VALUING URBAN ENVIRONMENTAL QUALITY IMPROVEMENT THROUGH HOUSEHOLD WILLINGNESS TO PAY FOR WASTE SEPARATION IN LANGATA SUB-COUNTY, NAIROBI, KENYA

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DECLARATION

This thesis study is my original work. It has not, prior to this submission, been presented for the award of any academic qualification in any institution.

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DISCLAIMER

This thesis study has been undertaken in individual capacity as a student of Environmental Policy to partially fulfil the requirements for the award of an academic qualification. The views and opinions carried in the study are the student's and do not necessarily represent the positions or views of my supervisors, CASELAP or the University of Nairobi.

DEDICATION

I dedicate this work to my dear parents Nicholas and Priscah who instilled in me the virtues of hard work, commitment, determination, and patience with oneself and others, my loving and supportive spouse Judith and sons Cyril, Colin and Clive for their unspoken inspiration.

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ABSTRACT

The management of solid waste continues to be a problem in Nairobi City County as well as other major urban centres in Kenya. The amount of waste generated in Nairobi has for a long time outstripped the City County government of Nairobi's handling capacity and has seen entry of both formal and informal private companies in the management of municipal waste, whose focus, like that of the City County government of Nairobi has been restricted to the collection of unsorted waste from neighbourhoods and business areas around Nairobi and transfer of this waste to open landfills. Current policy trends drawing from the need to transition to a circular economy point towards ISWM whose point of departure is the source separation of wastes. This study deployed the contingent valuation method to establish the willingness to pay for waste separation by the households in Langata Sub County. 183 households, identified through a stepwise application of stratified random sampling and simple random sampling were interviewed using a CV questionnaire. The determinants of this willingness to pay was established using regression analysis. The results revealed that households were willing to pay Kshs 372 per month for waste separation which is higher than the average monthly charge of Kshs 202 they were paying. Households further stated willingness to pay an average of Kshs 587 for 3-way waste separation bins. The willingness to pay for waste separation of households is higher than the current monthly payments for waste collection and is significantly related to sex of household head, household expenditure on water, current payments for waste collection and household expenditure on rent. The results also reveal that the demand for separation of household wastes depends on the type of housing or residential ownership. The study recommends an immediate roll out of the Nairobi City County ISWM plan and further recommends that the WTP values be used to be used to determine service charges for collection of separated waste and also to design of fiscal policy measures and development control regulations to ensure social inclusion and equality as well as effectiveness in the delivery of solid waste collection and management services.

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ACRONYMS AND ABBREVIATIONS

AU	Africa Union
AUC	Africa Union Commission
CASELAP	Centre for Advanced Studies in Environmental Law & Policy
CCN	City County of Nairobi
CVM	Contingent Valuation Method
DESA	Department of Economic and Social Affairs
EMCA	Environmental Management and Co-ordination Act
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GoK	Government of Kenya
IIBRC	Interim Independent Boundaries Review Commission
ISWA	Integrated Solid Waste Association
ISWM	Integrated Solid Waste Management
IUCN	International Union for the Conservation of Nature
JICA	Japan International Cooperation Agency
KARA	Kenya Association of Resident Associations
KNBS	Kenya National Bureau of Statistics
MEAs	Multilateral Environment Agreements
NAMA	Nationally Appropriate Mitigation Action
UN	United Nations
UNCHS	UN Centre for Human Settlements (now UN-HABITAT)
UNDP	United Nations Development Programme
UNEP	UN Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-HABITAT	UN Human Settlements Programme
UoN	University of Nairobi
USAID	United States Agency for International Development
SDGs	Sustainable Development Goals

SWM	Solid waste management
WB	World Bank
WHO	World Health Organisation
WTP	Willingness to Pay

CHAPTER ONE: INTRODUCTION

1.1 Background Information

Population growth and rapid urbanization as well as increased consumption have resulted into a big increase in the amount of municipal solid waste[1] generation globally. In urban areas, lifestyle changes and changes in consumption, including but not limited to the utilisation of products made from non-biodegradable raw materials have significantly compounded this problem (IUCN, 2009). Solid waste presents a severe environmental problem in many urban areas in the developing world (UN-HABITAT, 2010). Every year, the world's urban areas generate about 2.01 billion tons of waste. About 33 per cent of this waste is not managed in an environmentally appropriate manner (Kaza et al., 2018). UNDESA (2018) projections indicate that the number of urban residents is growing by close to 60 million per year and that in the year 2050, about 68 per cent of the world's population will live in urban areas. In this rapidly urbanising global society, city and other urban authorities will continue to contend with the management of solid wastes as one of their key challenges.

The quantities of waste produced by low income countries is expected to increase threefold by 2050 (Kaza et al., 2018). More than a third (37 per cent) of the waste produced globally currently ends up in one type of landfill or another; eight per cent ends up in a sanitary landfill while open dumping accounts for about one third of the waste. Only 19 per cent is recovered through either recycling or compositing. A further 11 per cent is disposed through incineration. The sound treatment or disposal of waste such as that that in controlled landfills or more stringently operated facilities remains largely a preserve of high and upper middle income countries. Low income countries account for 93 per cent of waste that is dumped openly with high income countries accounting for only two per cent of such. While the highest of proportion of waste in upper middle income countries ends up in controlled countries, this rate decreases to 39 per cent in high income countries in which approximately 35 per cent of waste collected is either recycled or composted depending on their attributes and technical capacities while about a fifth to incineration, especially in high income countries with limited land. Owing to the widespread capacity handicaps associated with the management of solid wastes in many cities and urban areas in Africa, the open combustion of solid waste is a common occurrence.

[1] **Municipal solid waste** "Municipal solid waste" (MSW) is a term usually applied to a heterogeneous collection of wastes produced in urban areas, the nature of which varies from region to region (UNEP 2005). A large proportion of this waste originates from households, while other sources included businesses, offices and other public and private institutions.

Whereas there are no reliable emission inventories African cities, the open burning is estimated to be a major contributor to urban air pollution. In Nairobi, most of the waste collected from points of generation ends up at the Dandora dumpsite. The waste collection is also characterised by the absence of source separation of waste and the recovery of resources such as plastics, glass, paper and metals from the waste stream is carried out by informal groups and individual scavengers at the open dumps (GoK, 2019)

Adoption of sound solid waste management policies and strategies is therefore a critical step for the control of environmental pollution, the protection of biodiversity and ecosystems as well as for enhancing aesthetic values. Many of the initiatives, including policies and investment programmes aimed at managing solid waste in developing country cities have disproportionately focused on the technical dimensions of the various approaches to solid targeting solid waste management in developing county cities have placed skewed focus on the technical aspects of the varied approaches to collection and disposal of solid, catering more to the interest of the waste collectors that on the demand side comprising of the producers of the waste. (Ezebilo, 2013). Yet the management of solid waste is a multifaceted issues comprising political, economic, environmental and social aspects alongside the technical aspects and therefore putting in place effective and sustainable investment programmes for urban solid waste management requires a sound appreciation of the needs and preferences of the full spectrum of solid waste management stakeholders. (Bernstein, 1994).

The separation of wastes at the point of generation, recovery of resources and recycling are essential elements of solid waste management as they provide an effective, economically efficient and long lasting solution to the ever growing problem of waste (Ghulam et al., 2018). If waste is not separated at source, it ends up at disposal site as mixed waste. It is difficult and can also get hazardous to recover resources from waste and recycle materials once materials in waste have been mixed together. Waste separation, allowing different materials to be separate into pre-defined categories, is therefore the first step of recourse recovery and recycling.

The plan for integrated solid waste management for the city of Nairobi provides for the implementation of a multi bin system to enable separation of solid wastes at source by the year 2013. The success of such a waste collection and disposal systems requires additional commitments from waste generators in terms of time, effort and money or a combination of

more or all of these. The generation for solid waste as an environmental and social problem is not solely the result of industrial activity as was considered by contemporary environmental policy. It also stems from the choices made by households every day in their roles as consumers and producers of waste (Berglund and Matti, 2006). Demand for improved solid waste collection and disposal is therefore a derivative of the demand by households, as, consumers to have these wastes removed from their environs. The service may comprise provision of waste bags to households which then place these bags at designated collection points where they are collected by the public or private service provider to whom the pay a service fee at pre agreed regular intervals. An improved collection service will entail either supply of more bags or bins per household or common receptacles, each coded by colour or other mark for different categories of wastes. This level of service is inevitably associated with increased costs in the form of time spent by the household to sort the waste or that cost associated with the extra bags or bins for the collection of segregated waste.

From observations, this three way waste separation system has not be realised in all zones with the exception of the central business district where 3 way bins have been erected along a few. This is because the three way waste collection bins are not available in residential neighbourhoods. The technical approach for the master plan focused on three main issues of planning for the collection and transportation of wastes, 4Rs, intermediate handling and final disposal while the institutional and financing components of the plan focuses among others organisational restructuring, legal reforms, financial management, private sector involvement and community participation. Further, the national strategy for solid waste management sets to enable public sector and private stakeholders transit to a 7R society by reduction, rethink, refusal, reuse, repair, recycling and refilling of waste (NEMA, 2014).

Households account for a great proportion of the waste generated in cities. It therefore follows that an understanding of households as a principle generator of waste and user of the waste management service is important for effective waste management. The key is to identify and anticipate household responses to solid waste management policy measures (Bernstein, 1994) put in place by urban environmental authorities. The study therefore focuses on the establishment of household willingness to pay for waste separation and to further understand the factors that influence that willingness.

1.2 Problem Statement

The City of Nairobi faces a growing problem of solid waste, where the waste generated daily by far outstrips the capacity of the City to collect and appropriately manage the waste. The manifestation of this problem includes the uncoordinated and environmentally unsound management of wastes. The coverage of the waste collection service is also inadequate. Only about one fifth (22 per cent) of this waste is collected and managed in a controlled manner. The City County of Nairobi has signalled intention to implement an integrated solid waste management strategy. The integrated solid waste management plan for the city of Nairobi has three major goals which are; to significantly expand the recovery of resources, including and going beyond creating and enabling environment and growing the market for recyclables, to awareness building and enhancing the capacity of for sources separation of solid wastes as an essential component of sustainable solid waste management and the restructuring and expansion of efficient and equitable collection of separated waste in the interest of public health and protection of the environment. The integrated solid waste management plan for Nairobi City County aims at implementing a three-way waste stream separation for hazardous, wet and dry wastes at sources in all its zones by 2013 (UNEP, 2010). An important factor of success for this plan is cost recovery, noting that waste management places huge demand on the budgets of local governments and as is the current practice, the generators of waste are expected to meet the costs associated with the service. Any policy seeking to implement or finance a household or city-wide waste collection system from user charges, either in part or full must take into consideration local attitudes, behaviour and the understanding of the key social economic factors that influence household behaviour. The translation of this goal into practical outcomes for solid waste management can greatly benefit from establishment of the demand side information on waste segregation at source. There is however no evidence of households' willingness to pay[2] for waste separation, what determines whether households adopt these practices, or whether the current policy framework is supportive of waste separation at household level.

[2] [2] Willingness to pay refers to the maximum dollar or equivalent amount that an individual is willing to pay for a particular good or to access a defined service.

1.3 Research question

The main question that this study seeks to answer to is: What is the willingness to pay for waste separation of the households in Langata Sub County? This is broken down into the following specific questions;

i. What is the willingness to pay for waste separation among the households in Langata sub county of Nairobi City County willing to pay for waste separation?
ii. What are the determinants of household willingness to pay for waste separation in Langata Sub County?
iii. To what extent is the policy, legal and regulatory frameworks on waste management adequate in enabling household waste separation in Nairobi City County

1.4 Research Objective

The objective of this study is to assess the willingness to pay for waste separation of households in Langata Sub County. This is operationalized in the following specific objectives.

i. To assess the households' willingness to pay for waste separation in Langata Sub County
ii. To establish the determinants of household willingness to pay for waste separation in Langata Sub County
iii. To appraise the adequacy of current policy framework in supporting household waste separation in Kenya.

1.5 Justification for the study

The study is motivated by the increasing importance of the need for effective approaches to the collection and disposal of solid waste in Nairobi of solid waste management in Nairobi and in deed the many other urban areas in Kenya. The initiatives by various public sector institutions to improve solid waste management have included proposals and plans for waste separation. However these proposals have lacked a critical component which is demand side information that is critical for the success of any service for which the users are expected to pay for. It is expected that households as waste generators will pay for the costs associated with this improved service (waste separation) either directly as monthly services based on contracts that households or the residential neighbourhoods in which they belong enter into with private waste collector or through property or other taxes and levies may be imposed by the City authorities as provided for by the relevant laws and regulations. Information about the value of the environmental improvement expected to be experienced by the residents of Nairobi as a

result of solid waste management enhanced by waste separation is important from waste service planning and is expected to provide useful information to the Nairobi City County to inform the design, especially of the cost recovery policy aspects of the 3 way waste segregation of solid wastes at the household level. The determination of the average WTP and the factors influencing it are useful in the assessment of the financial feasibility of the proposed system for waste separation and further help in the design of solid waste collection programmes and setting of service charges.

The study is therefore beneficial to the Ministry of Environment and Forestry and the National Environment Management Authority (NEMA) who are responsible for development of national waste management policies and strategies respectively as well as the government of Nairobi City County in whose docket the implementation of the Integrated Solid Waste Management Plan lies as well as private firms involved in collection of household waste or manufacture of waste collection bins. The study also contributes to literature on this topic by illuminating the determinants of household willingness to pay for waste separation and is therefore useful to other researchers.

1.6 Limitations to the Study

The study could not take on a larger sample size mainly due to financial implications for questionnaire administration and many cases of refusal of access to households by research assistants for purposes of questionnaire administration due to security concerns of respondents. This incidences of refusal to grant entry into households or refusal to grant consent for the questionnaire interview was highest in the upmarket residential neighbourhoods of Karen and Langata.

The household respondents who were unwilling to grant access were offered the option of completing the questionnaires and returning to the researcher through electronic mail. However, only three questionnaires were correctly completed and returned by email. To mitigate the impacts of refusal of access and to correctly completed questionnaires, alternative households were selected from within each respective sampling frame to act as a replacements.

Since there was no actual waste separation service arrangements for household waste at the time of the study, the questionnaire responses were based on description of a hypothetical service. This hypothetical nature of the questions is expected to impact on the truthfulness of the statement of the willingness to pay for waste separation by the respondents. While the willingness to pay values are expressed in Kenya shillings or United States dollars, this study does not focus on allocating monetary value to the improvement of the quality of urban environment resulting from waste separation. It instead aims to providing City authorities and private solid waste handling firms with information for design of waste separation service, public policy measure to ensure success of waste separation schemes and pricing of the services.

CHAPTER TWO: LITERATURE REVIEW

This chapter contains a review of existing literature to support the study undertaken in this thesis. While willingness to pay for waste segregation is the central academic subject area of this study, the scope of this literature review was expanded to include the key themes in the research question i.e. the problem of waste, waste management practices and approaches, economics of waste management and environmental valuation and also includes the gaps identified in existing literature.

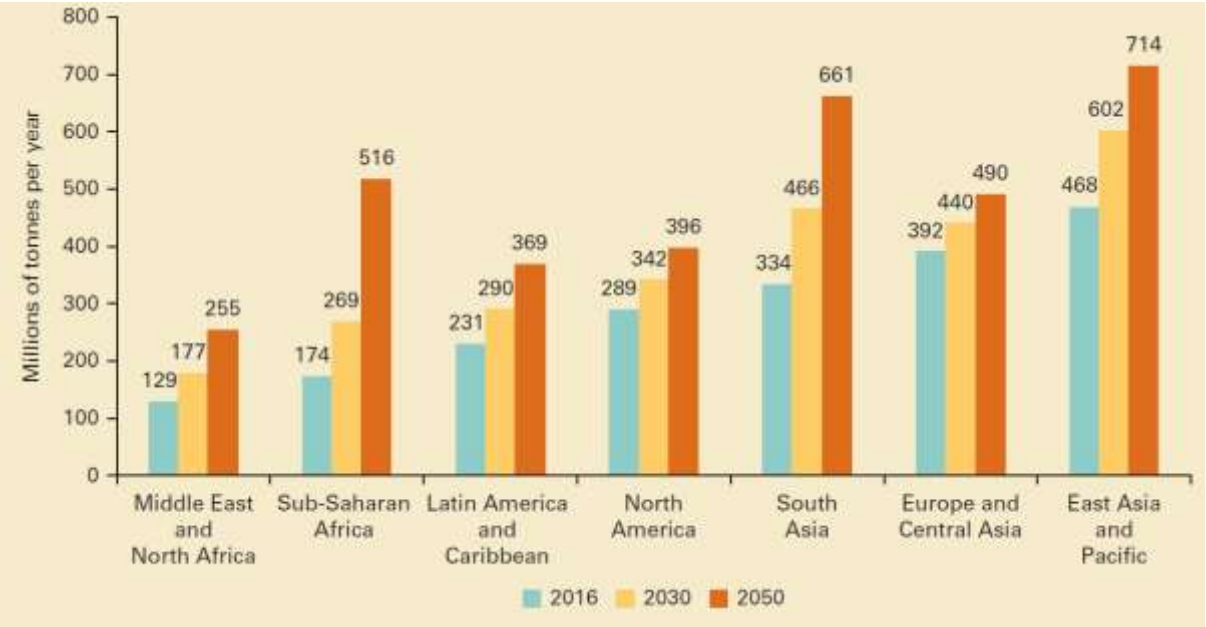
2.1 The Problem of Waste

Waste is a formidable environmental, economic and social problem and a key challenge facing cities and other urban areas around the world (Bojan, 2017). Christensen's definition of waste implies waste to be an item or product that has the attributes of being residual, redundant or of no marginal value and one whose owner no longer wishes to keep in their possession (Christensen, 2010). Wastes may originate from households or from any other source within the jurisdiction of a local authority, including hazardous wastes, non-hazardous wastes (Strange, 2002). The production of waste is a function of expenditure, production and consumption and therefore is correlated to gross domestic product (GDP) of a country, increase in population and increase in individual income (Cointreau and Hornig, 2003). By the year 2016, cities in the world were generating an aggregated 2.01 billion tons of solid waste translating to a 0.74 kg of waste per capita daily. Aided by rapid growth in urban population, the yearly generation of solid wastes is anticipated to grow to approximately 3.4 billion tons by the year 2050 representing an increase of 70 per cent in just thirty five years (World Bank, 2016). From the foregoing, it is clear that the amount of waste produced in any given areas is related to factors such as population, social and economic factors as well the existence or lack of localised waste minimisation initiatives including but not limited to reuse, recycling and composting.

Waste management cuts across many spheres of society and the economy besides being a major environmental issue. Waste management, particularly poor waste management is closely related to other problems such as public health, climate change, poverty reduction as well as sustainable production and consumption. The indirect and/ or direct linkages between waste and more than half of the sustainable development goals (UNEP, 2015), a universal framework

for sustainable development covering almost all facets of human life reinforce the global dimension of the waste management problem. Urbanization results into aggregation of human settlements, and consequently higher populations in urban areas which is accompanied by a corresponding increase in production and use of material resources to meet the needs of those populations (Odum and Odum, 2006), consistent with the material balance principle and often at a rate beyond the absorptive capacity of the environment. Most of the waste in the world is generated in the East Asia and Pacific region which accounts for twenty three per cent, while the Middle East and North Africa contributes only 6 per cent to global waste generation. The production of solid waste in sub-Saharan Africa is expected to grow three fold by 2050. A common feature of these regions is the current open dumping of solid wastes which further implies that the current trends on waste generation will be accompanied by corresponding public health and environmental thereby signalling need for urgent remedial action. Within this regions, more than half of the waste generated is currently dumped in the open with the implication that the prevailing trends on growth in solid waste quantities will increase the predisposition of the people to not only public health hazards and damage to the environment but also to the prosperity that may be associated with high urban environmental quality (UNEP, 2015).

Figure 2.1: Projections of waste generation by region (million tons per year)



Source: World Bank, 2018

Poor management of wastes can result into serious environmental, public infrastructure, and public health problems. Solid waste that is not well managed can cause clogging of rivers and drains, which causes flooding and subsequent damage to critical infrastructure such as roads. The contamination from poorly managed waste may precipitate the diffusion of microbial pathogens responsible for diseases such as malaria and cholera (Abul, 2010: Dzotsi et al. 2016) which are serious public health problems. There is also limited evidence that poorly managed wastes and the contamination of human bodies is linked to congenital abnormalities, low birth weight, respiratory ailments and elevation of the rick to a number of cancers (Porta et al. 2009; WHO, 2015). It was estimated that in 2016, five per cent of GHG emissions were from solid waste treatment and disposal, with the main attribution being the burning and disposal of wastes in unsanitary landfills or open dumps and that the emissions linked with solid wastes are likely to increase to about 2.4 billion tons of CO_2 equivalents per annum by 2050 under the business as usual scenario. Food waste, which is organic and therefore compostable, accounts for nearly half of these emissions. With the achievement of higher living standards by many countries, the waste burden on the plant with increase. This requires that more environmentally sound and economically efficient solid waste management in order to lead to better welfare for people and planet. In addition to population growth, rapid urbanisation and changing patterns of both production and consumption, the global trade of waste and waste trafficking is also a cause for the increase in waste generation in Africa (UNEP, 2018). The gaps in the capacity of waste management systems in Africa as is the case for developing countries, particularly where the diversion of wastes from the waste stream is concerned, is evidenced by the disproportionate share of developing countries in global waste generation contribution of waste relative to per capita incomes (Beede and Bloom, 1995). If this trends persist without sustainable solutions, waste management has the potential to significantly undermine Africa's progress towards achieving the SDGs (UNEP, 2018) and the closely related Africa Agenda 2063

Whereas it is evident from the desk studies that current and reliable data on waste generation in Kenya is limited, the estimated generation of waste nationally is about 22, 000 tons translating to about 0.5 kilogrammes per capita per day. 40 per cent of this waste or about 3000 tonnes is estimated to be generated in Nairobi (GoK, 2019, UNEP 2010). It is estimated that the City of Nairobi produced more about 3,000 tonnes of solid waste daily in 2010, with this rate having risen steadily increased between the years 1973 and 2010 (UNEP, 2010). The National Waste Management Strategy put this estimate at 2400 tonnes per day further casting

a light on the inaccuracies since a reduction in daily waste generation is inconsistent with the population growth in the city and increase in GDP. The available data however indicates that the growth in waste generation outstrips the growth in capacity for collection and management of the wastes and that the daily rate of collection was also lower that the daily production of waste. In 2010 for instance, the total waste collection in Nairobi was about 40 per cent per day (UNEP 2010), while in 2014, this was projected to be between 60 per cent and 70 per cent (NEMA, 2014). A UN Habitat 2019 assessment of data for SDG indicator 11.6.1 also found that daily waste generation in Nairobi was 2977 tonnes (UN Habitat) with a per capital production of 0.64 kg per day (UN Habitat 2019)[3] .

Further, the waste that is collected by the City County of Nairobi, private waste collection companies and community based service providers or informal pickers end up at the open dump located in Dandora. According to the UN HABITAT study, the collection rate for solid wastes was around 77 per cent and that only one fifth (22 per cent) of this waste is collected and managed in a controlled manner. The overall solid waste management capacity of the City County of Nairobi is low. The City spends about USD 5 million of its annual budget averaging USD 300 million on waste management which is less than 2 per cent and this compares poorly to 20 per cent to 50 per cent in developing countries (UNDP, 2017). The weak capacity also extends to planning, governance, enforcement of existing legislation and this is further compounded by the absence of economic, financial or other types of incentives to enhance participation in the sound management of solid waste. The interplay between these factors have resulted in solid waste management remaining a formidable challenges to Nairobi City Country as it is the case for all other countries (NEMA, 2014).

2.2 The Management of Solid Wastes

Solid waste management refers to the measure taken to control generation, storage, transfer, transport, processing and disposal of solid waste. Sound waste management of solid waste must be consistent with the best practice in environmental considerations, public health, legal, financial, economic and social aspects (Othman, 2002; Pongcraz et al., 2004). Notwithstanding

[3] Presentation of Results of the SDG 11.6.1 Data collection exercise, made by Nao Takeuchi, UN HABITAThttps://africancleancities.org/data/2ndGeneralMeeting/28th_ResultsoftheSDG11_6_1DataCollectionExercise_EN.pdf - accessed on 13th September 2020

the fact that approaches to the collection, treatments and disposal of solid waste varies across different countries, influenced the varied economic and social indicators, the least economically efficient and environmentally sound solid waste menegemtn practices are usually found in developing countries (Beene and Bloom, 1995). The total urban waste generation in urban areas of about 2 billion tonnes annually (Global Waste Outlook, 2015). Per capita waste generation is also projected to increase by about 20 per cent until the year 2100. The place of waste management in the global socio-economic agenda is recognised in the SDGs with waste reduction and management being reflected in the action targets for goals 11 and 12 (United Nations, 2015).

The management of wastes has both public good and private good attributes. As private goods, individual households, which generate wastes, have a preference to have the wastes collected and removed to a disposal site and may even pay private companies or local government to collect the waste. Stigliz argues that the management of solid waste should be considered a public good (Stigliz, 1989) because it is non-exclusive i.e. if the service if provided to a segment of a given community, it benefits overall public welfare as opposed to those benefits being a reserve of only those to who the service is provided. This implies the impracticality of excluding others from enjoying the benefits of the service provided. Second, any member of the community is able to enjoy ne benefits produced by a waste collection service without reducing the ability of other members of the same community to enjoy those same benefits. An additional characteristic of a public good, for instance the provision of waste collection services is its being essential for public health and protection of the environment (Cointreau, 1994).

There have been arguments in favour of municipal waste management services being treated as private goods meaning that service can be denied by a private waste service provider until payment has occurred. But viewing waste management services as private goods means that they become exclusive, rivalled goods. The importance of these services as one of the determinants of public welfare is therefore diminished. When viewed as a public good, where it is difficult to exclude others and which cannot be protected by general market forces, the internalisation of costs becomes the central problem. Options for managing this concern include applying levies for the use of the services or by following a command and control policy or a combination of both (Bhattarai 2002). This place the management of the waste

problem in the domain of public policy which therefore necessitates government intervention. The rationale for government intervention can be judged when the costs of producing the service decline as more of the service is produced and used and when production or use of the good or service results in negative externalities such as environmental pollution (Bhattarai 2002).

Cointreau adds that it is possible to treat solid waste management as a private waste management (Ibid). In communities where the awareness on the need for a clean environment exists, the waste collection service may be regarded as a private good for which residents will be willing to pay. In such a case, where the service charge is made for purposes of collection and removal of the waste, the residents may not be paying for the full cost of solid waste management because if the waste is merely transferred and dumped in another location, it creates environmental and social problems.

Drawing on the "public good" nature of solid waste management, broad societal considerations must be taken into consideration when making decisions on the waste collection service despite the high likelihood of limited financial capacity of governments (World Bank, 2011).

Cointreau and Harnig estimate that many developing county cities are spending between twenty and forty per cent of their budgets on waste collection and disposal and cleaning of streets or a combination of both (Cointreau and Harnig, 2003). More than two thirds of municipal solid waste management budgets in low income countries are directed to waste collection (Cointreau and Harnig 2003, Athena Infonomics, 2012). This thereby implies that the management of solid waste has the potential to be a significant budgetary expenditure for developing countries. The non-exclusive and non-rivalled nature of waste management is a good justification for the overall responsibility for waste management to fall within the public policy domain. Waste handling, comprising of the collection, transfer and disposal have been traditionally been services provided by city authorities. In Kenya, the Public Health Act (CAP 242) places the responsibility for waste management on the respective Local Authority in whose administrative jurisdiction waste generation occurs. The practice of solid waste collection varies but in most urban areas, garbage is either collected by a local government agency, a private service provider contracted by the respective local authority or private contractor (s) and this constitutes a basic and expected government function in the developed

world. Kenya's long term policy for development, the Vision 2030 identifies and emphasises on the need for an efficient and sustainable waste management system to be development as part of the transformation toward a highly industrialised, middle income country with a high standard of living by 2030 (GoK, 2012)

2.3 Waste Management Models

The paradigm shift in waste management globally has been towards the concept of integrated management of solid wastes, based on 3Rs principles; promoting the reduction, reuse and recycling of waste. Integrated solid waste management is a tool used to determine the most energy-efficient, least-polluting ways to deal with the various components and items of a community's solid waste stream (USAID, 2003). ISWM provides a systematised framework for responding to increasingly important environmental, public health and regulatory demands by handling and processing the different waste streams in more economically efficient and environmentally sound ways. The framework approach facilitates the design and implementation of new waste management systems as well as for assessing and optimising those that already exist stressing on the concurrent analysis and consideration of both the technical and non-technical aspects of the system (UNEP 2005). The full spectrum of ISWM involves generation and separation of wastes, collection, transfer and transport, treatment, recycling and final disposal. Key considerations to achieve the desired impact of ISM include the involvement of all stakeholders, including waste generators who are also the users of the service, waste service providers as well as authorities. The creation of an enabling environment comprising of technical, institutional, social cultural, environmental as well as policy and legal elements is also an important element for the success of ISWM (Guerrero et al., 2012).

The hierarchy of waste management is a common thread in waste management policy (UNEP 2005) and is acceptable as the most practical basis for urban solid waste management systems. It ranks waste management operations according to their environmental and resource benefits and can contribute to the economic efficiency and environmental effectiveness of a waste management system.

Waste recycling is one of the most commonly referred to elements of integrated solid waste management. Segregated collection of wastes and recycling are considered basic elements of any modern solid waste management system (ISWA 2010). The segregation of solid waste at

the point of generation enhances the homogeneity of the various waste streams and limit the cross contamination of the various waste streams. Both the technical and economic hurdles for recycling can then be lowered and this increases the recycling viability. Lachytová and Mihaliková found that the basis of successful recycling is waste separation[4] (Lachytová and Mihaliková, 2014; Low S. et al, 2016). Chun et al (2019) asserts that waste separation is a pre-requisite for effective waste management. Further, experiences from cities like Pune in India and Maseru in Lesotho showed that well designed solid waste segregation and recycling systems can result into economically and environmentally significant resource recovery from waste and diversion of waste away from landfills (UNEP, 2009). In an effort to respond to need and priority for effective solid waste management, cities across the world are progressively implementing source segregation and recycling initiatives for dry materials and organics (Kaza et al, 2018).

It is in the interest of cities to implement or enforce the requirement for waste separation as an entry point into the integrated management of solid wastes. It is expected that governments have the duty and ultimate responsibility for overall policy and for the management of municipal solid waste management systems (UNEP 2005). The waste is to be placed in different containers or bags clearly earmarked for the respective type of waste. Countries like Malaysia for instance introduced source separation in 2015 in order to cut down on the amounts of solid waste sent to dumpsites by 40 per cent by the year 2020 and increase the rate of recycling by at least 22 per cent by 2020 (Low S. et al, 2016). Waste separation can reduce environmental pollution from waste by removing waste materials e.g. batteries that contain hazardous elements and direct them toward more appropriate handling facilities. It can also response to economic imperatives by helping to turn wastes into treasure.

That said, the fiscal shortfalls mean that fulfilling the obligations related to solid waste management will continue to be financially constrained due to the limited financial capacities of national and local governments. This has had the effect of deteriorating the quantity and quality of waste management services. While some may hold the perception that city

[4] Household waste separation refers to the practice of setting aside post-consumer materials and household goods at the household level so that they do not enter mixed waste streams for purposes of resource recovery, reuse, recycling or improved waste management.

authorities ought to provide a waste collection service without directly charging for it, others are already accustomed to privately sourcing and paying private entities for waste collection services (UN Habitat 2010). Currently, most Nairobi households pay for the waste collection charges of varied amounts to various categories of service providers. These may be included in the monthly service charges levied to individual housing units in gated communities or collected directly from household by waste service providers licenced by the City County of Nairobi.

There is compelling evidence that the generation and management of waste are sensitive to income and prices, the natural predisposition of the individual to overuse common property will inevitably result of inter and intra generation externalities meaning that the public good nature of environmental quality cannot be left private economic behaviour (Beede and Bloom 1995). This is already a compelling case for public policy intervention to secure the public good.

Schubeler (1996) found that in areas where service fees are levied on residents for the removal of wastes, the overall rate of collection can be less than desired and without any additional intervention, this may mean overall reduction in environmental quality attributed to the waste that is left in place, leading to a further reduction in the willingness to pay for the waste removal service because of the perception that its quantity and quality is are declining. Consequently, there's has been a trend, partly motivated by the failure of local authorities to deliver or by advice from central government or foreign development agencies, to outsource the provision of waste management services, either in part or full to private sector players. Massoud and El Fadel (2002) concluded that the increasing costs of providing solid waste management has compelled local authorities in many countries to examine if the service is best when provided by the public sector and whether the private sector is more capable of providing the service. There is accumulating analytical support for the involvement of private entities in urban services such as waste collection (Beede and Bloom 1995).

"Private public partnerships" are a variety of relationships between public and private entities usually in providing for public goods or services. Public–private partnerships have emerged as a promising alternative to improve municipal solid waste management performance with privately owned enterprises often outperforming publicly owned ones In Kenya, the public private partnerships policy sets out the government's desire to promote this type of partnerships

to as many sectors as possible and identifies solid waste management as one of those areas in which PPPs are to be encouraged, emphasising on among others the principle of value for money for both the government and its citizens and ensuring social and environmental safeguards (Republic of Kenya, 2011)

2.4 Valuation of Environmental Quality

The proper management of urban solid waste results into a package of public goods and social outcomes that are ordinarily be traded in the market and therefore no price exists for those goods. Such goods and outcomes include enhancement in urban environmental quality, improved aesthetics due to elimination of litter and ambient odours, aesthetics and the prospects of passing on a clean and greener neighbourhood to the next generation. Where the separation of household solid wastes results into improved urban environmental quality, the value of this improvement may be estimated through either the estimation of preference parameters revealed through behaviour related to one or more aspect of the amenity or through obtaining information concerning the preferences for that amenity (Carson, 2000). In addition, there may be costs associated with waste separation at the household such as time spent by a household member which may represent a cost in terms of the inconvenience or opportunity cost related to the allocation of time. The stated preference approach has come to be known as contingent valuation[5] (Hoyos and Mariel, 2010) since the valuation estimate obtained from the preference information given by a respondent is said to be contingent on the details of the hypothetical good as will be presented in the survey.

2.5 Contingent Valuation

Contingent valuation has been used to establish the determinants of willingness to pay for many services or public outcomes and determine the policy implications of the willingness to pay. This information comprises important stakeholder information that should be integrated in the design of policies, plans, strategies for one or more aspects of urban solid waste management. Contingent valuation takes on a holistic approach, considering the value, in monetary terms, of transiting from the status quo to a desired states that is depicted hypothetically (Hynes et. al

[5] Contingent valuation methodology is an economic valuation technique used to estimate the economic value of a resources with no traditional market value. The central premise of CVM is than one can assign monetary value to the category of goods and services that are not ordinarily traded in the market.

2011). It is useful for estimation of the economic benefits derived from improvements in waste management which may not be easily derived from the market noting that these improvements are public in nature and therefore likely to be under-priced. The methodology has attribute of flexibility, allowing for both continuous application using open ended questions as well as discrete application using dichotomous choice questioning which has contributed to it wide use (Li et al, 2016). The CVM methodology has been used in several studies on waste management in the recent past in both developing and developing countries. Bamlaku et al (2019) used a the contingent valuation with a bivariate model to estimate the household willingness to pay for improved solid waste management in Shashamane and found that the age of the household head, household size, income, level of education and amount of solid waste generated were key determinants in solid waste improvements. Djemadi (2015) used the CVM approach to estimate the WTP for improvements in SWM in Isser City, Algeria and found that the WTP was significantly influenced by age, level education attainment, incomes and the quality of service. Li et al (2016) applied the CVM to establish the attitude and WTP for solid waste management in Macau, concluding that there was a positive attitude towards sources separation of wastes at home and that the residents were ready to carry out the segregation if there was a government requirement for it. In their study, higher levels of education attainment was associated with increased probability to answer yes to the WTP question.

In the context of this study, willingness to pay is defined as the amount that an individual is willing to pay for improvement in the urban environmental quality. Knetsch (1990) reckoned that economic instruments of environmental conservation may be undertaken with the use of individual willingness to pay measures. The willingness to pay gives an automatic monetary indicator of preferences (Pearce and Turner, 1990) and is based on the assumption that the true costs of the unfavourable impacts are the total amount that people will be willing to pay to avoid them (Knetsch, 1990).Within this debate, critics of the contingent valuation technique contend that the responses derived from a CV survey do not reflect true economic preferences and that they should therefore be used for decision-making (Diamond, 1993 and Milgrom, 1993 in Nunes and Stokkaert, 2003). Many economists disagree with this position as a narrow interpretation of consumer preference. According to Kahneman and Knetsch (1992), the contribution of an individual to a public good can be explained by two driving forces; a) that the individual desires to receive the public good or service to be provided and b) that

contributing to the public good or service give the individual moral satisfaction and makes him/her feel good about contributing. Nunes and Stokkaert (2003) also empirically tested and provide additional support for Andreoni's impure altruism theoretical framework.

2.6 Gaps in Literature on Waste Management

Review of literature revealed that there already existed a market for household waste collection services in Nairobi. However, there is no market for improved waste collection that is responsive to the ISWM paradigm as is characterised by the solid waste pollution challenge in the city (UNEP 2010, JICA 2010 and UNDP 2015). Many of the documents attempts to improved solid waste collection have placed focus on the technical aspects of various means 0f collection and disposal (WB, 1992). In recent times, however, as regards the provision of urban services and public utilities, increasing attention is being accorded to the enhancement of waste management approaches as well as the institutional framework for service delivery with focus on privatization of services (Cointreau, 1994) and private public partnerships (UNDP, 2000). Literature on the demand-side of water and sanitation can be found (Whittington *et al,* 1990; Whittington *et al,* 1991; Whittington *et al,* 1993; Altaf and Hughes, 1992). There is however much less effort directed at investigating the demand side for waste separation despite and therefore this widens the gaps between solid waste management policy and the realities faced in the actual service provision. Ideally no, level of service should be set up that does not meet the criteria for sustainability or which is not reflective of household's willingness to pay.

2.7 Theoretical framework

This study uses the random utility theory which is used to model preferences of individuals. The central hypothesis of the random utility theory is that every individual is a rational decision maker who seeks to maximise the utility relative to the choices he or she has (Cascetta 2009). It assumes that people will on a consistent basis rank their choices dependent on their preferences which are uniquely attributable to that person as a result of various factors.The random utility model allows estimation of preferences under choice situations. The theory may be used to explain an individual's observable behaviour and choices. The contingent valuation method is best suited for this study because it is based on a survey eliciting responses to hypothetical scenarios described to the respondents. The contingent valuation methodology uses a contingent market by directly eliciting customer's preferences and willingness to pay

for proposed market conditions which offer potential improvements (Othman and Chuen-Khee 2010). It elicits the maximum willingness to pay of individuals to obtain improvements of environmental quality or avoid damages on environmental media in a hypothetical market.

Contingent values build on the neo-classical theory of welfare economics which focuses on supply and demand as the primary driving forces underpinning the production, pricing, and consumption of goods and services. On typical basis, the contingent valuation (CV) design would have two major components; a description of the amenity being offered including conditions of availability and a process for eliciting a respondent's willingness to pay (WTP) for it while making all attempts to limit hypothetical bias (Altaf and Hughes, 1992). In this case of improving environmental quality through waste separation, if we considering a utility model that depends on income and non-market goods;

$$r\ (p, q, r, h, m) \tag{1}$$

Where q = environmental quality improvement, r = individual displeasure with poor aesthetics arising from lack of or poor waste handling, h = is the health status of the household and society and m is income.

$$\frac{\partial r}{\partial q} > 0, \frac{\partial r}{\partial r} < 0, \frac{\partial r}{\partial h} > 0\ and\ m > 0 \tag{2}$$

The willingness to pay is the maximum shilling amount taken away from the household's or individual's income for purposes of waste separation or ensuring success of the waste separation policy that leaves the household no worse off than they would be if they did not separate the waste or if the policy option for waste separation was not implemented.

$$r\ (p, q, r, h, m) = \ r\ (p', q', r', h'm - WTP) \tag{3}$$

Where $p < p'$ is the increase in cost collection attributed to introduction waste separation, $q > q'$ is the decrease in urban environmental quality, $r > r'$is the change in individual's or household's exposure to poor aesthetics due to poor waste handling and $h < h'$ is the change in health status of the society that would result from improved neighbourhood cleanliness to which the waste separation programme would contribute. If the value of the environmental

quality change is negative and exceeds the positive value of risk and environmental quality changes, the willingness to pay will be negative.

2.8 Conceptual Framework

In the case of waste segregation, we are dealing with a service which is not currently available in the waste collection market in not only Langata Sub County but also the larger Nairobi County and in deed in the country. Whereas there exists a market for conventional waste collection as is currently practiced by the City County of Nairobi and the various private and community-based entities collecting wastes from households and businesses under agreements with residents or business, waste separation at the household level reflects discernment and desire to achieve more sustainable waste handling. Faced with the scarce resources and the resources intensity of sanitation services such as including solid waste management are generally assigned a lower priority during local authority and government budgeting, further weakening the financial capacity for providing the services (JICA, 2005). To cover the shortfalls in budgetary allocations, cities have tended to outsource contracts to private to who the residents pay directly. Due to inequalities with in urban areas, there is a wide disparity in the abilities of residents to pay for waste collection that poses a challenge for those entities trying to establish any type of sustainable waste management systems and the results is that private sector will not be able to provide the service to those who are unable to pay for it. Those who are excluded from the waste collection service will dispose of their wastes in any other manner including open dumping thereby generating negative externalities that are borne by the whole society regardless of their ability to pay for the service. Financial and other instruments may be deployed by city authorities to attempt to make the generators of waste pay for the waste management service. For purposes of ensuring equity and inclusion, it is also necessary to explore ways to minimise the financial burden on poorer households. Solid waste is seen as a negative environmental externality, the cost of which is borne by society as a whole. Fiscal instruments employed to address this issue aim to internalize the costs of waste collection and disposal. Since equity concerns are of primary importance, city or government authorities must find ways of minimising the burden on poorer households and ensuring that those unable to pay are not excluded from the service while meeting the cost recovery objective. Figure 2.4 explains the factors that influence the willingness to pay.

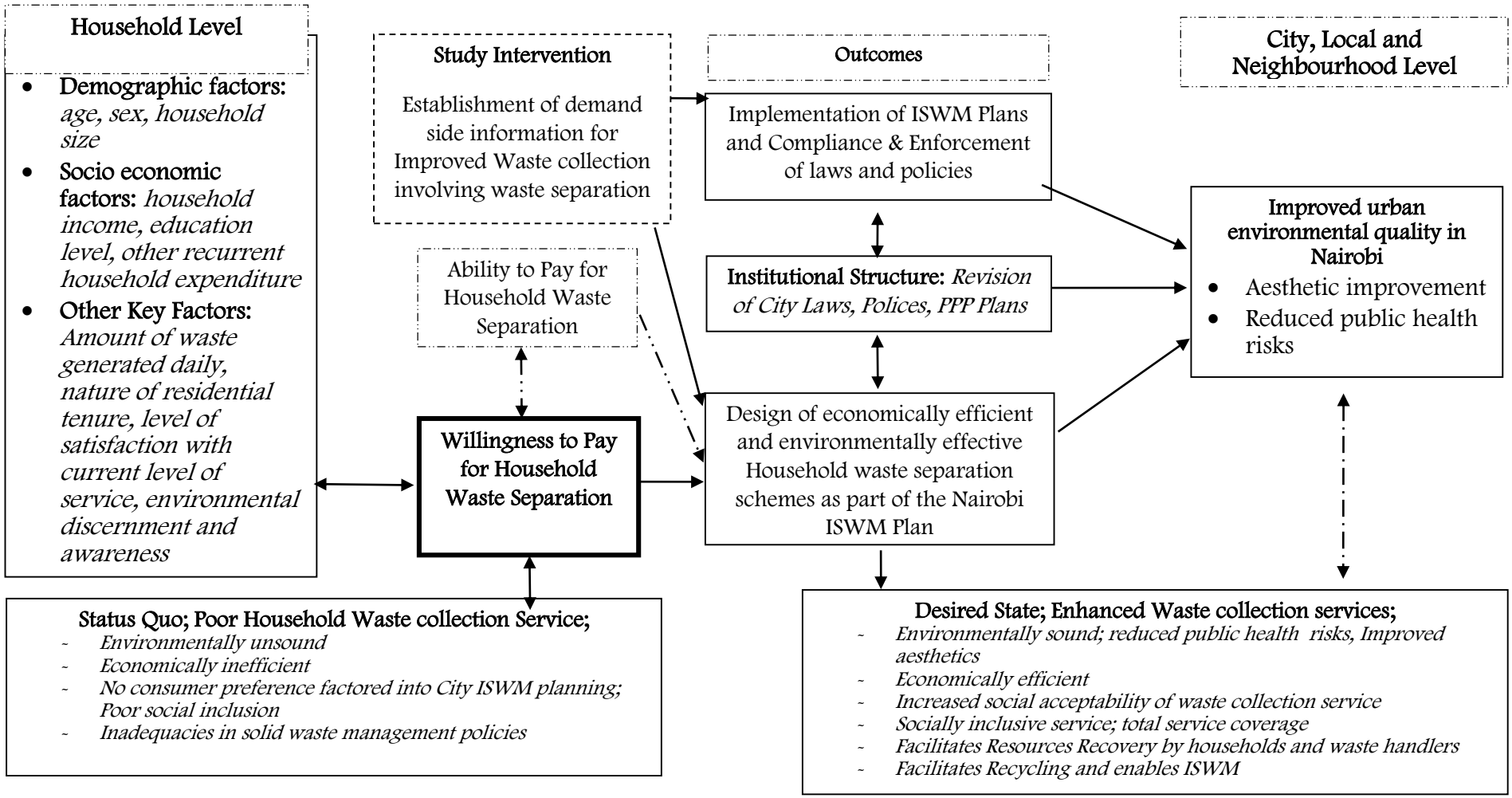


Figure 2.2: Conceptual Framework for Willingness to pay for Waste Separation at household level

At the household level, the process of source separation of wastes may also be viewed within the context of a household's production function, combining time and labour inputs as well as some capital costs in the form of additional temporary waste storage bins and recurrent costs in the form of additional fees for the collection of segregated waste. Here, the value of the waste separation service is equated to the additional amounts that household are willing to pay to for the operations involved in segregated waste collection and it is therefore important to consider the socio economic attributes of households. Alternatively, the policy view may look at statutory fees, taxes for the collection of segregated wastes or the fines imposed on households if they do not separate waste in the manner prescribed by city environment authorities.

An appropriate waste management tax may be proposed based on the socioeconomic characteristics of solid waste management service users (households, business entities or individuals) by using direct valuation instruments such as CVM establish the willingness to pay for waste separation and related variables such as consumer or producer preferences based on environmental charges or taxes. The willingness to pay for waste separation may also inform the price modelling for private sector waste collection service providers.

As seen in figure 2.4 above, while the hundreds of household within the City County of Nairobi and Langata sub county are expected to have varied features in terms of the demographic and socio-economic attributes, the underlying principle of the segregated waste collection policy should be social inclusion, not only for altruistic reasons but because waste collection and in broad terms, waste management are public goods.

CHAPTER THREE: METHODOLOGY

3.1 Description of the Study Area

The area of study was Langata Sub County[6], covering an area of about 223 km^2. The sub county has an elevation of 1790 meters above the sea level and records an annual average rainfall of 1061mm while temperatures range from 17.77 degrees Celsius to 24.49 degrees Celsius. Langata is one of the nine sub counties within Nairobi City County (see map on Appendix II). The other districts (also referred to as sub counties) are Embakasi, Njiru, Dagoretti, Westlands, Kamukunji, Starehe, Makadara and Kasarani. Langata Sub County was chosen because its representative of the three socioeconomic classifications of the population found in Nairobi (Mitulla, 2003). It is one of the 17 zones in the Nairobi City County demarcated for purposes of solid waste management in the first schedule of the Nairobi City County Waste Management Act, 2015. The sub county has high income, low income, middle income groups spread across the informal and formal settlements that are found in the sub county. It is therefore considered to be reasonably representative of Nairobi and by extension all major urban areas in Kenya.

3.2 Data Types, Needs and sources

The study employed the contingent valuation technique of environmental valuation because of the importance of capturing the non-use values associated with environmental quality and improved waste management. In this study, households were treated as economic. Two methodologies were used in this study. The first involved the design and administration of a contingent valuation survey questionnaire in order to obtain the necessary primary data for analysis. Dichotomous questions are frequently used to estimate the value of nonmarket goods. The second methodology involved the application of an econometric model to compute mean willingness to pay estimates. Primary data includes household demographic factors (age, gender, education level, occupation, family size), socio-economic factors (monthly income, tenure, household location based on socioeconomic zoning) was obtained from household using a structured questionnaire administered directly to respondents. The administration of the questionnaire began with an explanation of the current waste collection and the suggested

[6] At the time of the design of the study and data collection, the study area was referred to as Langata District (Kibera Division) and comprised of Langata and Kibera. These administrative boundaries were later revised to conform to new Boundaries defined by the Interim Independent Boundaries Review Commission (IIBRC). After the revision, Kibera which was included in this study is no longer part of Langata Sub County.

possibility of introduction of household waste separation into a three-way system. Secondary data which includes demographic data was obtained from desk studies of written literature.

3.3 Sampling and sample size determination

The study employed stratified random sampling to identify the sample. Due to the fact that the population of Langata is not homogenous, the study area was classified into distinct sub-populations using socio-economic parameters. The study had the option of using two wide categories of formal and informal settlements. However the formal settlements category was found not to be homogenous since, with wide variations in population density, and infrastructure. As a result, three distinct sub populations were used. These were; high-income neighbourhoods; middle-income neighbourhoods; low income neighbourhoods or informal settlements, guided by a classification developed Mitulla, (2003). The selection of households from each strata was done using simple random sampling.

According to Gregg (2008), the sample size is determined by the desired confidence level and precision of estimates and the variability of the characteristics being measured for the population. The formula for determining sample size is therefore;

$$n = z^2 \frac{pq}{d^2} \quad (4)$$

where; n is sample size; z is standard normal deviate (1.96 for a 95 per cent confidence level); d is the level of accuracy needed or sampling error (set at 0.05); p is the proportion of the population having the characteristic being measured (if proportion is unknown, set at 0.5); q is the proportion of the population without the characteristics i.e. (1-p). Using this formula at 5 per cent level of significance gives a sample size of 384 respondents. The total number of households in the entire Langata district is 108,477 spread over an area of 223km^2 (KNBS, 2010). The number of households from each strata was derived proportionate to the total number of households to arrive at the sampling frame below**.** Obudho (in Mitulla, 2003) classified Karen location as high income, Langata location as middle income and Kibera as low income residential areas. In the absence of an alternative socio economic classification of populations in Nairobi, this study applies this classification in the stratification of the study population.

Table 3.1: Distribution of sample size

Neighbourhood Type	Total number of Households	Selected No. of households	Percentage of Total
High Income (Karen Location)	4,223	15	**4.0**
Middle Income (Langata location)	36,773	130	**33.8**
Low Income (Serangombe Location)	67,481	239	**62.2**
TOTAL	**108,477**	**384**	

3.4 Data collection

Household data on the willingness to pay for waste separation as well as the independent variables such as demographic data, socio- economic data as well as the elicitation of the willingness to pay for waste separation and willingness to pay for the three way waste separation was collected between April 23rd and May 22nd 2012, through a questionnaire administered in person at the household by research assistants to household heads. Household heads were to be identified as either husband or wife or main tenant in cases of single occupancy, with the assumption that these were individuals with decision making power within the household. The main instrument used in the study was a household questionnaire administered to the households sampled. The questionnaire was administered by the student with assistance from three research assistants who were trained by the student on the elicitation of WTP responses prior to the survey. A dry run of the questionnaire was conducted in Kibera during the first week of the data collection to test understanding of the research assistants.

The study was faced with the dilemma of whether to elicit willingness to pay values from individuals or households. Welfare and demand theory is based on individual preferences; the household may be regarded as a unitary decision maker rather than as a sum of individual. The study chooses the household as the unit of analysis due to practical considerations, given that the identifiable unit that generates waste is the household. This is also supported by findings of Quiggin (1997) who found that household willingness to pay is equal to the aggregate private willingness to pay because households are expected to be able to redistribute income with the objective of making every member better off.

Secondary data was collected from desk studies of literature including of census reports, newspaper articles, reports, plans, strategies, regulations, legislations and policies from relevant government agencies. Data such as the map of the study area and applicable laws was obtained from the Kenyan National Bureau of Statistics and National Council for Law Reporting respectively. Secondary information on the subject of study was obtained from an extensive review of academic literature written on the subjects of waste management, contingent valuation and the economic theories underpinning the methodology

3.5. Data Analysis

3.5.1 Descriptive statistics

This describes the general attributes of the households sampled using measures of central tendency such as means, mode and median for nominal and ordinal variables such as age, household size and total household incomes. The description of the data obtained also includes measures of spread i.e. range and standard deviation. These statistics were analysed using Stata.

3.5.2 Willingness to Pay and its determinants

In the case of the environment, the specified "good" could be changes in the quality of the environment. The willingness to pay is taken to be additive across individuals within a specific community so that;

$$a_i WTP_i = WTP_n \; and \; WTP_n = WTP_k \quad (5)$$

Where *i* represents individuals in the n^{th} household and *k* is the sum of households *n*. From the equation above, the effective willingness to pay, in our case for Langata Sub County is the aggregated WTP of all households in the sub county. If we further assume that the household head will practice risk avoidance with respect to demanding an environmental public good and employing utility income mapping based on the assumption that the utility or well-being of an individual is dependent on income and environmental health, the amount an individual is willing to pay for an improvement in waste collection in terms of an the additional charge to be paid as a waste separation charge or the cost that he/she incurs in order to make waste separation possible at the level of his household is the proportion that the individual is willing to part with while still leaving that individual at the same level of utility or well-being as before the payment. Hanemann states that the willingness to pay is the amount that compensates utility

loss due to reduction in income by an improvement in the good or service in question and leaves the household on the same indifference curve (Hanemann 1991). The willingness to pay gives an automatic monetary indicator of preferences (Pearce and Turner, 1990), assuming that the true cost of the undesired impact of poor waste collection and dumping is the total amount that individuals are willing to pay to avoid those impacts (Knetsch, 1990). In general, the willingness to pay can be represented as

$$WTP_i = f\ (Q_i, Y_i, T_i, S_i) \quad \textbf{(6)}$$

Where; Q_i is quality of environment; Y_i is income level; T_i is a vector of preferences; S_i is a vector of socioeconomic factors. The household willingness to pay (willingness to pay) function is expressed as;

$$Log\ WTP = log\ b_0 + b_i(log\ y) + b_2(log\ a) + b_3(log\ e) + b_4(log\ p) + b_5(log\ d) + b_6\ (log\ k) \quad (7)$$

where;
y = monthly household income
a = age of the respondent
e = Level of educational attainment
p = size of household
d = sex of the respondent
k = daily household waste generation (weight in kg)

3.5.3 Policy analysis

In order to determine the adequacy of the current policy framework, including policies, laws regulations, plans and strategies for household waste separation in the City of Nairobi and in the country, the study carried out content analysis of the spectrum of existing policy documents that guide or provide for the management of solid wastes as well as those with which any waste menegemtn efforts interact. These included national policies and legislation on waste

management, national waste strategies as well as policies that are specific to the City County of Nairobi. The study also analysed global frameworks from which national polices derive their organising principles. Additional analysis was done of local or national documents which have short or medium term implications on the management of wastes.

3.6 Ethical Considerations

i. Informed consent was obtained from each respondent prior to questionnaire administration by giving adequate explanation about the purpose of the study, and also the subject under investigation as well as a no-benefits-for-responses notification.

ii. Respondents were informed that they were under no obligation to respond to the questionnaire and that they had the liberty to stop responding to the research assistants at any time during the questionnaire administration without having to give reasons for doing so.

iii. The study also treated the confidentiality of responses a high priority. The application of responses of the questionnaire survey was therefore limited to this particular study and did not make reference to unique markers of the respondents such as such as names, addresses telephone contacts or household coordinates.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

This chapter presents the findings by discussing the relationships between the socio-economic and demographic characteristics of the households and the willingness to pay for household waste separation.

4.1 Demographic characteristics

The mean age of the respondents was 30 years with a standard deviation of 10.05. The age of the respondents ranged from 15 to 58 years with the modal age being 30 years. The mean age of male respondents was 32.6 years while that of females was 29 years. There was no significant difference in mean ages of respondents between the formal and informal settlements. However there was a significant difference of 13.9 years in the mean ages between that formal residential neighbourhoods and that of informal settlements. Similarly, there was a significant difference of 13.95 years between respondents in middle income areas and those in high income residential areas.

Table 4.1: Demographic characteristics of households

Variable		**Mean**	**Min**	**Maximum**
Age of Household Head/ respondent	Female	29		
	Male	32.6		
	Total	30 years	15	58
Education		11.6	0	18
Household Size		4.3	1	16

Source: Survey data

The respondents comprised of a higher number (71.6 per cent) of females than males. The distribution of the sex of the respondents across the residential neighbourhoods is as given in the table below. The proportion of female respondents was higher in the informal settlements at 77.9 per cent and the middle income neighbourhoods at 67.5 per cent. However, in the high income residential neighbourhoods, the male respondents were more than (63 per cent) female respondents (34 per cent). The average household size for this study was 4.26 members with a standard deviation of 2.13. The smallest household was made up of 1 member while the largest household comprised 16 members. The modal household size was 4. There was a significant difference in the mean household size between households located in informal settlements and those located in formal settlement neighbourhoods. Similarly, there is a significant statistical

difference in the average household size between household located in high income areas and those located in high income neighbourhoods. The mean number of years spent in education is 10.80 with a standard deviation of 4.80. The number of years spent in formal education ranges from 0 to 18 years. The tables below summarises the education levels according to region the respondents. It can be noted that there is a significant difference in the mean number of years spent in education between respondents in informal settlements and formal residential neighbourhoods. There is also a significant difference in the mean number of years of years spent in education between respondents in informal settlements and those in high income residential neighbourhoods. There is however no significant difference in mean number of years of education between respondents in middle and high income residential neighbourhoods. Across the two sexes, there is significant statistical difference in the mean years spent in education with males having spent more years in education, on average than female respondents.

4.1.1 Residential Characteristics

The study cut out three major classifications of residential neighbourhoods in Langata districts; high income, middle income and informal settlements. The classification was done based on the predominant neighbourhood characteristics. The largest proportion of respondents i.e. 51.91 per cent was drawn from low income settlements, followed by middle income residential neighbourhoods at 43.72 per cent, while those from high income neighbourhoods of Langata district made up 4.37 per cent of the total sample.

The largest proportions (48.1 per cent) of respondents interviewed were residing in slum houses while 42.62 per cent lived in apartments or flats. These are residential units with shared common areas such as verandas, access, compound and temporary waste storage areas. 9.29 per cent of the respondents lived in bungalows or maisonettes which are semi-detached or fully detached residential units with own compounds. 76.5 per cent of the respondents lived in rented housing units while the rest live in their own houses or houses for which they are paying mortgage.

Table 4.2: Distribution of sample by type of residential dwelling structure and neighbourhood

Type of dwelling structure	Neighbourhood type			
	Informal settlements	**Middle income**	**High income**	**Total**
Apartment/Flat	6	72	0	78
Mansion/ Maisonette/bungalow	2	7	8	17
Slum House	87	0	0	88
Total	95	80	8	183

Source; survey data

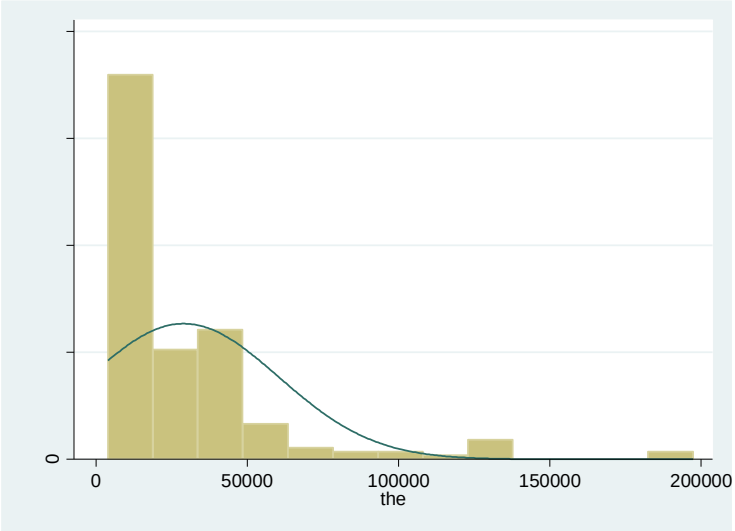
4.1.2 Household Income

The monthly income of each household was arrived at by summing up all the monthly expenditures of the household. This method was thought to be more practical than a direct question on the amount earned by each household as most respondents were reluctant to reveal their incomes during the pilot questionnaire survey. The mean monthly salary earned by households in Langata district is Kshs 28,929.95 with the highest and lowest and highest monthly household earnings being Kshs 197,400 and Kshs 3,900 respectively.

There is a very significant difference in the mean household incomes across the three residential neighbourhoods with the highest difference in mean monthly incomes being between the low income settlements and the high income residential neighbourhood.

The distribution of household incomes in the study area is not normal as can be seen in figure 4.1 below.

Figure 4.1: Distribution curve for household incomes in Langata Sub County



Source: Survey data

The figure above highlight the wide incomes inequalities among the households interviewed, Income distribution is important because the aggregate WTP is determined by the equality or inequality of distribution of incomes among individual households (Baumgartner et al. 2016). Social or aggregate WTP is important in this case because the improvements in urban environmental quality is a public environmental good.

4.1.3 Waste Collection

Waste Collection involves all activities ranging from the picking up of waste from the point of generation to the transfer site. The collection is usually influenced by the storage method, pick up point's requirements, type and composition of waste and the kind of equipment, labour availability and cost (Oluwasola and Ogunsola, 2008). The cost involved in the collection of separated waste at the point of collection can be divided into two major components i.e. the capital costs related to the acquisition of waste separation and storage bins and secondly the recurrent costs, charged monthly by the waste collection service provider. Respondents were asked to state their willingness to pay for the 3-way waste bins as well as their willingness to pay related to the monthly service charge.

From the results of the questionnaire survey, only 59 per cent of the respondents expressed their perception of what the most pressing environmental problem in their neighbourhood was. From this group the nuisance from uncollected wastes and poor waste management emerge to

be the most serious problem with a combined 26 per cent of the respondents reporting it to be the most serious environmental problem. This is closely followed by inadequate water supply (25 per cent) was the most serious environmental problem and poor sanitation (21 per cent).

Respondents were asked to provide an estimate of the waste they generate on a daily basis. All responses were therefore based on these estimates and not verified weight. Majority (96 per cent) of the households generate 5 kilograms or less of waste daily, while 42 per cent of the households, with 43 per cent of these having an estimated daily waste generation of less than one kilogram per day. Only 3.83 per cent of the households produce wastes weighing more than 5 kg daily and these were predominantly in the high income residential areas.

Table 4.3: Estimated daily weight of waste generated by households

	Neighbourhood Type			
Daily waste generation (kg)	Low income	Middle income	High income	Total
<1kg	37	40	0	77
1-5kg	58	38	3	99
>5kg	0	2	5	7
Total	95	80	8	183

Source; survey data

Amongst the household interviewed, approximately 73 per cent have their household waste being collected by a waste collection service provider of some sort, while more than a quarter of the sampled household reported that the waste they produce is not collected by any service. The main service provider in Langata district is private entrepreneurs accounting for about 45 per cent of all the waste collected. Other waste collectors include community groups, which mainly operate in the informal settlements located in the low income neighbourhoods. Community groups collect 72 per cent of all the solid waste collected from household in low income settlements. The highest proportion of household whose waste is not collected among the sample was in the low income settlements. Approximately 37 per cent of the households in informal settlements did not have their waste collected. The uncollected waste is usually dumped in open spaces located within these settlements.

Table 4.4: Waste collection service providers across residential neighbourhoods

Waste collection Service Provider	Neighbourhood type			
	Low Income	Middle income	High income	Total
City County of Nairobi	0	0	0	0
Private company	9	65	8	82
Community group	43	0	0	43
Waste not collected	35	15	0	50
Total	95	80	8	183

Source; Survey data

4.1.4 Payment for Waste Collection

More than 80 per cent of the respondents pay a service fee to the waste collection service providers serving them. The mean monthly payment made for waste collection is Kshs 185 with a standard deviation of 186.87. The payment ranges from zero for respondents who do not pay or those who do not have access to any waste collection service to Kshs 800 per month in the high income residential areas. There is a significant difference in the mean amounts currently being paid for household waste collection between all the three neighbourhood type with the largest difference (Kshs 66.97) in mean payments being between paid for being between low income settlements and high income residential neighbourhoods.

4.2 WTP for waste Separation

The willingness to pay for waste separation is equated to the value assigned by household to the environmental quality improvements in Nairobi that can be realised by improvements in solid waste management characterised by effective separation of household wastes as one of its pivotal elements. It is the maximum price the household is willing to pay for a given level or quality of service, in this case a 3 way waste separation at household level. Respondents were also asked if they would be willing to pay for 3-way waste containers. To elicit the willingness to pay households, the respondents were asked if they were willing to pay some amount (Kshs. 100) more than they were currently paying to in order to have a 3-way waste separation. Approximately 68 per cent of the respondents to this question were willing to pay an amount above the current charges levied for waste collection if a 3 way waste separation system of waste collection was introduced.

Table 4.5: Willingness to pay for waste separation

Neighbourhood	Household WTP for 3 way waste separation			
	YES		NO	
	Count	Percentage	Count	Percentage
High Income	7	100	0	
Middle Income	64	82.1	14	17.9
Low Income	67	68.4	31	31.6

Source: Survey data

In order to establish the maximum willingness to pay for collection of separated waste, the household respondents were further asked what maximum amount they would be willing to pay for a waste separation. The mean maximum willingness to pay values expressed was Kshs. 356. This maximum willingness to pay is higher than the mean payment (Kshs. 202) which was paid by households for waste collection in the study area. The mean willingness to pay stated by male respondents Kshs. 504 per month was higher than that of females which was Kshs. 318.

4.3 Determinants of Willingness to Pay

For the purposes of this study, waste separation refers to the sorting of waste by waste generators, in this case, households according to the categories predefined by the City authorities and the placement of those wastes for temporary storage in predesignated waste bins for collection by solid waste collection service providers. This section explains the analysis of the factors determining the willingness to pay for waste separation as well as the willingness to pay for waste separation bins.

4.3.1 Determinants of Willingness to Pay for waste separation

To understand the relationship between the willingness to pay for waste separation and household socio-economic factors, the study ran regressions analysis on for the different independent variables. Table 4.6 below shows the regression estimates for factors that influence WTP for waste separation.

Table 4.6: Factors influencing willingness to pay for waste separation

Number of obs	**=**	**155**
F(12, 142)	=	14.17
Prob > F	=	0.0000
R-squared	=	0.5449
Adj R-squared	=	0.5064
Root MSE	=	273.12

Variable	Coef.	Std. Error	t	P >| t |
Age	0.5308	2.3484	0.23	0.822
Sex	90.8289	50.9092	1.78	0.077*
Years in Education	7.4821	5.4003	1.39	0.168
Household Size	6.3534	11.1606	0.57	0.570
Water bills	-0.02130	.01206	-1.77	0.080*
Other household expenditures	0.0004	.0034	0.10	0.918
Daily Waste generation (kg)	-53.9817	48.0746	-1.12	0.263
Current payment for waste collection	.4651	.2165	2.15	0.033**
Concern on Waste Disposal	21.7870	37.7649	0.58	0.565
Need for Waste separation	20.7220	52.2944	0.40	0.693
Household Income	.0025	.0020	1.24	0.216
Monthly rent/mortgage	.0049952	.0025	2.03	0.045**
Constant	38.7611	118.9102	0.33	0.745

Source: Survey data

Key * - 10 per cent confidence level, ** = 5 per cent confidence level

The coefficient (R-squared) estimates help to identify the factors that have a statistically significant influence on the willingness to pay. The adjusted coefficient of determination was 0.5064 which can be interpreted to mean that 50.6 per cent of the variations in the willingness to pay values stated by respondents can be explained by the influencing variables in table 4.14 below.

From the regression estimates, the independent variables that have a significant statistical influence on the willingness to pay for waste separation are sex (p=0.077) and household monthly expenditure on water (p=0.080), while the current amounts paid by households for waste collection (p=0.033) and the households' monthly expenditure on rent or mortgage payments were significant at 5 per cent confidence intervals. The coefficient for monthly water bills is negative implying that the amount paid by household for water every month has a negative influence on their maximum willingness to pay for waste separation. This contrasts with that of household expenditure on rent or mortgage which is also has a string relationship but a positive correlation. This may be explained by the fact that higher rents are associated with more formal and organised neighbourhoods which are already receiving regular waste collection services and are likely to want to pay more to have that service improved. In this study, the level of household income was estimated by summing up the key expenditures at household level.

The key expenditures considered in the study were monthly household expenditure on rent or mortgage, water bills, energy bills and the sum of other household expenses. From the results of the regression analysis, it emerged that there is no strong relationship (p=0.216) between the income earned by a household and willingness to pay for waste separation. However the coefficient was positive implying that however insignificant or weak the relationship between household incomes was as a determinant of household willingness to pay for waste separation, it was a positive contributor. While in many studies, income had a significant income on willingeness to pay for improved management of household waste (Li et al, 2016, Bamlaku et al., 2019 and Djemaci, 2015, Awunyo-Victor et al, 2013), others like Balasubramanian, 2018 found income to be an insignificant influence on overall willingess to pay for improved solid waste management in India. This means other factors outside the scope of this study could be intervening in the influancing the willingenss to pay. There was a strong relationship between the amount expended by households on rent or mortgage on the maximum willingess to pay (p= 0.045) with a positive coeficient of 0.005.

4.3.2 Willingness to Pay for 3 Way Waste separation Bins

The basic infrastructure for separation of wastes at the household level includes the separation bins for temporary storage of separate streams of waste. The ISWM plan for Nairobi set out an aspiration for the implementation of a 3 way waste separation system by the year 2013. While

the plan did not specify who would be responsible for meeting the financial cost associated with provision of these bins, the study made the assumption that the waste generator is ultimately responsible for the wastes they produce. The Nairobi City County Solid Waste Management Act also provides for the City County government to provide the waste collection service as well as to determine and prescribe the fees to be levied for the service.

Table 4.7: Factors influencing willingness to pay to pay for 3 way waste separation bins

Number of obs	=	155
F(12, 142)	=	13.94
Prob > F	=	0.0000
R-squared	=	0.5408
Adj R-squared	=	0.5020
Root MSE	=	1050.4

Variable	Coef.	Std. Error	t	P>| t |
Age	9.3917	9.0320	1.04	0.300
Sex	339.4002	195.7997	1.73	0.085*
Years in Education	-6.0993	20.7699	-0.29	0.769
Household Size	42.5065	42.9244	0.99	0.324
Water bills	-.05385	.0464	-1.16	0.248
Other household expenditures	-.0226	.0132	-1.72	0.088*
Daily Waste generation (kg)	-83.8928	184.8976	-0.45	0.651
Current payment for waste collection	-3.5671	.8328	-4.28	0.000***
Concern on Waste Disposal	3.9595	145.2458	0.03	0.978
Need for Waste separation	-131.4177	201.127	-0.65	0.515
Household Income	.0203	.0076	2.68	0.008***
Monthly rent/mortgage	.0377	.0095	3.98	0.000***
Constant	48.8897	457.3351	0.11	0.915

Key * = 10 per cent confidence level, ** = 5 per cent confidence level, *** = 1per cent confidence level

Source, Survey data

The study therefore sought responses from households to determine their willingness to pay for 3 way waste collection bins. The study made the assumption that the bins would be assigned to each household and that the cost of the bins would met through be a one-time expenditure by the household. The mean willingness to pay for the 3-way waste containers was Kshs 587. This is a one-off payment rather than a recurrent service charge. The table 4.15 above contains

a summary of the relationship between independent variables and the willingness to pay for the waste separation bins.

The variables found to be of significant positive influence the household willingness to pay for the 3 way waste separation bins were sex of household head/respondent and other household expenditures at 10 per cent confidence level, current amounts paid for waste collection, household income and household monthly expenditure on rent or mortgage at 1per cent confidence levels. There was a strong relationship between the monthly household income (p=0.008) and maximum WTP for the 3 way separation bins. This can be interpreted to mean than an increase in household income by 1 shilling results into an increase of 0.02 in the willingness to pay for the waste separation, holding other variable constant. Higher amounts in rent or mortgage are also associated with higher incomes. This means household with higher incomes are more willing to pay for the 3 way waste bins.

The current amount paid by households for waste collection has a strong statistical relationship (P= 0.000) with the willingness to pay for the three way waste separation bins. There was also a strong relationship between household income (0.008) and monthly payments for rent or mortgage (p=0.000) on the maximum willing ness to pay for the three way waste separation bins.

4.4 Policies influencing waste separation in Kenya

The policies influencing waste separation within the broader context of solid waste management can be categorised into global, national and local. National policies comprise both national level policies and laws that cover the whole territory of Kenya and also includes sector specific policies which apply regardless of administrative boundaries. There are also policies and laws that are specifically enacted to be applied within local government, in this case the Nairobi City County.

4.4.1 Global and Regional Frameworks

This session discusses global and regional frameworks that are relevant to waste management in Kenya. These include Multilateral environmental agreements to which Kenya is party as well as other regionally or global agreed framework that applicable to Kenya. These MEAs

and frameworks are relevant because they are supposed to be translated into local policies and integrated into our laws as provided for the Constitution of Kenya.

4.4.1.1 The 2030 Agenda for Sustainable Development

The 2030 Agenda is a global plan of action to achieve sustainable development. The agenda is accompanied by a framework of seventeen sustainable development goals which UN member states may base their national policies, plans and actions on as their national contribution to the achievement of the agenda. Kenya was among the 192 Members States that adopted the agenda in 2015 which, in relation to waste movement management, thereby committing to reduce the negative impacts of urban activities through the environmentally sound management of wastes, including amongst others, the reduction and recycling of wastes. The SDGs framework within the agenda include three specific targets on waste management: Target 11.6 which aims at reducing the adverse per capita impact of cities on the environment including by paying special attention to municipal and other wastes management, target 12.4, which aims at achieving environmentally sound management of wastes, significantly reducing their release into air, water and soil by 2020 and target 12.5 which targets a substantial the reduction of waste generation through prevention, reduction, reuse and recycling (United Nations, 2015) The SDGs therefore adequately provide a basis for waste separation to be adopted as part of waste policy.

4.4.1.2 UN Framework Convention on Climate Change

The United Nation Framework Convention on Climate Change is a global agreement that provides the main guidance for global and national efforts to tackle climate change. In Article 4, all signatory member states commit to, inter alia, promote the development of practices and processes that control, reduce or prevent man made emission of greenhouse gases from sectors including the waste management sectors (UN, 1994). Waste has been identified as a source of greenhouse gas emissions globally and in a bid to mitigate greenhouse gas emissions, signatories to the Convention committed to develop nationally appropriate mitigation actions pursuant to the Bali Action Plan Agreement. Kenya developed its NAMA as part of the implementation of the Kenya National Climate Change Action Plan's subcomponent 4 on mitigation actions that targeted amongst other the waste management systems planned to be developed in various Counties in the country as a mitigation opportunity. The government of Kenya deposited this Nationally Appropriate Mitigation Action (NAMA) as part of the

implementation of Kenya's commitments under the Bali Action Plan of the United Nations Framework Convention on Climate Change (UNFCCC). This NAMA provides an alternative for the existing waste value chain by facilitating the diversion of 90 per cent of waste collected away from disposal waste and directing it into various recycling streams. The separation of solid waste at the household level is a critical factor for the successful implementation of this alternative. The modelling of the circular economy approach described in the NAMA indicates that it is possible to offer waste collection service as a fee equivalent to USD 1[7] per household every month. This amount is lower than the mean fees of USD 1.85 reported to be currently paid by residents of Langata Sub County for waste collection, further signalling a likely buy in by most households in Nairobi. The pilot projects further suggest that this service fee if feasible under the circular economy model and that at the monthly fee of USD 1 per household, waste collection can be afforded by 90 per cent against the current 33 per cent. The NAMA also recommends privatisation of the solid waste management sector and therefore makes the establishment of the willingness to pay for improved waste collection services, comprising of segregated waste a useful information for any private sector investors or to the national government and the government of the City of Nairobi for the design of public private partnership for efficient and sustainable waste collection.

4.4.1.3 Africa Agenda 2063

The Agenda 2063 is Africa's shared vision for inclusive growth and sustainable growth that was adopted by AU member states. Kenya included in 2014, signal their commitment to translate the agenda into their domestic policies. The first ten year plan of the agenda (2014-2023) aims to have African cities recycling at least 50 per cent of the wastes they generate by 2023 and encouraged member states to lay out policies that encourage the growth of urban waste recycling industries. The implementation of the waste separation at source within the ISWM plan for the City of Nairobi is therefore a national contribution to the achievement of this target. This however creates the imperative for the careful design of incentives and disincentives to encourage recycling of wastes.

[7] 1 USD = Kshs 108.4 (https://www.centralbank.go.ke/rates/forex-exchange-rates/ - accessed on 11th September 2020)

4.4.2 National Policies

This sub section discusses the policies and strategies as well as legislation that influence waste management in the country either directly or indirectly.

4.4.2.1 Constitution of Kenya

This is the supreme law of Kenya. In its article 42, the Constitution guarantees every Kenyan the right to a clean and healthy environment which further includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures including in Article 69 (1,) d, public participation in the management, protection and conservation of the environment and in Article 69 (g) eliminating processes and activities that are likely to endanger the environment (GoK, 2010)**.** Drawing the above constitutional provisions, the improvement of the current solid waste collection regimes in Nairobi to include waste separation would be helping to reduce the dangers posed by household solid wastes to the environment. Article 61 (2) obligates every Kenyan or resident of the territory of Kenya to work with State agencies and other persons to conserve and protect the environment. Given that the Constitution in in Fourth Schedule assigns the function of solid waste disposal to County Governments, residents of Langata Sub County are obligated to cooperate with the Nairobi City County Authorities or any other legal entity designated by the City County in efforts to improve the management of household wastes by through implementation of any plan of measure to achieve household solid waste separation. Article 69 (1) g, requires outline public participation in the management and protection of the environment, the implication for the topic of study being that involving households in all the design aspects of solid waste separation and disposal is a requirement sanctioned by supreme law. The determination of the demand side information such as willingness to pay becomes is arguably one of the effective ways of ensuring that consumer information is used in the design of such programmes.

4.4.2.2 Sessional Paper No. 12 of 2012 on the Kenya Vision 2030

The Kenya Vision 2030 is the country's long term economic development compass for the period 2008 to 2030 and aims to guide the transformation of Kenya into a globally competitive and prosperous country with a high quality of life by 2030. The long term development strategy also include the provision of a clean and secure environment as an ingredients of the high quality of life of Kenyans. This policy aims to achieve the long term vision through three main

pillars; economic, political and social. The Social pillar comprises the environment and aims to improve waste management through application of the right economic incentives and considers private public partnerships to be a strategy to ensure increased efficiency. The establishment of a solid waste management system for Nairobi City was one of the flagship projects to be achieved by 2012 and one which would set example for other Counties in the country. One of the areas of progress includes the preparation of the National Solid Waste Management policy. The flagship project for setting up a Waste management Policy in Nairobi is yet to be fully realised with one of the outputs being the ISWM Plan for the city of Nairobi which was completed. In the Second Medium Term Plan (2012-2017), the government set out to achieve the conversion of waste into wealth and urban waste collection livelihood opportunities for youths and creation of green jobs respectively. This can greatly benefit from household waste separation at sources as it facilitates resources recovery. In its third Medium Term Plan (2018-2022), separation of solid waste at source, waste collection network infrastructure are identified as one of the main component of the solid waste management infrastructure. Further, one of the flagship programme for this period include provision of incentives to investors to establish a waste to energy infrastructure for Nairobi and three other large urban areas. The existence of an effective solid waste separation at sources would be one incentive as it facilitates such investments as waste to energy or waste to wealth. However, the pace of implementation of the ISWM plan in Nairobi needs to be speeded up to match these aspirations.

4.4.2.3 Sessional Paper No. 1 of 2017 on National Land Use Policy

The National Land Use Policy recognises waste management as one of the vital elements for the sustainable development of various sectors in Kenya and also acknowledges that while the country is experiencing rapid urbanisation and growth in human population, most of the human settlements in Kenya lack adequate infrastructure for waste disposal. The policy requires County governments to encourage environmentally waste management programmes. In the mitigating the problems or urban environment, the policies aspires to promote appropriate technologies for waste management that involve the reduction, reuse and recycling of wastes and to provide incentives for recycling and reclamation of reusable packaging materials. The policy also envisages that all urban development plans in the country will provide for waste management sites and that the national government will develop a strategy for improving urban solid and liquid waste management.

While this policy does not explicitly dealt with the separation of wastes as an approach to waste management, it outlines, the government's aspiration for overall improvement in the strategies for waste management and expressly mentions the recycling of wastes as one of the elements thereof, leaving the elaboration of the waste management to the level of strategy development.

4.4.2.4 National Environment Policy

The National Environment Policy identified waste as a threat to Kenya's biodiversity and to the enjoyment of clean and health environment. It also highlights the waste issues across various sectors of the Kenya economy. With respect to the management of wastes, the policy identifies inefficient production processes, short durability of products and unsustainable consumption and production patterns as factor lead to excessive and ever increasing waste generation, which are impeding efforts to reuse, recycling and recovery. The national waste management strategy, discussed in section 4.3.3 below was an outcome of this policy. The policy further spelled out the intention to promote the use of economic incentives to manage waste and promote establishment of facilities and incentives for cleaner production, waste recovery, recycling and re-use. The policy is therefore supportive of a waste separation regime in Nairobi and in any other urban or rural areas of Kenya.

4.4.2.5 Draft National Waste Management Policy 2019

The draft policy identifies the management of waste as a fundamental contributor to each of the government's "Big Four" priorities; transformational agenda on housing, manufacturing, food and nutritional security and health care and to Kenya's leadership in the blue economy. This policy is aimed at propelling the country towards a circular economy and sustainability, including the realisation of Zero Waste principle, consistent with the National Waste Management Strategy which preceded it. The draft policy aspires to put in place measures for source separation at point of generation, reuse, collection and recycling and the channelling the residual waste to secure, sanitary landfills. In the implementation of this policy, county governments are expected to put in place measures to optimise the waste value chain to generate job and enterprise opportunities for diverse stakeholders. The policy identifies that the avoidance of waste mixing at the household level and ensuring waste separation at the point of generation are key to the realisation of circularity in waste management. The strategy further assigns the primary responsibility for preventing the generation of waste and sorting of waste on individuals households. This responsibility is further extended to payments of waste

management services and returning of goods and collected under the deposit refund system. This policy therefore carries a very explicit expectation that the costs associated with the implementation of any improved solid waste management system will be met either in full or partially by the waste generators and users of the service.

4.4.2.6 The Environmental Management and Coordination Act (EMCA)

The Environmental Management and Coordination Act (EMCA) is the framework environmental law that entered into force in 2000. The Act (section 57) makes provisions for the Cabinet Secretary of the National Treasury to make proposals for taxation and other fiscal tools including fees, incentives and disincentives to stimulate and promote the sound management of the environment, including in respect of any measures taken to recycle wastes. The Act (in Section 86) gives powers to the Standards and Enforcement Review Committee to issue guidelines or any other measures for waste management in consultation with the relevant agencies. These powers also relate to the prescription of standards, classification and analysis of waste and to the formulation and issuance of the necessary advice and standards for disposal means and methods, including that touching on separation. To operationalise the polluter pays principle, the Act places the responsibility for ensuing that waste is managed responsibly until the waste is transferred to an authorised entity. Section 87 of the Act also outlaws the discharge of any waste, whether generated within or outside Kenya in any manner that can cause pollution of injure the health of any person. Similar to the Policy, the act further reinforces the responsibility for the proper management of waste on the household as a waste producer. The implication of this act and the policy from which it is supposed to draw the aspirations for waste management, households are obligated to use the waste collection service offered to them by the respective local authority without due regards to the quality of waste collection service provided. This contradicts literature which requires the greatest amount of citizen cooperation for such a service to succeed (Furedy, 1989).

4.4.2.7 Public Health Act,

The Public health Act is aimed at ensuring the protection of public health and together with the Penal code, they make it an offence to soil the environment in any way. However, they do not dwell on solid waste specifically or on waste separation.

4.4.2.8 Physical and Land Use Planning Act of 2019

The Physical and Land Use Planning Act is relevant to this study because it is the main development control legislation under whose provisions the approval for construction or modification of physical structures, including those used for residential purposes by households are done. The legislation makes reference to wastes in the context of construction waste but does not provide for the management of wastes in any way. However it provides for County authorities, in their processing of development applications to consider environmental, health, safety, aesthetics, community convenience and any other matter that a county government may consider necessary for purposes of planning. The law does prescriptively deal with the subject of waste management although County government may enact county level legislation to give effect to specific considerations related to improvement of wastes from all developments within their areas of jurisdiction.

4.4.2.9 Waste Management Regulations

These regulations were put place in 2006 to operationalise respective sections of the Parent Act, the Environment Management and Coordination Act of 1999. Regulation 5 (1) requires any person who engages in an activity that generates waste to separate the waste into hazardous and non-hazardous waste and to dispose of that waste in a facility as will be provided by the local government under whose jurisdiction the waste is generated. This regulation supports the segregation of both solid wastes and biomedical and healthcare waster but falls short by not prescribing the relevant categories of wastes to meet the objectives of integrated waste management i.e. waste reduction, resource recovery and recycling. The regulation further works on the assumption that the relevant local authority shall have an appropriate disposal site for both hazardous and non- hazardous waste. It is quite evident that, that these Regulations require to be updated to not only conform to the Constitution of Kenya but also to match the aspirations in the National Waste Management Policy and National Waste Management Strategy. The Nairobi City County Solid Waste management Act is already ahead of the regulations.

4.4.2.10 National Solid Waste Management Strategy

The National Solid Waste Management Strategy, which addresses only one core area of the National environment policy on the management of waste, is aimed at establishing a platform for action between various stakeholders to systematically improve solid waste management by

assisting the public as well as public and private institutions involved to achieve a 7-R oriented society in Kenya; by Reducing; Rethinking; Refusing; Recycling; Reusing; Repairing and Refilling their waste. The Strategy is premised on the principle of "Zero Waste", aimed at ensuring that waste management is optimised to promote the creation of employment, enterprise opportunities and wealth and to reduce the pollution of environmental media by waste. The role out and scale up of a source separation scheme for household waste in Nairobi and in other Counties in Kenya would therefore be a key success indicator for the implementation of this strategy.

4.4.3 County Level Policies

This subsection outlines the county level policies and legislation that guides waste management in the City of Nairobi.

4.4.3.1 The Nairobi City County Waste Management Act, 2015

This is the most relevant local level legislation guiding the management of household waste in Langata Sub County. Enacted in 2015 to make provisions for the management of solid waste in the City County of Nairobi, the Act in Section 25 requires every generator of solid waste within Nairobi City County to separate or cause the waste to be separated into; organic, plastics, paper, metal or any others that may be provided for in the regulations. The act further specifies that the segregated waste shall be respectively shall be respectively contained separately in the approved containers for such category of waste prior to collection or other handling as appropriate and also places the responsibility of ensuring appropriate collection and transportation of the various waste on the waste generator, in this case the household. The Act prescribed the colour coding as; a) green for organic waste, b) blue for paper and plastic and c) brown for any other type of waste. The prescription is with respect to liner bags, litter bins and any other waste containers. This further creates a gap in the understanding of what is the most appropriate choice amongst the bins or liners and further complicates the desired uniformity.

In cases of non-compliance, a waste generator is liable for a fine of up to Kshs. 300, 000 or to imprisonment for a period not exceeding 3 years to both fine and imprisonment. Of relevance to the question cost of waste separation, the Act requires all owners of premises where waste if generated to ensure that the occupiers of their premises register for waste collection services which may be offered by the City County or through firms licenced and authorised by the City

County authorities to provide waste collection services. From the analysis of the Act, the City County expects that financial costs of provision of waste collection services to households will be met by the household themselves of by property owners. The provision of waste bins for waste collection is limited to the streets and public areas while for other properties, section 18 (1) of the Act indicates that the City County may hire out to the owners or occupiers of such properties the prescribed waste bins at a fee and conditions to be determined by the City county.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In order for waste management to be environmentally sustainable, it needs to be environmentally efficient, economically affordable and socially acceptable. This study used the contingent valuation methodology to elicit household responses on various variables including their willingness to pay for waste management. The study then employed regressions analysis to establish the determinants of the willingness to pay for waste separation and further analysed the existing institutional, policy, legal and regulatory framework for solid waste management in Nairobi. The results of the study provide a basis for setting up waste collection charges as well as policy implications for improved solid waste management within the context of the ISWM plan for the City County of Nairobi.

The primary objective was to establish the willingness to pay for waste separation of household in Langata Sub County. The mean monthly willingness to pay for waste separation was found to be Kshs 356. Given that the current mean payments for waste collection is less that the average willingness to pay, the study concludes that households place value on the environmental quality improvements that would results from the implementation of a household solid waste and are indeed willing to pay more for waste separation. The willingness to pay for the 3 way waste separated bins or containers, one time payments proposed in the Nairobi Integrated Solid Waste Management was Kshs 587. However it should be noted that 27 per cent of the respondents were unprepared to make any payments for the bins. The study also notes that the ISWM does not contain costings for such bins or for the monthly collection of wastes itself, neither does the Plan nor other legislation already provide specifications for the nature and type of bins to be used for separation. It is therefore not possible to make an accurate prediction of how adequate the WTP for 3 way bins is relative to the actual cost of providing them.

The second objective was to establish the factors that determine the WTP for waste separation in Langata Sub County. Three variables, i.e. sex, monthly expenditure on water bills, current payments for waste collection and monthly household expenditure on rent or mortgage were found to be have statistically significant relationship with the WTP for waste separation. An analysis of policies governing waste management reveals that there are gaps in as far as the

policies being supportive to the household waste separation. The key gaps include the lack of sufficient enforcement and delayed implementation of the Nairobi ISWM plan. The development of the polices and strategies for solid waste management have also not adequately involved the participation of the public which is not only a legal requirements but helps to determine important demand side information for an inclusive design of the waste collection programme.

The analysis of policies that underpin waste management in Kenya reveals there has been considerable evolution between the year 2000 and 2017, with the broader aspiration on solid waste management being refined to include modern approaches to waste management that do not only focus on the management of waste but places priority on shifting away resources from the waste stream destined for landfills or open dumps. The National waste management strategy and the City of Nairobi's plan for integrated waste management provides clear direction in terms of what is expected to be achieved which the Waste Management regulations and the Environment Management Act and the City County of Nairobi's Solid Waste Management Act go further to define how waste separation will be done an setting penalties for non-compliance. However, there are gaps in the legal provisions of important pieces of legislation key among them the Physical and Land Use Planning Act which is the main legal framework for guiding the suitable physical developments of neighbourhood's plans and development control. The enforcement of the already existing legal provisions supporting waste separation is also lax. The main plan to guide the roll out of waste separation i.e. the integrated solid waste management plans is behind schedule in terms of implementation.

5.2 Recommendations

Inferring from the existence of positive willingness to pay for waste separation, the study recommends immediate roll out of the waste separation envisaged to have been implemented under the Integrated Solid Waste Management Plan by 2013. The participation of households in such a scheme if one of the greatest factor of its success. The study finds that some of the key factors that influence the willingness to pay for waste separation, a recurrent cost, are the current amounts paid for waste, sex of household head and monthly payments for rent or mortgage. This contrasts with similar studies which found education levels and incomes to have a strong positive influence o resident on the willingness to pay for improved household solid waste management. I recommend that the roll out of the programme include a public

communication and education element to influence the attitudes and behaviours of citizens for greater uptake.

While on aggregate there is a positive willingness to pay for waste separation, the willingness to pay in some of the residential neighbourhoods may be significantly lower and may require separate approach for effective cost recovery while ensuring effective solid waste management. In agreement with Stigliz who argued that waste management can be regarded as completely public goods (Stigliz, 1989) meaning they are goods are non-exclusive, meaning that once the service is provided to some proportion of the community, it benefits the overall public welfare, not only the residents that specifically receives the service. This may require additional designs of tax instruments to ensure that all residents of Langata Sub County are able to access the waste separation regardless of their ability to pay and the availability of private waste service providers.

For the 3 way waste separation bins which constitute basic infrastructure to enable effective waste separation and the collection thereof, the study found a strong relationship between monthly incomes, rent/mortgage payments and the willingness to pay for the waste separation bins. This implies that the disposable income play a big role in determining how much households are willing to pay for these bins. This requires design of cost recovery mechanism that combines staggered purchase terms for existing households. For new residential units under development, the provision of 3 way waste bins may be connected to the statutory approval processes. This may necessitate revision of County Laws and the Building approval schedules under the Physical Planning Act.

5.3 Areas for further studies

This study used CVM, one of the stated preference valuation methodologies, to determine the overall willingness to pay for waste separation. Waste separation on the other hand may have many attributes including factors such as degrees of separation e.g. between a 3 way system of waste separation vs a 5 way systems and additional investments such as household yard composting. This study recommends additional studies determine the most environmentally appropriate degree of separation of wastes as well as additional ranking of the preferences that household may place on these different attributes.

Second, the study also recommends additional studies to establish the most appropriate instrument for the provision of the waste which is vital for the informed design of payment vehicle to be deployed by the city county of Nairobi, considering that this study only focused on households which are only one of the many generators of waste. The design of the payment vehicle is also important for purposes of ensuring a highest rate of compliance while guaranteeing social inclusion in the provision of improved waste collection that includes waste separation.

The study recognises that the payment for waste management directly by households may translate to double taxation of residents premised on the fact that the resident remit property taxes annually. While the consideration of this issue is outside the scope of this study, the study recommends additional studies to determine the effectiveness of property taxes in enabling cost recovery for waste separation.

Lastly, student acknowledges the limitations associated with the limited sample size and recommends that the City County of Nairobi and the Nairobi Metropolitan Services consider a city wide survey for more accurate base for policy decisions.

REFERENCES

Abul S. (2010) Environmental and Health Impacts of Solid Waste dumping at Mangwaeni Dumpsite in Manzini, Eswatini, Journal of Sustainable Development in Africa Vol. 12

AUC (2013) Agenda 2063; The Africa We Want- A Shared Strategic Framework for Inclusive Growth and Sustainable Development, First Ten Year Implementation Plan 2014 -2023, Africa Union, Addis Ababa

Akter S. (undated) Farmers' Willingness to Pay for Irrigation Water under Government Managed Small Scale Irrigation Projects in Bangladesh, *Department of Economics North South University* http://www.bdiusa.org/Publications/JBS/Volumes/Volume9/jbs9.1-2.pdf accessed on 24th November 2011)

Altaf A.M and Deshazo J.R (1996) Household Demand for Improved Solid Waste Management: A Case Study of Gujranwala, Pakistan. *World Development* 24 (15) 857-868

Altaf A.M and Hughes J.A (1992) Measuring the Demand for Improved Urban Sanitation Services: Results of a Contingent Valuation Study in Ouagadougou, Burkina Faso. *Urban Studies*, Vol. 31, No. 10, 1994 1763-1776

Athena Infonomics (2012) Public Private Partnerships in Municipal Solid Waste Management. Potential and Strategies. Athena Infonomics, Chennai, India.

Asian Development Bank (2017) Integrated Solid Waste Management for Local Governments – A Practical Guide

Awunyo-Victor et al (2013) Urban Household's Willingness to Pay for Improved Solid Waste Disposal Services in Kumasi Metropolis, Ghana, Urban Studies Research. Accessed at https://www.hindawi.com/journals/usr/2013/659425/#conclusion-and-policy-implications

Balasubramanian M. (2019) Household Willingness to Pay for Improved Solid Waste Management Services: Using Contingent Valuation in India, Intechopen, 83598

Bamlaku et al. (2019) Household Willingness to Pay for Improved Solid Waste Management in Shashamane Town, Ethiopia, African Journal of Environmental Science and Technology

Basili M., Matteo M., and Ferrini S. (2006) Analysing Demand for Environmental Quality: A Willingness to Pay/ Accept Study in the Province of Siena (Italy). *Waste Management* 26 (2006) 209-219

Batemann, I.J and Turner, R.K (1993).Valuation of the Environment, Methods and Techniques; "Contingent Valuation Method". *Sustainable Environmental Economics and Management* R.K Turner, eds, pp 112-173

Baumgartner et. al (2016) Income inequality and willingness to pay for public environmental goods. Economics Working Paper No. 2016-04, Kiel University, Department of Economics, Kiel

Beede and Bloom (1995) The Economics of Municipal Solid Waste, World Bank Res Obs (1995) 10 (2): 113-150

Berglund C. and Matti S. (2006) Citizen and Consumer: The Dual Role of Individuals in Environmental Policy. Working Paper 6 of 2006, Luleå University of Technology, Sweden

Bernstein J. (1993) Alternative Approaches to Pollution Control and Waste Management. Regulatory and Economic Instruments, International Bank for Reconstruction and Development, Washington.

Bernstein J. (1994) Toolkit for Social Assessment and Public Participation in Municipal Solid Waste Management, Urban Environment Thematic Group World Bank, Washington.

Bhattarai C.R (2002) Household behaviour on solid waste management: A case of Kathmandu Metropolitan city; Paper presented at the Second World Congress of Association Environmental and Resource Economists, Monterrey

Bel G, Fageda X, Warner M.E (2010) Is private production of public services cheaper than public production? A meta-regression analysis of solid waste and water services. Journal of Policy Analysis and Management 29(3):553–577

Bojan R, Neven V. and Branka (2017) Concept of Sustainable Waste Management in the City of Zaghreb: Towards Implementation of Circular Economy Approach, Journal of the Air and Waste Management Association

Carson R.T (2000) Contingent Valuation: A User's Guide. Environmental Science and Technology 34, 1413-1418

Cascetta E. (2009) Transportation Systems Analysis. Models and Applications. Springer Optimization Volume 29, 2009 pp 89-167

Christensen (2010) Solid Waste Technology and Management, Wiley 2010

Chen F et al. (2019) Research on the Driving Mechanism of Waste Separation Behaviour: Based on Qualitative Analysis of China's Urban Residents, International Journal of Environmental Research and Public Health

City County of Nairobi (2010) Integrated Solid Waste Management Plan for the City of Nairobi, Kenya: 2010-2020, Nairobi

City County of Nairobi (2015) Nairobi City County Solid Waste Management Act, Nairobi City County Gazette Supplement, Nairobi 2015

Cointreau-Levine S. (1994) Private Sector Participation in Municipal Solid Waste Services in developing countries. Volume 1, Urban Management Programme Working Paper No. 13, UNDP/UNCHS/World Bank, Nairobi.

Chuen-Khee P. and Othman J. (2010). Household demand for solid waste disposal options in Malaysia. *World Academy of Science and Engineering* 66 1153-1158 2010

City Council of Nairobi (2007) City of Nairobi Environment Outlook, Nairobi

Fasakin J. and Olajuyigbe A. (2010) Citizens' Willingness to Pay for Improved Sustainable Water Supply in a Medium sized city in South Western Nigeria. *Current Journal of Social Sciences* 2 (2) 41-50, 2010.

Cointreau S. and Hornig C. (2003) Global Review of Economic Instruments for Solid Waste Management in Latin America, Regional Policy Dialogue, Inter-American Development Bank, Washington

Competition Authority (2011) Altering the Structure of Waste Collection Markets; A Submission to the Department of Environment, Community and Local Government, Ireland

Ezebillo, E. (2013) Willingness to Pay for Improved Residential Waste Management in a Developing Country. International Journal of Environmental Science and Technology 10, 413-422, 2013

Darfor et al. (2025) willingness to Pay for Improved Solid Waste Disposal in Tema Metropolis, Department of Economic, University of Cape Coast

Djemaci B. (2015) Using a Contingent Valuation Approach for Improved Household Solid Waste Management in Algeria, University of Bourmerdes

Furedy C.D, (1989) Responsibility Sharing In Solid Waste Management: Encouraging Citizen Participation and Cooperation in Asian Metropolises, International Experts Meeting on Policy Responses Towards Improving Solid Waste Management in Asian Metropolises, Kitakyushu, Japan, October 16-21, 1989.

GoK (2009) National Environment Action Plan Framework 2009- 2013, National Environment Management Authority, Nairobi.

GoK/UNCHS (2001) Nairobi Situational Analysis. Consultative Report

GoK (2010) 2009 Kenya Population and housing Census Volume 1 A. Population Distribution by Administrative Units, KNBS, Nairobi.

GoK (2012) Sessional Paper No. 12 of 2012 on the Kenya Vision 2030, Ministry of State Planning and National Development and Vision 2030Hanemann, W.M (1991) Willingness to pay and willingness and willingness to accept – How much can they differ? *American Economic Review*, Vol. 81 (3) p. 635-647, 06/1991

Hoyos D. and Mariel P. (2010) Contingent Valuation. Past, Present and Future, Prague Economic Papers, 4, 2010.

Medina M. (2010) Solid wastes, poverty and the environment in dev eloping country cities: challenges and opportunities. Working Paper//World Institute for Dev Economics Research, 2010(23)

Ini-Mfon et. Al (2017) Households' Willingness to Pay for Improved Solid Waste Management in Uyo Metropolis, Akwa Ibom State Nigeria, America Journal of Environmental Protection, 2017, Vol. 5, No. 3, 68 -72

ISWA (2010) Solid Waste, Guidelines for Planning, International Solid Waste Association, São Paulo

IUCN, (2009) Environmental Fiscal Reform in Abbottabad: Solid Waste Management IUCN Pakistan, Islamabad, Pakistan. IV+20 pp.

JICA (2005) Supporting Capacity Development for Solid Waste Management in Developing Countries; Towards Improving Solid Waste Management Capacity of Entire Society. Institute for International Cooperation, JICA

JICA, MoLG and CCN (2010) Preparatory Survey for the Integrated Solid Waste Management in the City of Nairobi in the Republic of Kenya. Draft Final Report Vol1. Executive Summary CTI Engineering Consultants & NJS Consultants, Nairobi

JICA (1998) The Study on Solid Wastes Management in Nairobi City in the Republic of Kenya. JICA Final report, Nairobi City Council, August.

Kaliba A., Norman D. and Chang Y. (undated) Willingness to Pay to Improve Domestic Water Supply in Rural Areas of Central Tanzania; Implications for Policy. *Paper Submitted to the International Journal of Sustainable Development and World Ecology*.

Kasozi A. and Blottnitz H. (2010) Solid Waste Management in Nairobi: A Situation Analysis. A Technical Document accompanying the Integrated Solid Waste Management Plan, UNEP, Nairobi (*draft document*).

Kawai, K. and Tasaki, T. (2016). Revisiting estimates of municipal solid waste generation per capita and their reliability. Journal of Material Cycles and Waste Management, 18(1):1-13

Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC

Knetsch J.L (1990) Environmental Policy Implications of Disparities between Willingness to pay and compensation demanded Measures of Value. *Journal of Environment Economics and Management*

Kothari C.R (2004) Research Methodology. Methods and Techniques (2nd Revised Edition) New Age International Publishers, Delhi

Lachytova and Mihalikova (2020) Analysis of Municipal Waste Separation in Slovakia and Possible Alternatives, TEM journal, Volume 9, Isssue3, August 2020

Li et al (2016) Residents' Attitudes and Willingness to Pay for Solid Waste Management in Macau, Qingbin. Procedia Sciences

Low S. et al (2016) Preferred Attributes of Waste Separation Behaviour: An Empirical Study, Procedia Engineering 145 (2016) 738 – 745

Ghulam K. et al (2018) Solid Waste Separation at Source among Households for Sustainable Solid Waste Management: The Application of the Solid Waste and Public Cleansing Management Act 2007. International Journal of Asian Social Science. Volume 8 - 10.18488/journal.1.2018.84.201.207

Guerrero L. A. et al. (2012) Solid Waste Management Challenges for Cities in Developing Countries, Waste Management Volume 33, Issue 1 2013 220 – 232

Maskev and Singh (2017) Household Willingness to Pay for Improved Waste Service in Gorkha Municipality of Nepal, Environments, 2017

Massoud M and El Fadel M. (2002) Public–Private Partnerships for Solid Waste Management Services. Environmental Management November 2002, Volume 30, Issue 5 pp 0621-0630

McGranahan G., Leitmann J. and Surjadi C. (1997) Understanding Environmental Problems in Disadvantaged Neighbourhoods: Broad Spectrum Surveys, Participator Appraisal and Contingent Valuation. Working Paper No. 16 Urban Management Programme, UNDP/UNCHS/World Bank/Stockholm Environment Institute, Washington

Mitulla W. (2003) Urban Slums Reports; The Case of Nairobi, Understanding Slums, Case Studies for the Global reports on Human Settlements 2003

Modak P. (2011). Chapter 5 - municipal solid waste management: turning waste into resources, Shanghai Manual - A Guide for Sustainable Urban Development in the 21st Century, Chapter 5

Moore S.A (2012) Garbage matters: Concepts in new geographies of waste. Progress in Human Geography. 36(6):780–799.

National Environment Management Authority (2014) National Waste Management Strategy, Nairobi

Nunes P. and Stokkaert E. (2003) Identifying the Warm Glow Effect in Contingent Valuation. Journal of Environmental Economics and Management, 45, 231-245

Ogawa T., Furukawa S., Fuji A. and Fujila Y. (undated) Estimation of Willingness to Pay for Water and Sanitation Services through Contingent Valuation Method (CVM)- A Case in Iquitos City, Republic of Peru. *JBICI Review No. 10.*

Omortor D. and Niringiye A. (2010) Determinants of Willingness to Pay for Solid Waste Management in Kampala City, *Current Research Journal of Economic Theory 2(3): 119-122, 2010.*

Otiato E.and Muniafu M. (2010) Solid Waste Management in Nairobi, Kenya. A case for emerging economies. *The Journal of Language, Technology & Entrepreneurship in Africa, Vol. 2.No.1. 2010.*

Pearce D., Pearce C. and Palmer C. (2002) Valuing the Environment in Developing Countries. Case Studies. Edward Elgar Publishing, United Kingdom.

Porta et al. (2009) Systematic review of epidemiological studies on health effects associated with management of solid waste

Pongrácz et al. (2004) Evolving the Theory of Waste Management: Defining key concepts

Quiggin J. (1997) Individual and Household Willingness to Pay for Public Goods. *American Journal of Agricultural Economics*

Republic of Kenya (1963), The Local Government Act: Chapter 265, National Council for Law Reporting, Nairobi.

Republic of Kenya (1999), Environmental Management and Coordination Act: Chapter 387, National Council for Law Reporting, Nairobi.

Republic of Kenya (2011), Policy Statement on Public Private Partnerships. Office of the Deputy Prime Minister and Ministry of Finance, November 2011

Republic of Kenya (2013), The Public Private Partnerships Act No.15 of 2013: National Council for Law Reporting, Nairobi

Republic of Kenya (2017), Sessional Paper No. 1 of 2017 on the National Land Use Policy, Ministry of Lands, Nairobi

Republic of Kenya (2019), The Physical and Land Use Planning Act No. 13 of 2019; National Council for Law Reporting, Nairobi

Republic of Kenya (2019) Draft National Sustainable Waste Management Policy, Ministry of Environment and Forestry

Samson K. and Wedgewood A. (2003) Willingness to Pay Surveys. A Streamlined approach. Guidance Notes for Small town water services. Water Engineering and Development Centre, Loughborough University, United Kingdom.

Schubeler P. (1996) Conceptual Framework for Municipal Solid Waste Management in Low Income Countries, Urban Management Programme Working Paper No. 9, UNDP, UNCHS and World Bank, Nairobi.

Strange K. (2002) Overview of Waste Management Options: Their Efficacy and Acceptability Issues in Environmental Science and Technology, No. 18 Environmental and Health Impact of Solid Waste Management Activities.

UNDESA, Populations Division (2019) World Urbanisation Prospects; the 2018 Revision, New York, United Nations

UNEP (2010) (*Draft*) Integrated Solid Waste Management Plan for the City of Nairobi, UNEP, Nairobi.

UNEP (2005) Solid Waste Management, Osaka Japan

UNEP (2015) Global Waste Management Outlook, Osaka, Japan

UNEP (2018) Africa Waste Management Outlook. United Nations Environment Programme, Nairobi, Kenya.

UN-HABITAT (2010) Collection of Municipal Solid Waste in Developing Countries, Nairobi.

UN-HABITAT (2010) Solid Waste Management in the World's Cities, Earthscan Publications.

UN-HABITAT and WHO (2010) Hidden cities: unmasking and overcoming health inequities in urban settings, United Nations, Geneva.

United Nations (1992) United Nations Framework Convention on Climate Change, General Assembly, New York

World Bank (1992) Development and Environment, World Development Report. Oxford University Press, Oxford, United Kingdom.

World Health Organisation (2015) Waste and human health: Evidence and needs; WHO Meeting Report, Bonn Germany

Whittington, D., Lauria, D.T. *et al*. (1993) Household demand for improved sanitation services in Camas, Ghana: A contingent valuation study. *Water Resources Research* 29(6), 1539–1560

Whittington, D., Smith, V.K. *et al*. (1992) Giving respondents time to think in contingent valuation studies: A Developing Country application. *Journal of Environmental Economics and Management* 22, 205–225.

Whittington, D., Lauria, D.T. *et al*. (1991) A study of water vending and willingness to pay for water in Onitsha, Nigeria. W*orld Development* 19(2/3), 179–198.

Xu et al. (2017) Understanding Household Waste Separations Behaviours; Testing the Roles of Moral, Past Experience and Perceived Policy Effectiveness within Theory of Planned Behaviour, Sustainability 2017, 9, 625

APPENDIX 1: CV QUESTIONNAIRE

HOUSEHOLD QUESTIONNAIRE

PART I; INFORMED CONSENT

[INSTRUCTION TO ENUMERATOR; the following statement must be read to every household head/ respondent.] May I have a minute of your time? **Mr. Innocent Maloba**, a graduate student of Environmental Policy at the University of Nairobi is conducting a thesis study on Waste Management in Nairobi. In order to meet this objective, it is important to obtain consumer (or potential consumer) information. The information is being collected for academic purposes only and there are therefore no personal benefits or risks to your participation. It is also not necessary for you to give your name or address- the only identifier on the questionnaire will be a number. All the information collected will be treated with utmost confidentiality. The interview takes approximately twenty minutes. You may terminate the interview at any point if you do not wish to proceed. If you would like to know more about this study, please contact …….at ……

1. Consent Granted: YES (proceed with interview)

   NO (thank person and look for next respondent)

The enumerator is required to keep this questionnaire whether the respondent agreed to participate or not.

2. Questionnaire Number [_____]
3. Interviewer Name [_____]
4. Interview date [M_____Day___] Time [_____]

Basic Information

Residential Area [_____]

PART II

A. Demographic Information

Q.	Question/ Detail	Response/Observation code	SKIP TO
100	Age of Respondent?	[_____] Years	
101	Size of Household/How many people normally live in this household?	[ ]	
102	What is the highest level of education you completed?	No **Grade** completed [ ] Primary School(8 years) [ ] Secondary School (4 years) [ ] College/University [ ]…..Years	

		Higher (Masters) [ ]	
103	Total monthly household income (from employment, businesses, dividends, remittances, e.t.c	0 – 5,000 [ ] 5,000 – 10,000 [ ] 10,000 – 20,000 [ ] 20,000 – 50,000 [ ] 50,000 – 100,000 [ ] 100,000 – 150,000 [ ] More than 150,000 [ ]	
104	Tenure type	Owner occupier [ ] Rented [ ] Company House [ ] Other (specify) [_____]	

B. Waste Collection Service Information

Q.	Question/ Detail	Response/Observation code	SKIP TO
200	Approximately how much waste does your household generate daily?	< 1 kg [ ] 1-5 kg [ ] ➢ 5kg [ ]	
201	Do you currently pay for Waste Collection?	YES [ ] NO [ ]	202 203
202	How much do you pay for waste collection per month? ***(obtain exact amount in Kshs)***	[ ]	
203	Who collects your waste? ***For private company/ community group, obtain name***	CCN [ ] Private Company [ ]…… Community group [ ]…… Waste not collected [ ] Other (describe) [_____]	
204	Are you satisfied with the level of waste collection service provided?	YES [ ] NO [ ]	 205

205	What is the main source (s) of your dissatisfaction with the service provided?		
206	Is your waste separated before collection?	YES [ ] NO [ ]	207 208
207	Who separates your waste?	Self [ ] Waste Collector [ ] Other (describe) [_____]	
208	What makes you not separate your waste?	It is useless [ ] Nobody else separates waste [ ] It is not required of me [ ] Other reason [_____]	
209	Do you know where the collected waste is taken after leaving your compound?	YES [ ] NO [ ]	210 210
210	Are you concerned whether the method of disposal of wastes collected from your household is environmentally friendly?	YES [ ] NO [ ]	211 212
211	Why do you feel concerned with what happens to the waste after it leaves your back or front yard?	WRITE REASON	
212	Why would you not be bothered with what happens to the waste after it leaves your back/front yard	WRITE REASON	

C. Willingness to Pay

Explanation to Respondent	The current mode of collection of household waste results into environmental degradation. Even though the waste is removed from your backyard, it is normally transported to another area where all of it is dumped together. This study proposes a multiple bin system of collection where you will be required to separate your waste say into; organic (e.g. food items), glass, plastic, metallic, electronic e.t.c **(show the respondent the photo of the multiple waste bin system)** ***Would you like to ask me any questions about this kind of waste separation?***

Q.	**Question/ Detail**	**Response/Observation code**	**SKIP TO**

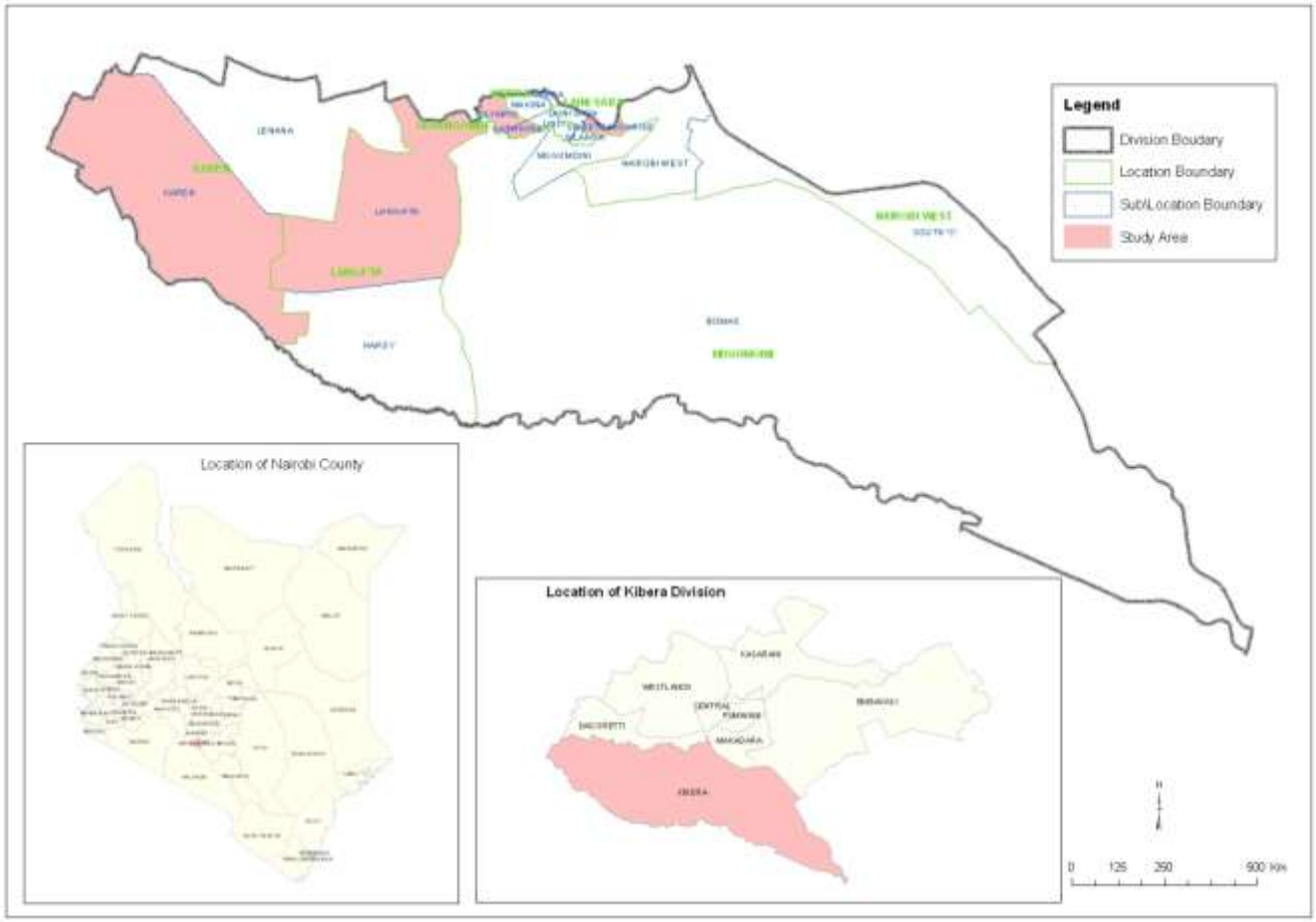
301	What in your opinion represents the most serious environmental problem faced by your household and neighbourhood? a) Air pollution b) Particulate matter (e.g dust) pollution c) Lack of/Inadéquate sanitation d) Lack of/inadéquate water supply e) Nuisance from uncollected waste f) Flooding/ poor drainage of storm water/ household waste water g) Poor waste management	**Please rank from 1- 7** A [ ] B [ ] C [ ] D [ ] E [ ] F [ ] G [ ] H (Don't know) [ ]	
302	Do you see/feel the need for separating your waste or having your waste separated	YES [ ] NO [ ]	305
303	Why do you find it necessary to separate your waste?	Care of the environment [ ] It is practised by neighbors [ ]	
304	What has prevented you from separating your waste now and in the past?	Absence of separation service [ ] Lack of appropriate container [ ]	
305	If a system of household waste separation involving 3 waste container/ bins was introduced in your neighbourhood, would you be willing to pay the waste containers?	YES [ ] NO [ ]	308
306	Why would you NOT be willing to pay for the 3 bin system?	Lack of space in compound [ ] The NCC should provide free[ ] Landlord should provide free [ ] No confidence in service [ ] Cannot afford [ ]	
307	In addition to paying for the containers, would you also be willing to pay an	YES [ ] NO [ ]	

	additional amount for the collection of your separated waste		
308	Would you be willing to pay your regular waste collector an additional amount to separate your waste after collecting it?	YES [ ] NO [ ]	311 309
309	Would you be willing to pay (***your regular waste collector***) an additional amount of say Kshs.100 to separate your waste after collecting it?		
310	What is the maximum amount you will be willing to pay for the 3 bin containers?		
311	What is the maximum amount you would be willing to pay per month for the collection of separated waste?	Indicate amount stated in Kshs. [……..]	
312	Do you belong to any resident association	YES [ ] NO [ ]	
313			
	I have come to the end of my questionnaire. Do you have any question about this study?		

End of Interview;

- Please verify that you have not forgotten to ask any Question
- Thank the respondent for his/her attention and time and proceed to next household**.**

APPENDIX 2: MAP OF THE STUDY AREA: LANGATA DISTRICT



Source: Kenya National Bureau of Statistics, 2013