1.7 %)	0
	PC	41(68.3 %)	19(31.7 %)	0	0	0	0
8	**KI**	38(63.3 %)	21(35.0 %)	1(1.7 %)	0	0	0
	Total	17(65.0 %)	59(32.8)	1(0.5 %)	2(1.1 %)	1(0.5 %)	0

Source: Author's elaboration

HSW: Represents household solid waste

Table 4.4 shows that most respondents have positive attitudes towards improved SWM. To determine households' attitudes towards improved household SWM, respondents were asked

both positive and negative questions. It was expected that if households had positive attitudes, they would strongly agree or agree when a positive question was asked, or strongly disagree or disagree when a negative question was asked. The results indicate that when households were asked positive questions, the majority of them chose the strongly agree and agree options, revealing that they have positive attitudes towards improved household solid waste management. When respondents were asked negative questions, most of them chose the strongly disagree or disagree options, also indicating positive attitudes towards improper household solid waste management. Table 4.5 present the χ^2 tests results, together with the p-values in brackets.

Table 4.5: Influence of education, income, age and gender on respondents' attitudes towards improved household solid waste management in Matsapha peri-urban area

Variable	Education	Income	Age	Gender
Improper dumping of HSW is a problem in Matsapha peri-urban area	13.047 (0.669)	14.7086 (0.929)	7.525 (0.962)	1.451 (0.835)
It is not a problem when individuals improperly dispose their household solid waste on their own property	15.492 (0.718)	28.838 (0.526)	11.507 (0.932)	3.609 (0.607)
It is not a problem when individuals dump their trash on other people's property	22.324 (0.133)	42.970 (0.010)***	4.766 (0.312)	26.040 (0.053)*
It is not a problem when individuals dump their trash on open public spaces like roads	26.038 (0.053*)	30.950 (0.155)	21.668 (0.154)	4.118 (0.390)
It is not a problem when individuals burn their own trash in their backyards	24.676 (0.214)	23.681 (0.786)	9.199 (0.980)	6.064 (0.300)
The current indiscriminate dumping and management of household solid waste in Matsapha is a problem of public concern	28.587 (0.096)*	29.259 (0.504)	18.540 (0.552)	2.850 (0.723)
I'm prepared to properly dispose my household solid waste for my own benefit and for the benefit of the people who live in my household	22.19124 (0.174)	23.655 (0.481)	21.755 (0.151)	2.351 (0.672)
I'm prepared to properly dispose my household solid waste for the benefit of all the people who live in Matsapha	21.124 (0.174)	19.646 (0.717)	35.879 (0.003)**	2.911 (0.573)

Source: Author's elaboration

*Note: *, **, *** denotes the statistical level of significance at 10 %, 5 % and 1 %, respectively*

HSW: Represents household solid waste

To further investigate the robustness of the sample results, χ^2 was used to establish the potential relationship of socio-economic variables on the variables that were used to determine respondents' attitudes towards improved household SWM in Matsapha peri-urban area.

The results in Table 4.4 show that all socio-economic variables have a positive influence on some of the questions that were used to capture respondents' attitudes towards household SWM. Education was statistically significant for both the questions asked to respondents to capture their knowledge about improved household SWM, "it is not a problem when individuals dump their trash on open public spaces like roads" and "the current indiscriminate dumping and management of household solid waste in Matsapha is a problem of public concern". As expected, the more educated an individual is, the higher the likelihood is that he or she will have a positive attitude toward improved household SWM, since an educated individual will know that it is a problem when individuals dump their trash on open public spaces like roads, and that individual will also know the consequences of dumping trash on open spaces like roads. This relationship is significant at the 10 % level for this variable.

Moreover, education was also significant at the 10 % level for the variable designed to capture respondents' attitudes towards improved household solid waste management, "the current indiscriminate dumping and management of household solid waste in Matsapha is a problem of public concern". As also expected, the more educated a respondent is, the higher the likelihood is that he or she will have a positive attitude towards improved household solid waste management. A person with knowledge of improved household solid waste management will know if the current indiscriminate dumping and management of household solid waste in Matsapha is a problem of public concern, because it is assumed that people with lower levels of understanding about improved household SWM might think it is only the government's concern when people poorly manage household solid waste. Income was statistically significant for the question used to capture respondents' attitudes towards improved household solid waste management, "it is not a problem when individuals dump their trash on other people's property". This relationship is significant at 1 % level. As expected, households with higher incomes are more likely to have positive attitude towards improved household solid waste management, as for this variable, households with higher incomes are able to finance the proper disposal of their household solid waste, as compared

with those households that have lower incomes, who might think it is not a problem to dump their household solid waste on other people's property.

Results show that age was statistically significant in influencing households' attitudes towards improved household solid waste management on the variable, "I'm prepared to properly dispose my household solid waste for the benefit of all the people who live in Matsapha". The relationship is significant at the 5 % level. This implies that older people are more likely to have positive attitudes towards improved household solid waste management. Older people in Matsapha peri-urban area have been improperly disposing of household solid waste, thus, they have seen the dangers of disposing household solid waste. Respondents were asked to give a reason why they ranked improved household solid waste collection as their top priority, and they revealed that they have suffered from cholera, which they think is caused by improper disposal of household solid waste, as their yards and surroundings are very dirty. Respondents also stated that improperly disposed waste helps breed flies and mosquitoes in summer, and they that were some diarrhoea outbreaks in the area. Therefore, this might be the explanation why older people indicated that they are prepared to properly dispose their household solid waste for the benefit of all the people who live in Matsapha.

Gender does not seem to have an influence on most of the questions that were used to capture respondents' attitudes towards improved household solid waste management, except for one question, "It is not a problem when individuals dump their trash on other people's property". This relationship is statistically significant at the 10 % level. This might indicate that females are more likely to have positive attitudes towards improved household solid waste management. Traditionally, women are responsible for cleaning the house and disposing of household solid waste.

4.2.3. Respondents' perceptions on improved household solid waste management in peri-urban areas of Swaziland

The purpose of this section was to determine respondents' opinions with regard to improved household SWM in Matsapha peri-urban areas. Respondents were given the following statements to determine their opinions towards improved household SWM in peri-urban areas of Swaziland: in your opinion, a well-organized program for household solid waste collection

can be a solution to the improper disposal of household solid waste in Matsapha peri-urban area; in your view, will household solid waste collection lead to a clean better quality of the environment; in your opinion, should the public be educated about proper disposal of household solid waste; in your view, do people dispose waste improperly because there are no better means of disposing household solid waste in the peri-urban areas of Matsapha; in your view, will people still dispose household solid waste improperly even if there is a formal system for waste disposal; and in your opinion, does the smell of improper disposed household solid waste affect you, your household and tenants. Table 4.6 show questions codes used in Table 4.7.

Table 4.6: Codes for questions

Question (variable)	Question code
In your opinion, a well-organized program for HSW collection can be a solution to the improper disposal of HSW in Matsapha peri-urban area	1
In your view, will HSW collection lead to a clean better quality of the environment	2
In your opinion, should the public be educated about proper disposal of HSW	3
In your view, do people dispose waste improperly because there are no better means of disposing household solid waste in the peri-urban areas of Matsapha	4
In your view, will people still dispose HSW improperly even if there is a formal system for waste disposal	5
In your opinion, does the smell of improper disposed HSW affect you, your household and tenants	6

Respondents were then asked to select the best option that represented their opinions about the given statements that were used to assess their opinions towards improved SWM. The options were set on a six-point Likert scale, with 1 indicating “strongly agree”, 2 “disagree”, 3 “Not sure”, 4 “Agree”, 5 “strongly agree” and 6 “don’t know”. Table 4.7 presents results of the analysis.

Table 4. 7: Respondents' perceptions towards improved household solid waste management in Matsapha peri-urban area

Variable	Split sample	Strongly agree	Agree	Not sure	Disagree	Strongly disagree	Don't know
1	MTC	31(51.7 %)	24(40.0 %)	2(3.3 %)	3(5.0 %)	0	0
	PC	33(55.0 %)	20(33.3 %)	6(10.0 %)	1(1.7 %)	0	0
	KI	36(60.0 %)	18(30.0 %)	2(3.3 %)	4(6.7 %)	0	0
	Total	100(55.5 %)	62(34.4 %)	10(5.5 %)	8(4.4 %)	0	0
2	MTC	39(65.0 %)	17(28.3 %)	3(5.0 %)	1(1.7 %)	0	0
	PC	39(65.0 %)	18(30.0 %)	2(3.3 %)	0	0	1(1.7 %)
	KI	37(61.7 %)	21(35.0 %)	1(1.7 %)	1(1.7 %)	0	0
	Total	115(63.9 %)	56(31.1 %)	6(3.3 %)	2(1.1 %)	0	1(0.5 %)
3	MTC	46(76.7 %)	12(20.0 %)	0	0	0	2(3.3 %)
	PC	41(68.3 %)	18(30.0 %)	0	1(1.7 %)	0	0
	KI	42(70.0 %)	15(25.0 %)	2(3.3 %)	1(1.7 %)	0	0
	Total	129(71.6 %)	45(25.0 %)	2(1.1 %)	2(1.1 %)	0	2(1.1 %)
4	MTC	20(33.3 %)	15(25.0 %)	5(8.3 %)	11(18.3 %)	2(3.3 %)	7(11.7 %)
	PC	21(35.0 %)	9(15.0 %)	14(23.3 %)	10(16.7 %)	2(3.3 %)	4(6.7 %)
	KI	16(26.7 %)	14(23.3 %)	13(21.7 %)	7(11.7 %)	2(3.3 %	8(13.3 %)
	Total	57(31.7 %)	38(21.1 %)	32(17.8 %)	28(15.6 %)	6(3.3 %)	19(10.6 %)
5	MTC	12(20.0 %)	17(28.3 %)	9(15.0 %)	11(18.3 %)	8(13.3 %)	3(5.0 %)
	PC	12(20.0 %)	16(26.7 %)	13(21.7 %)	11(18.3 %)	5(8.3 %)	3(5.0 %)
	KI	12(20.0 %)	25(41.7 %)	9((15.0 %)	12(20.0 %)	1(1.7 %)	1(1.7 %)
	Total	36(20 %)	58(32.2 %)	19(10.5 %)	34(18.9 %)	14(7.8 %)	7(3.9 %)
6	MTC	44(73.3 %)	13(21.7 %)	1(1.7 %)	2(3.3 %)	0	0
	PC	40(66.7 %)	17(28.3 %)	0	2(3.3 %)	1(1.7 %)	0
	KI	38(63.3 %)	21(35.0 %)	0	1(1.7 %)	0	0
	Total	122(67.8 %)	51(28.3 %)	1(0.5 %)	5(2.8 %)	1(0.5 %)	0

Source: Author's elaboration

The results show that the majority of respondents have positive perceptions towards improved household SWM in Matsapha peri-urban areas. Respondents were asked both positive and negative questions to check if they have the right perception about household solid waste management. Table 4.7 shows that when respondents were asked positive questions, most of them strongly agreed, suggesting that respondents have positive perceptions about improved household SWM. To further investigate the robustness of the sample results, χ^2 was used to establish the potential relationship of socio-economic variables on the variables that were used to determine respondents' perceptions towards improved

household SWM Matsapha peri-urban area. Table 4.8 present the χ^2 test results, together with the p-values in brackets.

Table 4.8: Influence of education, income, age and gender on respondents' perceptions on improved household solid waste management in Matsapha peri-urban area

Variable	Education	Income	Age	Gender
In your opinion, a well-organized program for HSW collection can be a solution to the improper disposal of HSW in Matsapha peri-urban area	16.034 (0.189)	22.741 (0.201)	31.600 (0.002)***	4.175 (0.243)
In your view, will HSW collection lead to a clean better quality of the environment	12.683 (0.696)	23.830 (0.471)	10.511 (0.839)	2.7360 (0.603)
In your opinion, should the public be educated about proper disposal of HSW	18.578 (0.291)	23.877 (0.469)	6.526 (0.981)	1.736 (0.784)
In your view, do people dispose waste improperly because there are no better means of disposing household solid waste in the peri-urban areas of Matsapha	27.838 (0.113)	30.421 (0.444)	18.862 (0.531)	10.200 (0.070)***
In your view, will people still dispose HSW improperly even if there is a formal system for waste disposal	25.962 (0.167)	23.788 (0.782)	23.962 (0.167)	4.521 (0.477)
In your opinion, does the smell of improper disposed HSW affect you, your household and tenants	36.215 (0.003)***	30.985 (0.184)	15.017 (0.523)	3.700 (0.448)

Source: Author's elaboration

*Note: *** denotes the statistical level of significance at 1 %*

HSW: Represents household solid waste

The results show that only education, age and gender have an influence on the respondents' perceptions towards improved household SWM. Education was statistically significant at 1 % level for the question designed to capture respondents' perceptions towards improved household SWM, "In your opinion, does the smell of improper disposed household solid waste affect you, your household and tenants". This suggests that the more educated an individual is, the higher the probability is that he or she will have knowledge about how the smell of waste can affect someone, thus influencing that individual's perceptions towards improved household solid waste management.

Age was statistically significant at 1 % level in influencing respondents' perception on the question that asked respondents about the improper management of household solid waste (a

well-organized program for household solid waste collection can be a solution to the improper disposal of household solid waste in Matsapha peri-urban area). As expected, the older the respondent is, the higher the likelihood is that he or she will think that a well-organized program for household solid waste collection can be a solution to the improper disposal of household solid waste in Matsapha peri-urban areas, as older people have seen other household solid waste programs failing in the study area.

Gender influenced the opinions of respondents when they were asked if people dispose of waste improperly because there are no better means of disposing of household solid waste in the peri-urban areas of Matsapha. This relationship was statistically significant at 1 % level. This may suggest that females are more likely to think that people dispose of waste improperly because there no better means of disposing of household solid waste. Income does not seem to have any influence on respondents' perceptions towards improved household solid waste management. Though statistically insignificant, income has the expected sign.

4.3 ECONOMETRIC ESTIMATION OF THE DICHOTOMOUS MODEL

4.3.1 Introduction

Since the sample in this study was divided into three split-samples, respondents' WTP for improved household SWM services was estimated for each split-sample in order to achieve the second objective of the study. To determine respondents' WTP for improved household SWM services for the three split-samples, a dichotomous question with follow-up or double-bounded model was used. The double-bounded model was estimated using maximum likelihood, using the likelihood function in equation (22).

Section 4.3.2 presents the estimation of respondents' WTP in Matsapha peri-urban households for improved household SWM services when the service provider is the Matsapha Town Council, a public corporation. Section 4.3.3 presents the estimation of respondents' WTP in Matsapha peri-urban households for improved household SWM services when the service provider is the Kwaluseni Inkhundla, a traditional community development administration. Lastly, section 4.3.4 presents the estimation of respondents' WTP in

Matsapha peri-urban households for improved household SWM services when the service provider is a Private Contractor, being a private agency.

4.3.2 Estimation of respondents' WTP in Matsapha peri-urban households for improved solid waste management services when the service provider is Matsapha Town Council, a public corporation

Before estimating the double-bound model for this split-sample, the distribution of the first bid amount was assessed. Table 4.9 presents the distribution of the first bid amount.

Table 4.9: First bid amount distribution

Bid1	Frequency	Percentage
10	20	33.33
20	20	33.33
30	20	33.33
Total	60	100.00

Source: Author's elaboration

There were three initial bid amounts, where each was given to 20 respondents, making a total 60 respondents. The distribution of the responses to the first bid was also analysed in order to determine the number of respondents who gave a positive response to the first question. Table 4.10 presents the first bid response distribution.

Table 4.10: First bid response distribution

Bid1 response	Frequency	Percentage
Yes	44	73.33
No	12	20.00
Don't know	4	6.67
Total	60	100.00

Source: Author's elaboration

The results show that about 73 % of respondents answered "yes" to the initial bid amount question. Lopez-Feldman (2012) stated that if you are using contingent valuation data, it is

imperative to check if respondents are sensible to the bid amount, because as the bid amount goes up, the number of respondents answering "yes" should decrease. Table 4.11 presents the responsiveness of respondents' responses as the first bid amount goes up, which is in percentages.

Table 4.1: Respondents responsiveness to the increase of the first bid amount

First bid response	**Bid**			
	10	**20**	**30**	**Total**
Yes	85.00	80.00	55.00	73.33
No	15.00	20.00	45.00	26.67
Total	100	100	100	100

Source: Author's elaboration

As expected, the proportion of positive responses decreases as the first bid amount increases. The first bid amount variable was tested if it is statistically significant and if the probability of a respondent giving a positive answer goes down as the bid increases. Results show that the first bid variable was statistically significant and it had a negative relationship with the first response given by respondents. As this study used the double-bounded CV, Table 4.12 presents the distribution of the second bid amount.

Table 4. 2: Second bid amount distribution

Bid2	**Frequency**	**Percentage**
5	3	5.00
10	4	6.67
15	26	43.33
30	16	26.67
45	11	18.33
Total	60	100.00

Source: Author's elaboration

The second bid amount was dependent on the respondent's answer to the first bid amount: if the respondent said "yes" to the first bid amount, the respondent was asked about his or her

WTP for a higher amount, whereas if he or she answered "no" to the first bid amount, a lower amount was offered. Table 4.13 presents the second bid responses.

Table 4. 3: Second bid responses

Bib2 response	Frequency	Percentage
Yes	36	60
No	23	38.3
Don't know	1	1.7
Total	60	100.00

Source: Author's elaboration

The results show that 60 % of the respondents in this split-sample responded "yes" to the second WTP bid amount. It can be noted that the number of respondents who answered "no" to the second amount is not the number of respondents who voted against the bill, as some of them answered "yes" to the first bid amount, but when asked about their WTP for a higher amount, they answered "no". Based on a follow-up question to the valuation question, respondents were then asked to give their reasons for voting for or against the bill. Table 4.14 presents the reasons respondents gave for voting against the bill.

Table 4.4: The most important reasons why respondents would not be WTP

Reasons	Frequency
It is government's responsibility to provide waste collection services	4
Income is low and cannot afford it	0
Volume and quantity of my household waste is low	1
I don't trust the service provider/ Service provider have tried before but failed	2
Total	7

Source: Author's elaboration

The reasons reflected in Table 4.14 were used in the identification of invalid responses, being WTP responses that were excluded from the regression. By using Table 4.14, actual zeros and protest zeros were identified. All the respondents who claimed "it is government's responsibility to provide waste collection services; volume and quantity of my household waste is low; I don't trust the service provider/ service provider have tried before but failed" were regarded as protest zeros, and thus were not included in the regression. However, the

respondents who said they voted against the bill because their income is low and cannot afford it were regarded as actual zeros. Table 4.15 gives a comparison of respondents who gave positive WTP, actual zero WTP and protest zero WTP.

Table 4.5: Comparison of positive WTP, actual zero WTP and protest zero WTP

Comparison of positive WTP, actual zero WTP and Protest zero WTP	Number of respondents	Percentage
Positive WTP	53	88.33
Actual zero WTP	0	0.00
Protest zero WTP	7	11.67

Source: Author's elaboration

The results show that about 88 % of the respondents voted for the bill, while 12 % of the respondents were regarded as protest zeros. Before the WTP was estimated, the protest zeros were removed from the sample. After the protest zeros were removed from the sample, WTP was estimated using ML. The doubleb command was used to estimate two models, one with no control variables and the other with control variables. In the one with no control variables, the doubleb command directly estimated β and σ in equation (15): WTP is $z'\beta$, therefore in this case WTP is basically the constant. In the model with covariates, the correlation coefficient matrix was computed to test for multicollinearity and all the variables were found not to be highly correlated with each other. The Breusch-Pagan test was used to test for heteroskedasticity and we failed to reject the null hypothesis that the variance is constant. The ML results of both models are presented in Table 4.16.

In Table 4.16, the results show that in the model without covariates, the estimated average WTP is E32.16, with a standard deviation of E14.20. At the lower bound, the mean WTP was E27.28 (95 % Lower Confidence Interval) and at the upper bound it was E37.05 (95 % Upper Confidence Interval).

When estimating the model with covariates, eleven control variables were included, most of them being categorical variables. In model II in Table 4.16, of the eleven estimated variables, only six are significantly related to the likelihood of giving positive WTP values. Coefficients of income (E2000- E5000) dummy variable, perception and attitude are significant at 1 % level of significance; while coefficients of female dummy variable, marital status

(widowed/divorced) dummy variable and less than 8 units of rental units dummy variable are significant at the 10 % level of significance. Whilst there was no statistically significance evidence for coefficients of income (less than E200) dummy variable, marital status (single) dummy variable, educational level (secondary education or less) dummy variable, educational level(technical/diploma) dummy variable and knowledge.

Table 4.6: Maximum Likelihood WTP bid function

Variable	**I:Intercept only**		**II: With characteristics**	
	Coefficient	**z-statistics**	**Coefficient**	**z-statistics**
Constant	32.16347***	12.90	52.19632***	3.71
Female			11.42228**	2.49
Income (less than E200)			8.728953	1.55
Income (E2000- E5000)			16.37394***	2.73
Marital status(single)			2.844384	0.51
Marital status(widowed/ divorced)			16.62367**	2.24
Educational level(secondary education or less)			-9.878197	-1.65
Educational level(technical/diploma)			-1.475972	-0.28
Number of rental units(less than 8 units)			11.11312**	2.48
Knowledge			-8.069422	-1.58
Attitude			-6.873672***	-3.44
Perception			-6.68773***	-3.20
Σ	14.20105***	6.89	10.16328***	6.63
Loglikelihood	-61.53798		-47.18244	
Prob>chi^2			0.01222	
Number of obs	53		53	

Source: Author's elaboration

*Note: **, *** denotes the statistical level of significance at 5 % and 1 %, respectively*

The female dummy was found to be statistically significant at the 5 % level of significance. The results show that the probability of WTP for improved household SWM for females is

higher than that for males. This finding is consistent with the findings of the study by Fonta *et al*. (2007) where they found that female respondents are more willing to pay for improved household SWM services than males are. Niringiye and Omortor (2010) stated that it is expected for the WTP for improved household SWM services of females to be higher than that of males; traditionally, it is the responsibility of women to clean the house and dispose of the waste. The coefficients of the two income dummy variables are positive, though they were expected to be negative. It would be expected that the probability of WTP of a respondent earning a monthly income of less than E2000 would be less than the probability of WTP of a respondent earning a monthly income of above E5000.

The results also show that the likelihood of WTP of a respondent earning a monthly income of E2000–E5000 is being higher than the likelihood of a respondent earning a monthly income of above E5000. Though it is expected that the higher the income, the higher the WTP for improved solid waste management services, which is in line with economic theory. Since solid waste services like waste collection are normal goods, and therefore it is expected that demand will increase with income. However, these unexpected results suggest that since the service provider for improved household SWM services for this sub-sample is the Matsapha Town Board, respondents earning a monthly income of above R5000 might prefer that private contractors perform as the service provider for improved household SWM services, since they have enough money to pay for their exclusive services. The results also show that the number of rental units (less than 8 units) dummy variable was statistically significant at the 5 % level, but surprisingly, the coefficient is positive. It was expected that the probability of WTP for improved household SWM services of a respondent with less than 8 rental units be lower than that of a respondent with 8 or more rental units. However, this surprisingly findings might indicate that respondents in this split-sample feel that, because they have fewer rental units, smaller amounts of household waste will be produced than those with more rental units, thus they would only have to pay for small amounts of household solid waste. Therefore, they are more willing to pay for improved household SWM services than those respondents with 8 or more rental units.

The dummy variable for marital status (widowed/divorced) was found to be statistically significant at a 5% level in influencing the WTP for improved household solid waste management services. Yusuf *et al.*, (2007) also found that marital status has a significant

effect on the WTP for improved household solid waste management services. The WTP for improved household solid waste management services of widowed or divorced respondents was found to be higher than that of married respondents. This finding was unexpected, however, and this might suggests that widowed and divorced respondents might have more money than married respondents do. This might occur especially where widowed respondents receive an inheritance from their deceased spouses, and divorced respondents receive divorce settlements from their ex-spouses. One of the significant variables in Model II is the attitude variable which was statistically significant at 1 % level of significance. The attitude variable has a negative coefficient, as expected. This variable is a question that was used to test respondents' attitude towards improved household SWM. Respondents were asked if it is not a problem when individuals dump their trash on other peoples' property. The results indicate that a respondent with a negative attitude towards improved household SWM has a lower WTP for improved household SWM services than those respondents who believe it is a problem when individuals dump their trash on other peoples' property.

The results also show that the perception variable was also statistically significant at 1 % level of significance. The perception variable was a question which was used to test respondents' perceptions towards improved household SWM. Respondents were asked if people dispose of waste improperly because there are no better means of disposing of household solid waste in the peri-urban areas of Matsapha. Respondents who believe that people dispose of waste improperly because there are no better means of disposing of household solid waste in the peri-urban areas of Matsapha had a lower WTP to pay for improved household SWM services than those who believe otherwise. From Table 4.16, it can be concluded that the majority of respondents did not believe that people dispose of waste improperly because there are no better means of disposing household solid waste. The results show that there was no evidence for statistically significant influence of the two dummy variables for educational level on WTP of respondents. This finding is consistent with Niringiye and Omortor (2010) who found that respondents' level of education did not significantly influence WTP for improved household SWM services. Tadesse and Hadgu (2009) also reached the same conclusion. However, the negative coefficients of the two dummy variables for educational level indicate that respondents with a tertiary level of education have a higher probability of WTP for improved solid waste management services

than those respondents with no or primary or secondary level of education and technical or diploma level of education.

The double-bound dichotomous model, Model II, was used to estimate households' WTP for an improved household SWM bid function when the service provider was the Matsapha Town Council. Average values of explanatory variables in Model II were used and the mean WTP was found to be E36.95, at the lower bound, the mean WTP was E31.65 (95 % Lower Confidence Interval), and at the upper bound it was E42.26 (95 % Upper Confidence Interval). Furthermore, from the estimated households' WTP for improved household SWM bid function, households' WTP for improved household SWM for each individual was calculated. From the households' WTP for improved household SWM of individuals, the mean WTP was found to be E47.71, which was higher than the mean WTP calculated from the average values of explanatory variables. The respondents who answered "yes" to both dichotomous questions ("yes–yes") and those who answered "no" to the first bid questions, but answered "yes" to the second bid question ("no–yes"), were then asked to state their MWTP. The mean WTP for "yes–yes" responses determined upper bound WTP for this split-sample, and the mean WTP for "no–yes" responses determined the lower bound WTP for this split-sample. The upper bound WTP was E56.29, which was in line with expectations, as it was expected that this WTP would overstate the mean WTP obtained from the double-bound dichotomous model. The lower bound WTP was E13.33, which was also consistent with expectations, as it was expected that this WTP would underestimate the mean WTP obtained from the double-bound dichotomous model.

4.3.3 Estimation of respondents' WTP in Matsapha peri-urban households for improved solid waste management services when the service provider is the Kwaluseni Inkhundla, a public agency.

Before estimating the double-bound model for this split-sample, the distribution of the first bid amount was assessed. Table 4.17 presents the distribution of the first bid amount.

Table 4.7: First bid amount distribution

Bid 1	Frequency	Percentage
10	20	33.33
20	20	33.33
30	20	33.33
Total	60	100.00

Source: Author's elaboration

There were three initial bids amount, where each was given to 20 respondents, making a total of 60 respondents. The distribution of the responses to bid 1 was also analysed in order to determine the number of respondents who gave positive responses to the first question. Table 4.18 presents the first bid response distribution.

Table 4.8: First bid response distribution

Bid1 response	Frequency	Percentage
Yes	44	73.33
No	16	26.67
Total	60	100.00

Source: Author's elaboration

The results show that about 73 % of respondents answered "yes" to the initial bid amount question. Lopez-Feldman (2012) stated that if you are using contingent valuation data, it is imperative to check if respondents are sensible to the bid amount, because as the bid amount goes up, the number of respondents answering "yes" should decrease. Table 4.19 presents the responsiveness of respondents' responses as the first bid amount goes up.

Table 4.9: Respondents' responsiveness to the increase of the first bid amount

Bid 1 response	Bid (percentages)			
	10	**20**	**30**	**Total**
Yes	70.00	70.00	80.00	73.33
No	30.00	30.00	20.00	26.67
Total	100	100	100	100

Source: Author's elaboration

Table 4.19 shows that the proportion of respondents who gave positive answers remained constant as the first bid (E10) went up and increased as the second bid increased, which was unexpected. As this study used the double-bounded CV, Table 4.20 presents the distribution of the second bid amount distribution.

Table 4.10: Second bid amount distribution

Bid 2	Frequency	Percentage
5	6	10.00
10	6	10.00
15	18	30.00
30	14	23.33
45	16	26.67
Total	60	100.00

Source: Author's elaboration

The second bid amount was dependent on a respondent's answer to the first bid amount; if the respondent said "yes" to the first bid amount, the respondent was asked about his or her WTP for a higher amount, and if he or she answered "no" to the first bid amount, a lower amount was offered. Table 4.21 presents second bid responses.

Table 4.11: Second bid responses

Bid 2 response	Frequency	Percentage
Yes	31	51.67
No	20	33.33
Don't know	9	15.00
Total	60	100.00

Source: Author's elaboration

The results show that about 52 % of the respondents in this sub-sample responded "yes" to the second WTP bid amount. It can be noted that the number of respondents who answered "no" to the second amount is not the same number as the respondents who voted against the bill, as some of them answered "yes" to the first bid amount, but when asked about their

WTP for a higher amount, they answered "no". Based on a follow-up question to the valuation question, respondents were asked to give their reasons for voting for or against the bill. Table 4.22 presents the reasons respondents gave for voting against the bill.

Table 4.12: The most important reasons why respondents would not be WTP

Reasons	Frequency
It is government's responsibility to provide waste collection services	7
Income is low and cannot afford it	1
Volume and quantity of my household waste is low	0
I don't trust the service provider/ Service provider have tried before but failed	3
Total	11

Source: Author's elaboration

The reasons set out in Table 4.22 were used to identify invalid responses, being WTP responses that were excluded from the regression. By using Table 4.22, actual zeros were identified from protest zeros. All the respondents who claimed "it is government's responsibility to provide waste collection services, volume and quantity of my household waste is low; I don't trust the service provider/ service provider have tried before but failed" were regarded as protest zeros, and thus were not included in the regression. However, the respondents who said that they voted against the bill because their income is low and cannot afford it were regarded as actual zeros. Table 4.23 gives the comparison of respondents who reflected positive WTP, actual zero WTP and protest zero WTP.

Table 4.13: Comparison of positive WTP, actual zero WTP and Protest zero WTP

Comparison of positive WTP, actual zero WTP and Protest zero WTP	Number of respondents	Percentage
Positive WTP	49	81.67
Actual zero WTP	1	1.67
Protest zero WTP	10	16.67

Source: Author's elaboration

The results show that about 82 % of the respondents voted for the bill, while about 2 % respondents were regarded as actual zeros, and about 17 % of the respondents were regarded as protest zeros. Before the WTP was estimated, protest zeros were removed from the

sample. After the protest zeros were removed from the sample, WTP was estimated using ML. The doubleb command was used to estimate two models, one with no control variables and the other with control variables. In the one with no control variables, the doubleb command directly estimated β and σ in equation (15): WTP is $z'\beta$, therefore, in this case WTP is basically the constant. The ML results of both models are presented in Table 4.24.

Table 4.14: Maximum Likelihood WTP bid function

Variable	**Intercept only**		**With characteristics**	
	Coefficient	**z-statistics**	**Coefficient**	**z-statistics**
Constant	35.17539***	13.71	79.65454**	3.10
Marital status(single)			-10.16949**	-1.96
Marital status(divorced/ widowed)			1.190355	0.18
Income (less than E200)			-5.826297	-0.84
Income (E2000- E5000)			-4.925895	-0.96
Household size(6 people and above)			-13.11958**	-2.39
Number of tenants(10 tenants and above)			11.3554**	2.05
Source of income(wage employed)			3.9804	0.86
Attitude			-5.682851**	-2.20
Perception			-5.508087	-1.17
Σ	13.86718***	6.64	11.01324***	6.41
Loglikelihood	-50.278577		-41.804582	
Prob>chi^2			0.0492	
Number of obs	50		50	

Source: Author's elaboration

*Note: **, *** denotes the statistical level of significance at 5 % and 1 %, respectively*

In Table 4.24, the results shows that in the model without covariates, the estimated average WTP is E35.17, with a standard deviation of E13.87. At the lower bound, the mean WTP was E30.15 (95 % Lower Confidence Interval), and at the upper bound it was E40.20 (95 % Upper Confidence Interval). When estimating the model with covariates, nine control

variables were included, most of which are categorical variables. In model II in Table 4.24, of the nine estimated coefficients, only four are significantly related to the probability of giving positive WTP values. Coefficients of marital status (single) dummy variable, household size (6 people and above) variable, number of tenants (10 tenants and above) dummy variable and attitude are significant at the 5 % level of statistical significance. While marital status (widowed/divorced) dummy variable, income (less than E2000) dummy variable, income (E2000- E5000) dummy variable, source of income (wage employed) dummy variable and perception showed no statistically significant evidence.

The marital status (single) dummy variable has a negative relationship with WTP. This indicates that the probability of WTP for improved household SWM of single respondents is less than that of married people. Niringiye and Omortor (2010) stated that married respondents are more likely to be more responsible for household SWM, since they may have large families and thus face higher risks of hygiene-related diseases than single respondents do. The marital status (single) dummy variable was significant at the 5 % level. Household size (6 people and above) dummy variable was significant at the 5 % level, this variable had a negative coefficient, similarly to the findings of Yeung and Chung (2014) and Yusuf *et al.*, (2007) who found that household size has a negative significant effect on WTP for improved household SWM. Meaning that the larger the household size is, the less likely the respondent would be willing to pay.

The results also show that the number of tenants (10 tenants and above) dummy variable was statistically significant at the 5 % level and with a positive coefficient, as expected. The probability of WTP for improved household SWM services of a respondent with 10 tenants or more is higher than that of a respondent with less than 10 tenants. This might suggest that respondents with a higher numbers of tenants receive more income per month, as compared with those respondents with fewer tenants. Therefore, respondents with more tenants are more WTP for improved household SWM services, as they have more income. The variable designed to capture the attitudes of respondents (the current indiscriminate dumping and management of household solid waste in Matsapha is a problem of public concern) was also statistically significant at the 5 % level of significance. The attitude variable has a negative sign, as expected. The results indicate that respondents with negative attitudes towards improved household SWM have lower WTP for improved household SWM services than

those respondents who believe the current indiscriminate dumping and management of household solid waste in Matsapha is a problem of public concern.

The results show that the perception variable has no statistically significant influence on the respondents' WTP for improved household SWM services. Both income dummy variables showed no evidence of statistical significance. This finding is consistent with findings of a study carried by Amfo-Out *et al.*, (2012) where it was found that income does not significantly influence the WTP for improved household SWM services. However, in this study, the coefficients of the two income dummy variables had negative signs, as was expected. The results indicated that the probability of WTP for improved household SWM services of respondents earning a monthly income of less than E2000 and income between E2000 and E5000 is lower than that of respondents earning a monthly income of more than R5000.

The double-bound dichotomous model, Model II, was used to estimate households' WTP for improved household SWM bid function when the service provider was the Kwaluseni Inkhundla. Average values of explanatory variables in Model II were used and the mean WTP was found to be E39.20 at the lower bound, with the mean WTP at E33.75 (95 % Lower Confidence Interval), and the upper bound was E44.65 (95 % Upper Confidence Interval). Moreover, from the WTP bid function estimated, households' WTP for improved household SWM services for each individual was calculated. From the households' WTP for improved household SWM services for each individual, the mean WTP was found to be E36.49, which was lower than the mean WTP calculated from the average values of explanatory variables. Accordingly, respondents who answered "yes" to both dichotomous questions ("yes–yes") and those who answered "no" to the first bid questions, but answered "yes" to the second bid question ("no–yes"), were then asked to state their MWTP. The mean WTP for "yes–yes" responses determined the upper bound WTP for this split-sample, and the mean WTP for "no–yes" responses determined the lower bounds WTP for this split-sample. The upper bound WTP was E50.83, which was in line with expectations, as it was expected that this WTP would overstate the mean WTP obtained from the double-bound dichotomous model. The lower bound WTP was E12.14, which was also consistent with expectations, as it was expected that this WTP would underestimate the mean WTP obtained from the double-bound dichotomous model.

4.3.4 Estimation of respondents' WTP in Matsapha peri-urban households for improved solid waste management services when the service provider is a Private Contractor, a private agency.

Before estimating the double-bound model for this split-sample, the distribution of the first bid amount was evaluated. Table 4.25 presents the first bid amount distribution.

Table 4.15: First bid amount distribution

Bid 1	Frequency	Percentage
10	20	33.33
20	20	33.33
30	20	33.33
Total	60	100.00

Source: Author's elaboration

There were three initial bids amount, where each was given to 20 respondents, making a total 60 respondents. The distribution of responses to the first bid amount was also analysed in order to determine the number of respondents who gave positive responses to the first question. Table 4.26 presents the first bid responses.

Table 4.16: First bid responses

Bid 1 response	Frequency	Percentage
Yes	45	75.00
No	11	18.33
Don't know	4	6.67
Total	60	100.00

Source: Author's elaboration

The results show that 75 % of the respondents answered "yes" to the initial bid amount question. If you are using contingent valuation data, it is imperative to check if respondents are sensible to the bid amount, because as the bid amount goes up, the number of respondents answering "yes" should decrease (Lopez-Feldman, 2012). Table 4.26 presents respondents' responsiveness to the increase of the first bid amount.

Table 4.17: Respondents' responsiveness to the increase of the first bid amount

Bid 1 response	Bid (percentages)			
	10	**20**	**30**	**Total**
Yes	90.00	60.00	75.00	75.00
No	10.00	40.00	25.00	25.00
Total	100.00	100.00	100.00	100.00

Source: Author's elaboration

As expected, the proportion of positive responses decreased as the first bid amount increased, although in this sub-sample, the responses increased in the last bid amount. Using the Probit command on Stata, it was found that the first bid variable was statistically significant and it had a negative relationship with the first response given by respondents. As this study used the double-bounded CV, Table 4.28 presents the distribution of the second bid amount.

Table 4.18: Second bid amount distribution

Bid2	Frequency	Percentage
5	2	3.33
10	8	13.33
15	23	30.00
30	12	20.00
45	15	25.00
Total	60	100.00

Source: Author's elaboration

The second bid amount was dependent on the respondent's answer to the first bid amount: if the respondent said "yes" to the first bid amount, the respondent was asked about his or her WTP for a higher amount, and if he or she answered "no" to the first bid amount, a lower amount was offered. Table 4.29 presents second bid responses.

Table 4. 19: Second bid responses

Bib 2 response	Frequency	Percentage
Yes	43	71.67
No	14	23.33
Don't know	3	5.00
Total	60	100.00

Source: Author's elaboration

The results show that about 72 % of the respondents in this split-sample responded "yes" to the second WTP bid amount. It can be noted that the number of respondents who answered "no" to the second amount is not the same number of respondents who voted against the bill, as some of them answered "yes" to the first bid amount, but when asked about their WTP for a higher amount, they answered "no". Based on a follow-up question to the valuation question, respondents were asked to give their reasons for voting for or against the bill. Table 4.30 presents the reasons respondents gave for voting against the bill.

Table 4.20: The most important reasons why respondents would not be WTP

Reasons	Frequency
It is government's responsibility to provide waste collection services	4
Income is low and cannot afford it	2
Volume and quantity of my household waste is low	0
I don't trust the service provider/ Service provider have tried before but failed	2
Total	8

Source: Author's elaboration

The reasons stated in Table 4.30 were used in the identification of invalid responses, being mean WTP responses that were excluded from the regression. By using Table 4.30, actual zeros and protest zeros were identified. All the respondents who claimed "it is government's responsibility to provide waste collection services; volume and quantity of my household waste is low; I don't trust the service provider/ service provider have tried before but failed" were regarded as protest zeros, thus were not included in the regression. However, the respondents who said they voted against the bill because their income is low and cannot

afford it were regarded as actual zeros. Table 4.31 gives the comparison of respondents who gave positive WTP, actual zero WTP and Protest zero WTP.

Table 4. 21: Comparison of positive WTP, actual zero WTP and Protest zero WTP

Comparison of positive WTP, actual zero WTP and Protest zero WTP	Number of respondents	Percentage
Positive WTP	52	86.67
Actual zero WTP	2	3.33
Protest zero WTP	6	10.00

Source: Author's elaboration

The results show that about 87 % of the respondents voted for the bill, while about 3 % of the respondents were regarded as actual zeros, and 10 % of the respondents were regarded as protest zeros. Before the WTP was estimated, the protest zeros were removed from the sample. After the protest zeros were removed from the sample, WTP was estimated using ML. The doubleb command was used to estimate two models, one with no control variables and the other with control variables. In the one with no control variables, the doubleb command directly estimated β and σ in equation (15): WTP is $z'\beta$, therefore in this case, WTP is basically the constant. Table 4.32 presents the Maximum Likelihood WTP bid function.

In Table 4.32, the results show that in the model without covariates, the estimated average WTP is E40.46, with a standard deviation of E18.68. At the lower bound, the mean WTP was E32.63 (95 % Lower Confidence Interval) and at the upper bound it was E48.29 (95 % Upper Confidence Interval). When estimating the model with covariates, eight control variables were included, most of which are categorical variables. In model II in Table 4.32, of the eight estimated coefficients, only two are significantly related to the probability of giving positive WTP values. Coefficients of age (50 years and above) dummy variables and number of tenants (10 tenants and above) dummy variable are significant at the 5 % level of statistical significance. on the other hand, income (less than E2000) dummy variable, income (E2000-E5000) dummy variable, educational level (secondary education or less) dummy variable, educational level (technical/diploma) dummy variable, perception and attitude showed no statistically significant evidence.

Table 4. 22: Maximum Likelihood WTP bid function

Variable	Intercept only		With characteristics	
	Coefficient	z-statistics	Coefficient	z-statistics
Constant	40.45767***	10.13	92.21231***	2.68
Age (50 years and above)			-17.2293***	-2.64
Income (less than E200)			-0.1831518	-0.02
Income (E2000- E5000)			-6.733999	-0.82
Number of tenants(10 tenants and above)			19.45826***	2.73
Educational level(secondary education or less)			-2.082665	-0.23
Educational level(technical/diploma)			-1.459759	-0.16
Attitude			-7.605696	-1.31
Perception			-3.543004	-1.49
Σ	18.68168***	5.39	14.31793	5.31
Loglikelihood	-48.215978		-37.37275	
Prob>chi^2			0.0663	
Number of obs	54		54	

Source: Author's elaboration

*Note: **, *** denotes the statistical level of significance at 5 % and 1 %, respectively*

The age (50 years and above) dummy variable is significant at the 5 % level and it has a negative coefficient, as expected. The probability of WTP for improved solid waste management services by a respondent who is 50 years or above is less than that of a respondent who is less than 50 years old. This finding is consistent with the findings of the studies by Appiah-Adjei *et al.,* (2015); Subhan *et al.,* (2014); Hagos *et al.,* (2012); Amfo-Out *et al.,* (2012); Niringiye and Omortor (2010) and Yusuf *et al.,* (2007), where these researchers found that age of a household head has a negative cofficient, indicating that older people who have been freely disposing of their household waste for many years are less willing to pay for improved SWM. Yusuf *et al.,* (2007) further stated that the negative age coefficient indicates that the likelihood of households paying for improved household SWM services decreases as the age of the respondent increases. The results also show that the number of tenants (10 tenants and above) dummy variable was statistically significant at the

5 % level, and with a negative coefficient, as expected. The probability of WTP for improved solid waste management services of a respondent with 10 tenants or more is higher than that of a respondent with less than 10 tenants. This might suggest that respondents with a higher number of tenants receive more income per month, as compared with that of respondents with fewer tenants. Therefore, respondents with more tenants are more willing to pay for improved SWM services, as they have more income.

Both income dummy variables showed no evidence of statistical significance, although they both have negative coefficients, as was expected. Amfo-Out *et al.*, (2012) also found that income was statistically insignificant in influencing the WTP for improved SWM services. The results indicated that the probability of WTP for improved solid waste management services of respondents earning a monthly income of less than E2000, and income between E2000 and E5000, is less than that of respondents earning a monthly income of more than R5000. The results also show that both educational level dummy variables showed no evidence of statistically significant influence on respondents' WTP for improved SWM services. This finding is similar to those of Subhan *et al.*, (2014); Tadesse and Hadgu (2009); and Altaf and Deshazo (1996), where they found that education have no statistical significance in influencing the WTP for improved SWM services. However, the negative coefficients were as expected. It is expected that the probability of WTP for improved SWM services of a respondent with tertiary education would be higher than that of a respondent with no education, primary education, secondary education or technical and diploma education.

The double-bound dichotomous model, Model II, was used to estimate households' WTP for improved household SWM bid function when the service provider is a Private Contractor. Average values of explanatory variables in Model II were used and the mean WTP was found to be E39.46 with, while the lower bound was E32.02 (95 % Lower Confidence Interval), and at the upper bound it was E46.90 (95 % Upper Confidence Interval). From the estimated WTP bid function of households, the WTP for improved household SWM services for individuals was calculated. From the WTP of individuals, the mean WTP was found to be E43.71, which was higher than the mean WTP calculated from the average values of explanatory variables. Accordingly, respondents who answered "yes" to both dichotomous questions ("yes–yes") and those who answered "no" to the first bid questions, but answered

"yes" to the second bid question ("no–yes"), were then asked to state their MWTP. The mean WTP for "yes–yes" responses determined upper bound WTP for this split-sample, and the mean WTP for "no–yes" responses determined the lower bound WTP for this split-sample. The upper bound WTP was E42.50, which was in line with expectations, as it was expected that this WTP would overstate the mean WTP obtained from the double-bound dichotomous model. The lower bound WTP was E11.67, which was also consistent with expectations, as it was expected that this WTP would underestimate the mean WTP obtained from the double-bound dichotomous model.

4.4 T-TESTS' RESULTS

Objective 3 was to investigate whether the identity of the institution providing improved household SWM services significantly influences households' WTP. The double-bound dichotomous model for each split-sample, Model II, was used to calculate individual WTP in each split-sample. After calculating individual's WTP in each split-sample, a Kruskal–Wallis test was conducted to test for equality of respondents' WTP for improved household SWM services of the three split-samples. The results indicated that there is a statistically significant difference among the three sub-samples (χ^2=19.651, p-value=0.0001).

Next, t-tests were used to test the hypothesis that respondents' WTP for improved household SWM services is significantly influenced by the type of institution providing improved household SWM services. Three paired t-tests were computed, each comparing the respondents' mean WTP of two sub-samples. The tests were done on STATA. The *p*-value determines whether the split-sample means are statistically significant. Paired t-tests for respondents' WTP for improved household SWM services when the service provider is the Matsapha Town Council, and when the service provider is the Kwaluseni Inkhundla, are presented in Table 4.33.

Results showed that the respondents' WTP for improved household SWM services when the service provider is the Matsapha Town Council is statistically significantly different from respondents' WTP for improved household SWM services when the service provider is the Kwaluseni Inkhundla. Therefore, we fail to reject the null hypothesis that the mean WTP for improved household SWM services of respondents when the service provider is the Matsapha

Town Council is statistically significantly different from respondents' WTP for improved household SWM services when the service provider is the Kwaluseni Inkhundla. This suggests that the way in which the two public providers operate is very different.

Table 4. 23: Paired t-tests for MTC and KI

Variable	Observations	Mean	Standard error	Standard deviation	95% Confidence	Interval
WTP_MTC	60	47.711	2.019	15.638	43.671	51.750
WTP_ KI	60	36.488	1.394	10.800	33.698	39.278
Difference	60	11.222	2.624	20.322	5.973	16.478
Mean (difference) = mean WTP_MTC - WTP_ KI					t = 4.278	
H_0: mean (difference) = 0					degrees of freedom = 59	
H_a: mean (difference) < 0		H_a: mean (difference)! = 0			H_a: mean (difference) > 0	
Pr (T < t) = 1.000		Pr (| T | < | t |) = 1.000			Pr (T > t) = 0.000	

Source: Author's elaboration

The respondents' mean WTP for improved household SWM services when the service provider is the Matsapha Town Council was higher than that for the Kwaluseni Inkhundla by E11.22, and statistically significant at 1 % significance level. Paired t-tests results for respondents' WTP for improved household SWM services when the service provider is Matsapha Town Council, and when the service provider is a Private Contractor, are presented in Table 4.34.

Results also show that the respondents' WTP for improved household SWM services when the service provider is the Matsapha Town Council is not statistically significantly different (p-value =0.1331) from respondents' WTP for improved household SWM services when the service provider is a Private Contractor. Therefore, we fail to accept the null hypothesis that the mean WTP for HH solid waste collection services of respondents when the service provider is the Matsapha Town Council is statistically significant different from respondents' WTP for improved household SWM services when the service provider is a Private Contractor. This was unexpected, as one would expect Private Contractors to be more efficient than a public service provider.

Table 4.24: Paired t-tests for MTC and PC

Variable	Observations	Mean	Standard error	Standard deviation	95% Confidence	Interval
WTP_MTC	60	47.711	2.019	15.638	43.671	51.750
WTP_ PC	60	43.706	2.017	18.627	39.669	47.742
Difference	60	4.005	2.630	20.369	-1.257	9.267
Mean (difference) = mean WTP_MTC - WTP_ PC					t = 1.523	
H_0: mean (difference) = 0					degrees of freedom = 59	
H_a: mean (difference) < 0		H_a: mean (difference)! = 0			H_a: mean (difference) > 0	
Pr (T < t) = 0.934		Pr (| T | < | t |) = 0.133			Pr (T > t) = 0.067	

Source: Author's elaboration

This might suggests that either Matsapha Town Council provide household SWM services exceptionally or in Swaziland, there is a huge market for Private Contractors in the SWM sector. Paired t-tests for WTP for improved household SWM services when the service provider is a Private Contractor and when the service provider is the Kwaluseni Inkhundla are presented in Table 4.35.

Table 4. 25: Paired t-tests for PC and KI

Variable	Observations	Mean	Standard error	Standard deviation	95% Confidence	Interval
WTP_PC	60	43.706	2.017	15.627	39.669	47.742
WTP_ KI	60	36.488	1.394	10.800	33.698	39.278
Difference	60	7.217	2.490	19.290	2.234	12.200
Mean (difference) = mean WTP_MTC - WTP_ PC					t = 2.898	
H_0: mean (difference) = 0					degrees of freedom = 59	
H_a: mean (difference) < 0		H_a: mean (difference)! = 0			H_a: mean (difference) > 0	
Pr (T < t) = 0.997		Pr (| T | < | t |) = 0.005			Pr (T > t) = 0.003	

Source: Author's elaboration

The last paired t-test results in Table 4.35 show the respondents' WTP for improved household SWM services when the service provider is a Private Contractor is statistically significantly different from respondents' WTP for improved household SWM services when the service provider is the Kwaluseni Inkhundla. Therefore, we fail to reject the null hypothesis that the mean WTP for HH solid waste collection services of respondents when the service provider is a Private Contractor is statistically significantly different from respondents' WTP for improved household SWM services when the service provider is the Kwaluseni Inkhundla. This was as expected, as it was expected that Private Contractors are more efficient in providing household SWM as compared with the Kwaluseni Inkhundla. The respondents' mean WTP for improved household SWM services when the service provider is a Private Contractor was higher than that of the Kwaluseni Inkhundla by E7.22, and statistically significant at the 1 % significance level. Figure 1 shows the WTP for improved SWM services in Matsapha peri-urban area.

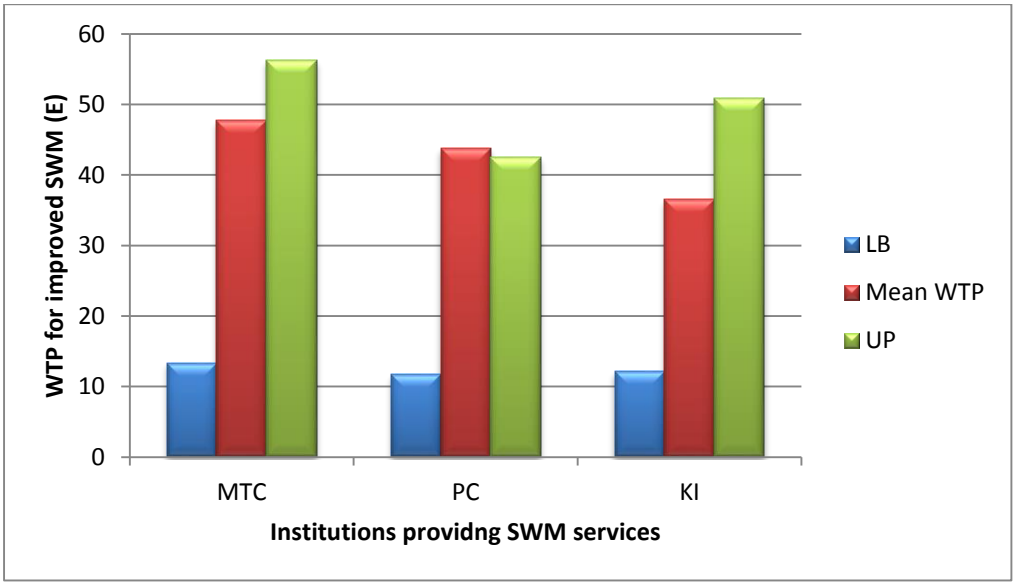

Figure 1: Willingness to pay for improved SWM services in Matsapha peri-urban area

Source: Author's elaboration

It can be concluded that the respondents' mean WTP for improved household SWM services, when the service provider is the Matsapha Town Council, was the highest of the three (E47.71), followed by the respondents' mean WTP for improved household SWM services when the service provider is a Private Contractor (E44.53), and that the lowest respondents' mean WTP for improved household SWM services was when the service provider is the

Kwaluseni Inkhundla (E36.49). The Kruskal–Wallis test and the three paired t-tests confirm that the respondents' WTP for improved household SWM services in Matsapha peri-urban area is significantly influenced by the type of agency managing the improved solid waste management services. Thus, we fail to reject the null hypothesis that respondents' WTP for improved household SWM services in Matsapha per-urban is significantly influenced by the type of agency managing household SWM services.

4.5 CONCLUDING SUMMARY

From the results presented in this chapter, five inferences can be derived. First, when analysing households' knowledge about improved household SWM, the results showed adequate evidence to suggest that households in Matsapha peri-urban areas demonstrate high levels of knowledge about improved household SWM. Second, there was sufficient evidence that households have positive attitudes towards improved household SWM in peri-urban areas of Swaziland. Third, households were demonstrated to have positive perceptions towards improved household SWM in Matsapha peri-urban areas. Education was found to have an influence on all constructs, suggesting that education plays a major role on the management of household solid waste. Income seemed to have an influence on households' knowledge and attitudes towards improved household SWM.

Forth, there was sufficient evidence that households' socio-economic characteristics have an influence on household's WTP for improved household SWM services. Lastly, results showed that households' WTP for improved household SWM services is significantly influenced by the type of agency providing improved household SWM services. There was ample evidence that there is a statistically significant difference among the three split-samples. The double-bound dichotomous model, Model II, was used to estimate WTP bid function when the service provider is the Matsapha Town Council. The estimated WTP bid function was used to calculate households' WTP for improved household SWM services for individuals. From the WTP of individuals, the mean WTP was found to be E47.71. The upper bound WTP was E56.29, which was in line with expectations, as it was expected that this WTP would overstate the mean WTP obtained from the double-bound dichotomous model. The lower bound WTP was E13.33, which was also consistent with expectations, as it was

expected that this WTP would underestimate the mean WTP obtained from the double-bound dichotomous model.

The double-bound dichotomous model, Model II, was used to estimate WTP bid function when the service provider is the Kwaluseni Inkhundla. The estimated WTP bid function was used to calculate households' WTP for improved household SWM services for individuals. From the WTP of individuals, the mean WTP was found to be E36.49. The upper bound WTP was E50.83, which was in line with expectations, as it was expected that this WTP would overstate the mean WTP obtained from the double-bound dichotomous model. The lower bound WTP was E12.14, which was also consistent with expectations, as it was expected that this WTP would underestimate the mean WTP obtained from the double-bound dichotomous model. The double-bound dichotomous model, Model II, was used to estimate WTP bid function when the service provider is a Private Contractor. The estimated WTP bid function was used to calculate households' WTP for improved household SWM services for individuals. From the WTP of individuals, the mean WTP was found to be E43.71. The upper bound WTP was E42.50, which was in line with expectations, as it was expected that this WTP would overstate the mean WTP obtained from the double-bound dichotomous model. The lower bound WTP was E11.67, which was also consistent with expectations, as it was expected that this WTP would underestimate the mean WTP obtained from the double-bound dichotomous model.

Results showed that the respondents' WTP for improved household SWM services when the service provider is the Matsapha Town Council is statistically significantly different from respondents' WTP for improved household SWM services when the service provider is the Kwaluseni Inkhundla. This suggests that the way in which the two public providers operate is totally different and that Matsapha peri-urban households prefer the Matsapha Town Board to be their service provider for improved household SWM services, when compared with the Kwaluseni Inkhundla. There was also sufficient evidence that Matsapha peri-urban households were indifferent between the Matsapha Town Council and a Private Contractor as service providers. This was unexpected, as one would expect Private Contractors to be more efficient than a public service provider. This might suggest that either the Matsapha Town Council provides SWM services exceptionally well, or in Swaziland, there is a huge market for Private Contractors in the SWM sector.

The last paired t-test results show that the respondents' WTP for improved household SWM services when the service provider is a Private Contractor is statistically significantly different from respondents' WTP for improved household SWM services when the service provider is the Kwaluseni Inkhundla. This was as expected, as it was expected that Private Contractors are more efficient in providing improved household SWM services, as compared with the Kwaluseni Inkhundla. It was found that the respondents' mean WTP for improved household SWM services when the service provider is the Matsapha Town Council was the highest of the three (E47.71), followed by the respondents' mean WTP for improved household SWM services when the service provider is a Private Contractor (E44.53), and that the lowest respondents' mean WTP for improved household SWM services was when the service provider is the Kwaluseni Inkhundla (E36.49).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This study employed the CVM to estimate households' WTP for improved SWM services in Matsapha using the double-bounded bid elicitation format. Data was collected from a random sample of 180 households split into three by potential SWM service provider: the Matsapha Town Council (a public corporation), the Kwaluseni Inkhundla (a traditional community development administration), and a private contractor. This study also determined household knowledge, attitudes and perceptions towards improved SWM. This chapter summarizes the study's key conclusions, recommendations, policy implications, limitations and suggests areas for further research.

5.2 CONCLUSION

From the results presented in Chapter 4, the following conclusions can be made. First, households in Matsapha demonstrate high levels of knowledge about the consequences on social welfare and the environment of inappropriate SWM practices. Second, households in Matsapha have perceptions and attitudes that are receptive to a policy that improves the *status quo*. In specific, education levels and income significantly influence households' knowledge, perceptions and attitudes towards improved SWM. Third, a number of socio-economic characteristics were shown to significantly influence household's WTP for improved SWM. Fourth, households mean WTP for improved SWM was positive and statistically significant. In particular, it was highest when the potential service provider was the Matsapha Town Council (E47.71 per household per month), followed by the private contractor (E44.53 per household per month) and lowest for the Kwaluseni Inkhundla (E36.49 per household per month). Finally, households' WTP for improved SWM significantly varies with the potential service provider: Matsapha Town Council was preferred to the Kwaluseni Inkhundla, the private contractor was preferred to the Kwaluseni Inkhundla, but households were indifferent between the Matsapha Town Council and the private contractor.

5.3 RECOMMENDATIONS AND POLICY IMPLICATIONS

The economic developments that have occurred in Matsapha peri-urban area in the past years have led to serious SWM problems. In as much as the Kwaluseni Inkhundla administration has unsuccessfully tried to put SWM systems in place, this study has unambiguously shown that households in Matsapha rank a state in which adequate and appropriate SWM services are provided higher than the *status quo*, even if such services were to be provided at a fee. On the basis of the foregoing, this study makes the following recommendations:

- First, there is a compelling case to motivate policy reforms in SWM in peri-urban areas of Swaziland that make the provision of adequate and appropriate SWM services mandatory. This is because households rank a state in which adequate and appropriate SWM services are provided higher than the *status quo*.
- Second, since the sustainable provision of adequate and appropriate SWM services has monetary implications, such services should be provided at a monthly fee. This is because this study shows that households rank a state in which adequate and appropriate SWM services are provided higher than the *status quo* even if such services were to be provided at a fee.
- The third conclusion concerns how much households should pay for such a service. Our analysis suggests that on average, households are WTP between E13.33 and E56.29 per household per month (independent of potential service provider) for improved SWM. On the knowledge that some households currently pay E10.00 per month to private contractors for this service, it is our view that a monthly household charge of between E13.33 and E56.29 is reasonable. However, the actual fee to be charged should be determined through stakeholder consultation. This is because in addition to economic efficiency, such a charge should be based on other considerations like ability to pay, poverty status, gender, location of household, willingness and ability of government to subsidize, the administrative costs of the charge, etc. What this study has only shown is the range of the charge if economic efficiency was the only consideration.
- Finally is the issue of preferred service provider. This study has shown that the Kwaluseni Inkhundla administration is without question not the preferred service provider. Such a service should either be provided by the Matsapha Town Council or a private supplier. Following the arguments presented in the preceding conclusion, the

actual choice of service provider should also be made based on stakeholder consultations.

5.4 LIMITATIONS OF THE STUDY AND AREAS OF FURTHER RESEARCH

This study was limited to determining household's WTP for improved SWM services. Since the Matsapha peri-urban area is characterised by many rental units, only household heads (landlords) were interviewed and not tenants. Therefore, the WTP for improved SWM services determined in this study is only for household heads, not tenants. There is a need to determine tenants' WTP for improved SWM services, since tenants are usually characterised as being one person or two people sharing a flat or as a very small family; thus, it might happen that their WTP for improved SWM is different from that of homeowners. Moreover, this study did not determine the amount of household solid waste generated per household, which might have a significant influence on how much households have to pay for waste collection services. The prospect of recycling was also not considered in this study. Recycling can help reduce the amount of household solid waste that needs to be collected from each household, thus reducing the amount of household solid waste that end up in landfills. Lastly, this study only focused on household solid waste, whereas respondents have indicated that there are no sewerage management systems available in Matsapha peri-urban areas. There is a need to determine household's WTP for the provision of improved sewerage management services in Matsapha peri-urban areas.

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APPENDIX A: LETTER OF CONSENT

Informed consent for participation in an academic research study
Department of Agricultural Economics, Extension and Rural Development

INFLUENCE OF GOVERNANCE INSTITUTIONS ON HOUSEHOLDS' WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT IN THE PERI-URBAN SETTLEMENTS OF MATSAPHA, SWAZILAND

Research conducted by:
Nonduduzo Ndlovu (14328829)
Cell SA: +27 78 040 3492
Swazi: +268 76728475)

Dear Respondent

You are invited to participate in an academic research study conducted by Nonduduzo Ndlovu, a Masters student from the Department of Agricultural economics, Extension and Rural Development at the University of Pretoria.

The purpose of the study is to estimate the demand for household solid waste collection services in the densely populated peri-urban settlements of Matsapha. The study will determine the following:

1) Is it economically efficient for the **Matsapha Town Council/ Kwaluseni Inkhundla/ a Private Contractor** provides improved household waste collection services to peri-urban residents of Matsapha?

2) How much are peri-urban households WTP per month for improved waste collection services?

3) What determines household's WTP for improved waste collection services?

4) What kind of institutional arrangements that peri-urban households prefer to provide waste collection services?

Please note the following:

- ✓ This study involves an **anonymous** survey. Your name will not appear on the questionnaire and the answers you give will be treated as strictly **confidential**. You cannot be identified in person base on the answers you give.
- ✓ Your participation in this study is very important to us. You may, however, choose not to participate and you may stop participating at any time without any negative consequences.
- ✓ Please answer the question in the attached questionnaire as completely and honestly as possible. This should not take more than an hour.
- ✓ The result of the study will be used for policy formulation, academic purposes only and may publish in an academic journal. We will provide you with a summary of our findings on request.
- ✓ Please contact my supervisor, Dr E.D. Mungatana at eric.mungantana@up.ac.za if you have any questions or comments regarding the study.

Please sign the form to indicate that:

- ✓ You have read and understand the information provided above.
- ✓ You give your consent to participate in the study on a voluntary basis.

Respondent signature……... **Date……**

APPENDIX B: SURVEY INSTRUMENT

SECTION A: GENERAL INFORMATION

The purpose of this section is to gather information about the interview in general.

1. Chiefdom:
    a. Kwaluseni
    b. Mhlane
    c. Logoba

2. Name of enumerator……..

3. Interview date……

4. Time interview starts……

5. Time interview ended……

Note: *for the purpose of this interview household solid waste refers to waste material generated in the residential environment, like plastics, clothing, bottles, organic matter etc….*

SECTION B: HOUSEHOLDS' KNOWLEDGE, ATTITUDES AND PERCEPTIONS ON HOUSEHOLD SOLID WASTE MANAGEMENT

The purpose of this section is to collect information about your personal knowledge, attitudes and perceptions on some issues concerning solid waste management in the peri-urban of Matsapha. Please read the questions and choose the response that best represents your standpoint concerning these issues.

6. Please indicate the extent to which you agree or disagree with the following statements about improper disposal and management of household solid waste. **Codes: Yes =1, No =2 and Don't know = 3**

Knowledge about solid waste management	**Code**
The improper disposal of waste can cause diseases like malaria and cholera	
Burning waste is bad for your health and that of others	
Improper dumping of household solid waste can pollute rivers, streams and wells	
Improper disposed waste can cause clogging of drainages and waterways	
There is improper disposal of household solid waste going on here in the peri-urban areas of Matsapha	

7. This question seeks to reveal your attitudes towards household solid waste management in Matsapha peri-urban areas. Please indicate you level of agreement with the following statements below. **Codes: Strongly disagree =1, Disagree = 2, Not sure = 3, Agree = 4, strongly agree = 5, Don't know = 6**

Attitudes towards household solid waste (HSW) management in Peri-urban Matsapha	**Code**
Improper dumping of HSW is a problem in Matsapha peri-urban area	
It is not a problem when individuals improperly dispose their HSW on their own property	
It is not a problem when individuals dump their trash on other people's property	
It is not a problem when individuals dump their trash on open public spaces like roads	
It is not a problem when individuals burn their own trash in their backyards	
The current indiscriminate dumping and management of HWS in Matsapha is a problem of public concern	

Attitudes towards household solid waste (HSW) management in Peri-urban Matsapha	Code
I'm prepared to properly dispose my HSW for my own benefit and for the benefit of the people who live in my household	
I'm prepared to properly dispose my HSW for the benefit of all the people who live in Matsapha	

8. The following question seeks to find out about your opinion with regard to household solid waste management in Matsapha peri-urban areas. Please select the response that best represent your opinion about the given statements below. **Codes: Strongly disagree =1, Disagree = 2, Not sure = 3, Agree = 4, strongly agree = 5, don't know = 6**

Perceptions with regard to Household Solid Waste (HSW) management in Matsapha peri-urban areas	Codes
In your opinion, a well-organized program for HSW collection can be a solution to the improper disposal of HSW in Matsapha peri-urban area	
In your view, will HSW collection lead to a clean better quality of the environment	
In your opinion, should the public be educated about proper disposal of HSW	
In your view, do people dispose waste improperly because there are no better means of disposing household solid waste in the peri-urban areas of Matsapha	
In your view, will people still dispose HSW improperly even if there is a formal system for waste disposal	
In your opinion, does the smell of improper disposed HSW affect you, your household and tenants	

10. How does your household currently dispose household solid waste?
    a. Garbage heap within the yard
    b. Open space along the road
    c. Temporal waste storage facility
    d. Bury it on within my yard
    e. Big sacks
    f. Burn it
    g. Dump it in river
    h. Private collector
    i. Other ……

9. Whose responsibility is to dispose waste in your household?
    a. Children
    b. Adults
    c. Shared (adults and children)
    d. Tenants
    e. Other (Specify) …….
    f. Don't know

1. Can you please rank the following in order of importance to you, from the most to the least important?
    a. Improved water
    b. Improved solid waste collection
    c. Improved sewerage
    d. Improved roads

2. Kindly motivate your reasons for your ranking in response to Q11 above?

    ……

    ……

SECTION C: CONTINGENT VALUATION METHOD

WTP for improved household solid waste management services

Currently, the Matsapha Town Board provides household solid waste collection services to Matsapha urban areas only, like in Mobeni and Tubungu areas. As you know residents of peri-urban areas of Matsapha either dispose their household waste within their backyards, burn it, dump it in open spaces nearby their plots and some of those who have vehicles transport and dump it in rivers nearby. The household waste disposed in the backyards and in open spaces nearby find its way to the roads, deteriorating the image of the country. The improper waste disposal here in Matsapha is a threat to your human health and well-being. It has resulted to negative environmental health and safety problems. Household waste in your backyards and in open spaces nearby is a breeding ground for flies, cockroaches and mosquitoes which transmit diarrhoea, malaria and yellow fever. The burning of household waste can also cause upper respiratory tract infections.

3. Do you agree that improper disposal of household waste is a threat to human health?
   a. Yes
   b. No
   c. I don't know

4. Do you agree that improper disposal of household waste is a threat to the environment?
   a. Yes
   b. No
   c. I don't know

Human welfare for peri-urban residents here in Matsapha is at stake and it will continue if something is not done to improve and manage household waste disposal. The current household waste disposal indicates there is an urgent need for the provision of household waste collection services.

There is a history of improving household waste management and disposal in Matsapha peri-urban area. Since we know the Kwaluseni Inkhundla with assistance from the Swaziland Environment Authority tried to set up a Waste Management Program, where structures were constructed at designated areas as temporal waste storage facilities, unfortunately, the storage houses were not emptied and the waste was left there for a very long time whilst some storage houses were converted into market places and no longer used as a waste storage facility. The waste collection scheme did not work because many households failed to pay the monthly fee for waste collection services. For those who paid, the money paid per month did not cover all the costs like fuel expenses, paying the fees at the landfill disposal site, wages for the driver and the labourers.

5. Are you aware that an attempt has been made to improve household waste management and disposal which resulted in failure?
    a. Yes
    b. No
    c. Don't know

Following that failure, now the government is considering passing a bill that will introduce household waste collection services in peri-urban areas of Matsapha. The objective of the bill is to promote proper household waste management and disposal in peri-urban areas. If the bill is passed **Matsapha Town Council/ Kwaluseni Inkhundla/ a Private Contractor** will extend its waste collection services to peri-urban areas of Matsapha. The **Matsapha Town Council/ Kwaluseni Inkhundla/ a Private Contractor's** tractor will collect waste generated by your household and tenants from your plots twice a week and dispose it at the Matsapha landfill.

Right now this is how Matsapha peri-urban areas look like:

As you can see in the picture, household solid waste is improperly disposed on open spaces near households and roads, placing your human health and well-being in danger. The waste disposed within your yards and next to roads nearby is a breeding ground for flies that spread cholera and mosquitoes that causes malaria. Improper waste disposal is destroying the scenic view of your surroundings.

This is how Matsapha peri-urban areas will look like after the bill has been passed:

As you can see in the picture, after the bill has been passed household solid waste will be collected from your households, resulting in a clean and healthy surroundings. You will no longer dispose waste in your backyards but it will be collected from your plots weekly. The area within and nearby your plots will be safe and clean. The main roads and the small roads coming into your plot will also be clean. The smell of improper disposed waste will no longer affect your household and your tenants. Proper waste collection trucks will come pick all the waste generated by household and tenants from your plot.

6. Are you convinced that the government can enact and pass a bill that enhances solid waste disposal and management in Matsapha peri-urban area?
   a. Yes
   b. No

7. If No in Q16, why?

   ……

   ……

8. In your view, do the **Matsapha Town Council/ Kwaluseni Inkhundla/ a Private Contractor** have the ability to implement improved SWM if the bill is passed?
   a. Yes

b. No

9. If No in Q18, why?

……

……

However, implementation of the bill requires funds to be generated in order provide household solid waste collection to all residents' of Matsapha per-urban areas and to avoid what happened to the previous attempt. Therefore, for the bill to be passed all households have to pay the same monthly fee for household solid waste collection. The money will be used to finance SWM activities like landfill disposal fees, fuel and maintenance expenses for waste collection trucks and wages for the truck drivers.

10. In your view, would the enactment of the bill be a good idea?
    a. Yes
    b. No

11. If No in Q20 above, why?

    ……

    ……

12. In the previous waste management project at Kwaluseni Inkhundla, households were required to pay only E 5 per month for waste collection, however that amount was not enough to cover waste collection expenses and now private collectors charge E30 per household per month. Considering your household's income and expenditure, would you be willing to vote for the implementation of the bill? Remember if the bill is implemented, you will be required to pay a monthly fee that will increase your household expenditure and every household would have to pay the same amount. If **Matsapha Town Council/ Kwaluseni Inkhundla/ a Private Contractor charges E10** per month, would you vote for the bill?
    a. Yes (*proceed to Q23)*
    b. No (*proceed to Q24*)
    c. Not sure*(proceed to Q24*

13. What if the **Matsapha Town Council/ Kwaluseni Inkhundla/ a Private Contractor charges E15.00** per month? Would you vote for the bill?
    a. Yes (*proceed to Q25*)
    b. No (*proceed to Q25*)
    c. Not sure (*proceed to Q25*)

14. What if the **Matsapha Town Council/ Kwaluseni Inkhundla/ a Private Contractor charges E5.00** per month? Would you vote for the bill?
    a. Yes (*proceed to Q25*)
    b. No (*proceed to Q26*)
    c. Not sure(*proceed to Q26*)

15. What is your maximum WTP for solid household waste collection services per month?
    E……. *(proceed to Q27)*

16. Why did you vote against the bill? (After this question please proceed to Section D)
    a. It is government's responsibility to provide waste collection services
    b. Income is low and cannot afford it
    c. Volume and quantity of my household waste is low
    d. Specify any additional reasons for voting against the bill:

    ……

    ……

17. What encouraged you to vote for the Bill?
    a. It will reduce improper disposal of household solid waste in the peri-urban areas of Matsapha
    b. There is a lot of household solid waste generated by households in Matsapha peri-urban areas
    c. Specify any additional reasons for voting for this bill:

……

……

SECTION D: DEMOGRAPHIC INFORMATION

This section seeks to find out information about you and your household which will be used to understanding how your WTP responds to individual characteristics in order for the researcher to gain information on the validity and reliability of the CV method.
Please remember that this information will be kept confidential. Your responses to these questions will help us understand how others like you might have responded to the questions in our questionnaire.

18. Name of respondent (optional) ……
Household Head:

a. Yes
b. No

19. Relation of respondent to household head if not household head if it's no above

a. Spouse
b. Child
c. Parent
d. Brother/sister
e. Other (Specify)……..

20. Age of respondent……

21. Please enter the details of household head in the table below, circle only the code or fill where appropriate.

Gender	**Age**	**Marital status**	**HH size**	**Number of tenants**	**Total number of people staying in your plot**	**Number of rental units**	**Monthly rent for each unit**	**Education level**
Male = 1 Female=2		Single = 1 Married = 2 Divorced = 3 Widowed = 4 Other = 5				1 room = 2 room = Bedsitter = Other (specify) ……	E..... E..... E..... E.....	None = 1 Primary = 2 Secondary = 3 Technical, diploma = 4 University degree =5

22. Please enter the details of the HH head's financial information. Please enter the appropriate code in the table below, by referring to the codes' box below the table.

HH head's details	**Code**
Employment status (a)	
Primary source of income (b)	
Monthly income (c)	
Monthly expenditure (d)	
Monthly savings (e)	
Purpose of savings (f)	
In case of emergency how do you obtain money (g)	

Codes

Code (a) Employment status

Formal employment = 1 Informal employment = 2 Self-employed = 3 Pensioned = 4 Unemployed = 5

Code (b) Primary source of income

Wage employed = 1 Self-employed = 2 Flats rent = 3 Pension = 4 Other = 5 (specify)…….

Code (c) Monthly income

R500≤ = 1 R500 – R1000 = 2 R1000 – R2000 = 3 R2000 – R3000 = 4 R3000 – R4000 = 5 R4000 – R5000 = 6 > R5000 = 7

Code (d) Monthly expenditure

R500≤ = 1 R500 – R1000 = 2 R1000 – R2000 = 3 R2000 – R3000 = 4 R3000 – R4000 = 5 R4000 – R5000 = 6 > R5000 = 7

Code (e) Monthly savings

None = 1 R500≤ = 2 R500 – R1000 = 3 R1000 – R2000 = 4 R2000 – R3000 = 5 R3000 – R4000 = 6 R4000 – R5000 = 7 > R5000 = 8

Code (f) Purpose of savings

Pay debts = 1 Education fees =2 Business/investment = 3 Household renovations = 4 Medical emergencies = 5 Other= 5…….

Code (g) In case of emergency how do you obtain money

HH savings = 1 Friends = 2 Informal credit = 3 Formal credit = 4 Insurance = 5 Other = 6 ……

23. Do you think your HH affords basic needs like food and water?
    a. Yes, always
    b. It is sometimes difficult
    c. No

24. Which of the following statements would best describe your family's financial situation?
    a. We have not enough even money
    b. We have money for food but cannot pay for public utilities like water, electricity…
    c. We can afford food and public utilities but it is difficult to pay for school fees

d. We can afford food, public utilities and pay for school fees but cannot afford to buy durable goods like TV, fridge…
e. We have enough money to pay for our needs and can also afford to buy durable goods.
f. Other
(specify)……

SECTION E: DEBRIEFING

This section will help to identify particular problems in the questionnaire as well confirm whether the questionnaire successfully accomplished its purpose.

34. In your opinion, did the respondent understand all the questions? Please rank the answers based on the level of understanding in the following table.

Level of understanding	**Rank**
Very well understood	
Clearly understood	
Understood	
Not understood	
Not clearly understood	
Not understood at all	

35. Were there any questions that the respondent found hard to answer because the options given did not include his/her response?
    a. Yes
    b. No

If yes please describe them.....

36. How would you rate the reliability of the responses given by the respondent? Please rank the reliability in the following table.

Level of reliability	**Rank**
Very reliable	
Quite reliable	
Reliable	
Not quite reliable	
Not reliable	
Not reliable at all	

37. Please provide reasons for your response for Q36 above……..

Thank you very much for your time and your participation in this survey!!!!!