AN ECONOMIC ANALYSIS OF IMPROVED ENVIRONMENTAL SANITATION IN WAJIR TOWN: A CONTINGENT VALUATION STUDY

BY

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DECLARATION

This paper is my original work and has not been submitted for a degree course in any other University.

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This Research Paper has been submitted for examination with our approval as University supervisors.

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ABBREVIATIONS

ASAL=Arid and Semi-Arid Land
CCF=Country Cooperation Framework
CVM-Contingent Valuation method
GOK=Government of Kenya
HPM=Hedonic Pricing Method
Ksh =Kenya shilling
LDC=Less Developed Country
MLE=Maximum Likelihood Estimation
MOH= Ministry of Health
NEP=North Eastern Province
NGO=Non-Governmental Organisation
OLS=Ordinary Least squares
PAL=Percentage of Adult Literacy
UNDP=United Nations Development Programme
UNICEF= United Nations Children's Fund
WCC=Wajir County Council
WHO=World Health Organisation
WTAC=Willingness to accept Compensation
WTP=Willingness to pay

Abstract

Environmental health (EH) in urban centres is an important policy concern for developing countries. Like most African countries, Kenya environmental sanitation problems especially faecal and solid waste management is posing major challenges. In Wajir town residents are faced with inadequate environmental sanitation services occasioned by poor faecal disposal of bucket latrines and solid waste management. This coupled with general apathy and lack positive attitudes toward public service delivery on the part of the Wajir County Council (WCC) have posed major environmental risks/hazards in the town. In light of the severity of the problem, this paper evaluates factors influencing households' economic values measures in terms of willingness to pay (WTP) for improved faecal and solid waste management. Secondly, the paper sets out willingness to accept compensation (WTAC) measures for the hazards posed by the poor sanitary conditions.

The paper employs the Contingent Valuation Method (CVM) to capture economic values measures from field survey on three aspects; environmental health in Wajir town, benefits and costs associated with EH, and socio-economic, demographic profiles of Wajir residents. A stratified systematic random sampling was utilised. The CVM design employed a direct bid elicitation approach to capture WTP on the same sample of 196 households.

The results show that there is overwhelming WTP for improved environmental sanitation even though these bids are low owing to the high-poverty income levels in the area. Such willingness to pay for the two goods was significantly influenced to large extent, by the households' income, the current disposal costs, the level of environmental awareness and the level of intervention by authorities notably WCC and NGOs. Strikingly, households who receive services are less willing to pay for the envisaged improvements. Other socio-economic and demographic factors such as the family size, age, and gender affect WTP less significantly. Education had mixed effects on the WTP for improved environmental sanitation. In both goods, the average expected monthly WTP was higher than the average current monthly disposal costs implying that there was relative preference for the expected improvement. Using the direct bid method, the study reveals that the individual average monthly WTP is Kshs 259.30 and Kshs 129.60 for improved faecal and solid waste management respectively. These were 28% and 14% of individuals' average monthly income in the area (which are relatively high). When this is aggregated across households yields economic values of Kshs 1.04 million and Kshs 518,400 a month. Finally, the study consistent with economic theory, confirms that the economic measures of WTP and WTAC differ markedly.

The policy implication of the high valuations of environmental health improvements by households is that a system of payment on a community-NGOs-government participation basis is necessary in return for regular and better services on cost-recovery basis. Further still, subsidizing of the cost of introducing a low-cost, simple, appropriate alternative sanitation technology may be feasible given the strong correlation between WTP and household income.

CHAPTER ONE

INTRODUCTION

1.1 Background

Measurements of benefits of environmental changes have long presented analytical problems to economists. Although it is likely that demand curves that are necessary for estimating benefits do exist for public goods[1] (or, more generally, goods with implicit rather explicit markets), it is very difficult to estimate them without direct transactions in these goods. As a result, analysts have necessarily resorted to indirect market valuation methods. These have included Hedonic Prices analyses (HP), or survey methods such as Contingent Valuation (CV)[2], to assess benefits from proposed environmental improvements (Goodman 1987, Hanley et al 1993).

Environmental sanitation for a long time has been generally misconstrued to exclusively mean provision and management of excreta through provision of appropriate disposal facilities. This is the narrow definition of environmental sanitation. Generally, therefore, it is not surprising that environmental sanitation has been accorded low priority in the development agenda and consequently poor ranking in terms of resources allocated to it. In the broader sense, sanitation may be defined as a systematic method of applying physical, chemical, biological and social procedures and measures which aim at controlling environmental factors that promote disease transmission in order to safeguard

[1] Environmental Sanitation (including faecal disposal and solid waste management) is considered here as public good with no explicit market and hence cannot be valued in the ordinary market.

[2] CV method has become accepted approach to valuing environmental amenities and other non-market goods. It is a survey method in which survey respondents are presented with a hypothetical scenario pertaining to the existence of a particular environmental amenity and then asked about the monetary value they would place on that scenario, in terms of either willingness to pay (WTP) or willingness to accept (WTA) payments.

human health. Clearly then, environmental sanitation encompasses the isolation of excreta from the environment, maintenance of personal hygiene, safe disposal of solid and liquid waste, and the safe drinking water and vector control. Thus, as a concept the term environmental sanitation comprises both hardware and software components that interrelate to achieve desired results. Both components bear the same weight for environmental sanitation to create any meaningful health and environmental impacts. The World Health Organisation (WHO) defines sanitation as the "control of all those factors in man's environment which exercise or may exercise deleterious effect on his physical development, health and survival."

The United Nations has launched a worldwide effort to break the faecal-oral transmission of diarrhoeal diseases by declaring the 1980s to be the International Drinking Water Supply and Sanitation Decade. The intention of this declaration at the time was to provide everyone with access to safe drinking water and waste-disposal facilities by 1990. This goal looks highly illusive ten-plus years after 1990 as it was formidable at the time of declaration because of the great number of people who need this service and the great cost involved. Following this failure, the Water Supply and Sanitation Collaborative Council in 1996 declared sanitation to be basic right and fundamental ingredient of human dignity. Yet for many people in developing countries lack of adequate environmental sanitation services continues to be the most pressing environmental issues. The problem is particularly acute in the densely populated peri-urban areas and rural areas where the large majority of the dwellers are typically low-income people. It is

estimated that over half a billion urban people and over 2 billion rural people lack sanitation.

Generally, solid waste and excreta are disposed of in uncontrolled open dumps in developing countries. The environmental consequences of such inadequate disposal sites are often quite evident, yet necessary improvements are seldom dealt with (Salequezzamana, 2000). More specifically, the excreta of urban centres in developing countries are disposed of through on-site sanitation systems such as private, public latrines and septic tanks. This is in contrast to industrialized countries where excreta are disposed of via cistern – flush toilets, citywide sewerage systems and central wastewater treatment works, all that constitute standard technologies. These are, however, unaffordable to most town inhabitants of developing countries.

The major problem in developing countries is the fact that faecal sludge collected from on-site sanitation installations are commonly disposed of untreated. This problem is mainly one of contrast even in less developed countries (LDC). In large cities, for example, haulage distances to outlying treatment or disposal sites are excessive and traffic congestion prevents efficient emptying and haulage of faecal sludge. Land within city boundaries is often highly valued and might thus, not be available for waste treatment. The sludge are therefore, dumped untreated at the shortest possible distance, be it on open ground, into drainage ditches, manholes and water courses, or into rivers and seas. Growing urbanization has worsened the situation in that it leads to an increase

in faecal sludge quantities to be disposed of and hence, to increased poor sanitation and general environmental pollution posing health risks.

Given their adverse consequences for economic growth and human welfare, chronically deficient sanitation poses perhaps the most serious current environmental problem in the developing countries, as they did historically with the industrialized countries. There are three categories of diseases related to poor sanitation[3] namely waterborne diseases, such as typhoid, dysentery, diarrhoea, infectious hepatitis; infections that are primarily caused because of defective sanitation and poverty, such as hookworm.

Sanitation related diseases account for a significant proportion of morbidity and mortality worldwide. Diarrhoea disease alone accounts for an estimated 4.6 million deaths per year. When combined with other related diseases like hookworm there are 3279 million cases each year by 1990 (Esrey et al 1991). This causes debilitation rather than death. Studies on the improvements on health have shown that sanitation and hygiene are more significant than provision of the safe water in the reduction of diarrhoea and other related sanitation diseases. A particular research by Esrey et al (1991) showed that safer excreta disposal led to a reduction in childhood diarrhoea up to 36 percent.

The key practices seem to be the isolation of excreta from the environment by maintaining standard hygiene methods. The compliance level required to prevent disease transmission within community is unknown globally. However, it has been suggested that compliance levels above 75 percent has the potential for great positive environmental and health impacts.

[3] The following is extracted from the United Nations Report on the State of the Environment

In addition, sanitation globally is seen as a vital building block for improving environment, health and general well being and is critical for even poverty reduction (Ndiba, MOH, Kenya 1999). Yet the need for different or improved excreta disposal facilities is rarely given priority except when the community has become crowded, housing is concentrated and the lack of privacy has become a problem. As result of being linked with a need perceived to be of higher priority, such as health services, sanitation improvement project introduced through integrated community development programmes; the installation of latrines or other means of excreta disposal can receive substantial community support and acceptance. However, in marginal squatter communities particularly in urban areas, a constraint to investing in improved sanitation is the fear of eviction or displacement.

Socio-economic impacts of improved sanitation are extremely hard to measure and reliable figures are not available particularly in rural areas. Improved sanitation benefits are often long-term and in most cases may not be recognized because measurement indicators are inappropriate (UNICEF 1999).

While investments and sanitation coverage have not kept pace with population growth, much has been learned on new approaches that may be accelerating the closing of the gap. One strategy that has emerged from the successful experiences in both the developed and the developing world is one that is demand-based and incentive-driven. This strategy capitalizes on the evidence that households in the absence of public provision are willing to pay significant amounts of money for both public and private provision of services

(Whittington et al 1993; Salequezzaman, 2000). In this context most solutions have invariably been lower-cost alternatives to conventional systems.

Further, the evidence from successful experiences (Salequzzaman et al 2000, Whittington et al 1993) indicates that an active participation of the community members in the decision making process is a key ingredient for the sustainability of sanitation investments. The initiative to implement sustainable sanitation systems typically emanates from the communities themselves and optimum decisions are reached when all parties are consulted and the implications of the feasible choices are clearly presented[4]. The challenge is to match this WTP with the menu of feasible technical options from which the potential beneficiaries can choose.

1.1.1 Environmental Sanitation in Kenya

The government of Kenya recognizes that there are inherent dangers of poor environmental sanitation provisions. The most serious danger being the spread of communicable diseases, which in some cases can be fatal (Wahome, 1986). The government through the Ministry of Health, division of disease control pursues certain objectives-namely, reduction of mortality and morbidity rates. To achieve these objectives, it works closely with communities on existing sanitation programmes and technologies and in some instances provides building materials for construction of latrines etc.

[4] These experiences are based on lessons learned in many developing countries – including Ghana in Africa 1992 and Bangladesh in Asia (2000).

Despite the government's efforts, 70 percent of Kenya's population lives in rural areas and is faced with Poor sanitation coverage, contaminated water sources and poor hygiene and environmental sanitation awareness. On the other hand, 60 percent of urban population lives in informal settlements and experience problems of overcrowding, significant production and poor disposal of solid and liquid wastes and poor latrine coverage (Macharia, 1999)

In Kenya, in the first half of 1990s, there has been no significant change in the proportion of population with an access to adequate sanitation especially in the rural areas where the proportion has reduced to 2 percent (situation analysis report GOK/UNICEF 1999). This was an evaluation after sanitation and water were declared basic human right in 1996. The report indicates that the average national coverage was 42 percent in 1990 but dropped to 40 percent in 1996. However, actual physical facilities have increased although this is not reflected in the percentage proportions due to a corresponding increase in population. However, access to sanitation throughout Kenya had risen significantly, from 46 percent nationally in 1997 to nearly 80 percent.

The percentage coverage may be of little significance given the large inter and intra regional variations. Regions within the high and medium potential areas have significantly high levels of coverage while those in the arid and semi-arid lands (ASALs) have sometimes extremely low levels. For example, sanitation coverage in Kiambu is estimated to be 96 percent while the same is only 20 percent in Turkana (GOK/UNICEF 1999).

The Government of Kenya (GOK) in partnership with UNICEF has been working in collaboration with communities in the country and allowing them to take more control in the design, implementation and management of sanitation systems, which is central in sanitation improvement and hygiene. In this context, a hygiene promotion was the umbrella term used to cover a range of strategies that aim to prevent sanitation-related diseases and thus optimise (minimize) the effect of sanitation intervention. Education and awareness strategies were used to try and change people's attitudes. Despite all these efforts, socio-cultural as well as economic factors have worked against many Kenyans in their quest for improved sanitation.

1.1.2 Legal, Institutional and Technological Arrangements

There are many legal, institutional and technological arrangements in Kenya all designed with intent to improve environmental sanitation. Various laws for example exist in Kenya that deal with sanitation. Chief among these is the Public Health Act (Cap 242). Other Acts include the Food, Drug and Chemical Substances Act (Cap 254); the Mosquito Control Act, the Local Government Act; the Water Act etc. All these provide legal framework for intervention in sanitation issues.

Several institutional arrangements do exist. Many actors in the sanitation sector are often seen in the rural areas. The key ones include Ministry of Health (MOH), Ministry of Environment and Natural Resources (Water Department), Ministry of Local Government and a number of Non-governmental organizations (NGO's) including UNICEF. The MOH has the overall national responsibility for health including public and environmental health. Within the MOH, the environmental health division is responsible

for policy making, preparation of guidelines, setting of standards and provision of support to districts. A major bottleneck though has been the lack of clear definition or roles for all the governmental institutions involved which has led to duplication of efforts.

Technologically, Kenya like other less developed countries has not advanced insofar as sanitation improvement is concerned. Matching technology with the user is often the most serious technical problem related to sanitation. No amount of hygiene can compensate for inadequate or inappropriate engineering design. It is vital that sanitation facilities are suitable to the culture and practices of the users. User choice is therefore a critical technical consideration.

Overall, inadequate research and development has been carried out to solve some of the technical problems. Areas in need of more research include low cost sanitation options for densely populated, low cost pit lining for areas of high water table[5] or collapsing areas, pit excavation in hard rock areas and termite control where timber structures are involved.

1.1.3 Sanitation Situation in Wajir Town

Wajir District covers an area of 56,501 km^2. It is the third largest district in the country and one of the four districts in North Eastern Province (others being Mandera, Garissa and Ijara). The district is considered as semi- arid, flat and sandy and about 150 metres above sea level in most parts.

[5] Typically the case in Wajir (Area of this study)

Climatically, the district lies within the Sahelian climatic region. It is very dry with short rainy seasons in April, October, November and December. The annual rainfall is slightly less than 200 mm. Evaporation is very high. The temperatures are very high reaching as high as 36^0 C in March and November just before the rains.

In the main town where the study is based, access to appropriate sanitation facilitates has long been difficult. Evidence of this is reflected in relatively high morbidity rate for the residents due in part to sanitation and waterborne diseases such as typhoid (District development Report 1994-1996). The poor sanitation stems from the fact that bucket latrine systems are in use by majority of the local households while others simply use open spaces and bushes. The bucket latrines are occasioned by the fact that the water table is very high in the area. The bucket latrines consist of squatting plate and a plastic bucket located in a small compartment below the squatting plate. Excreta are deposited into the bucket, which is periodically emptied by night soil labourers locally known as "*Chura*" into local council tanks and finally taken to collection depot in the outskirt of the town.

The bucket latrines are rarely disinfected. They are always poorly maintained and bad odour emanate from them. Given that the main water sources for the town are shallow wells (which are poorly maintained), the sinking of pit latrines can contaminate ground water hence posing major health risks. The bucket latrine system, even if improved, is not a form of sanitation that can be recommended for modern societies. It is a short-term

measure that should be replaced with other technologies. Over flows from bucket latrines are quite often washed into wells, which are uncovered during rainy season.

What has worsened the situation is that Wajir County Council (WCC) whose mandate it is to dispose and manage waste, has in many instances, sabotaged this, particularly faecal disposal. Even with the little effort, WCC is not still familiar with any modern waste management system and it appears to have taken a "*devil –may care*" approach to tackling the problem.

Traditionally, before the 1990s, the town's wastes including night soil had been collected through definite council's trucks and dump them to a far-depressed place in the outskirt of the town. But in the 1990s, the situation worsened. The number of WCC workers reduced considerably, as well at the number of equipment including truck for collecting night soils. In addition to the faecal management problem, solid waste are also disposed of every available space in the town, thereby compounding the environmental sanitation hazards and/or risks.

To come to grips with this problem, several measures have to be taken. To begin with, estimation of a demand for sanitation improvement by way of economic analysis of the people's environmental valuations is necessary. This presupposes the existence of high level of awareness of environmental dangers of the poor sanitation. The application of these measures will imply considerable costs to the society.

In order to decide if these measures are worthwhile, it was necessary to find out if the benefits accruing from environmental sanitation improvement (low-cost alternative sanitation technology) exceed costs. To do this the value Wajir residents place on improved environmental sanitation was elicited.

1.2 Statement of the Problem

Wajir Town is now faced with severe inadequate sanitation services occasioned by bucket latrines and poor faecal disposal. Wajir County Council (WCC), as local government seems to have failed in the proper management and disposal of faeces due to limitation of funds and manpower corruption, lack of willingness to public services etc. All these combined and general apathy have made the situation pathetic. With bucket latrines in use, the sanitation in the town is reaching a crisis level.

The excreta of most town dwellers are disposed through sanitation systems such as bucket latrines owing to the fact that the location of the town is one with high water table. This is in contrast to other major towns in Kenya where excreta are disposed of via pit latrines, cisterns –flush toilets, sewages systems and central wastewater treatment works. General apathy on the part of the WCC coupled with lack of awareness of environmental risks by residents, as well as socio-economic factors have worked against any attempt to redress the scenario. The bucket latrines more often than not do overflow presenting negative externalities to others.

A major environmental problem posed by this is that the overflows from bucket latrines are seen everywhere and disposal at times takes place in the midst of the residential areas.

These unsanitary living conditions are therefore the major cause of the degradation of the quality of ground water (wells), which are the main sources of water for domestic purposes including drinking.

The evidence of this is reflected in relatively high morbidity rates for the local residents, due in part to sanitation –related diseases such as typhoid. Consequently, households are confronted with a dilemma; either continued poor sanitation (more so faecal disposal) risking illness thereby, or securing alternative improved technologies, perhaps at a cost depending on their willingness-to-pay (WTP). In addition, solid waste in Wajir town is posing major environmental risks. Households dispose of the waste they generate in any available space. Consequently, large heaps of solid waste are found everywhere in the town. Improving general sanitation in the town is costly and may involve tradeoffs with other social objectives. Thus, although a decision on sanitation improvement requires economic analysis, appropriate means and ways to treat, use, dispose and generally manage excreta are consequently, urgently required.

This study set out to determine empirically the WTP of the residents for an improvement in the faecal disposal system and other solid wastes using a technique of CVM. The study also, on the basis of the outcome suggests remedial policy measures to address and/or redress the grave sanitation situation.

1.3 Objectives of the Study

Generally, the aim of the study was to assess the environmental problem (s) the residents of Wajir town have to contend with occasioned by poor environmental sanitation (including faecal disposal and solid waste management).

More specifically, the study sought:

(i) To assess the environmental sanitation conditions in Wajir town.

(ii) To determine Wajir residents' the willingness-to-pay (WTP), as well as factors influencing WTP for improved environmental sanitation in terms of both the faecal disposal and solid waste enhancements.

(iii) To establish willingness to accept compensation (WTAC) for environmental and health risks and/or hazards of poor environmental sanitation in Wajir town.

(iv) Based on (ii) and (iii) above, draw policy recommendations.

1.4 Study Hypotheses, Justification and Significance

1. WTP_f and WTP_s disparity

- There is no significant difference between the average WTP_f and average WTP_s

  That is,

  H_{01}: $WTP_f = WTAP_s$ against the null H_{a1}: $WTP_f \neq WTAP_s$

  Where:

  WTP_f and WTP_s are the willingness to pay for improved faecal management and solid waste management respectively.

2. $WTAC_f$ and $WTAC_s$ Disparity

- There is no significant difference between $WTAC_f$ and the average $WTAC_s$

H_{02}: $WTAC_f = WTAC_s$ against the null H_{a2}: $WTAC_f \neq WTAC_s$

Where:

$WTAC_f$ and $WTAC_s$ are the willingness to accept compensation for the faecal and solid waste conditions in Wajir town.

3. WTP and WTAC Disparity

- There is no significant difference between household WTP and WTAC for improved faecal and other solid waste management.

That is,

H_{03}: $WTP_{f/s} = WTAC_{f/s}$

H_{a3}: $WTP_{f/s} \neq WTAC_{f/s}$

Where the variables are as defined above.

4. Cost of disposal and WTP Disparity.

- There is no significant difference between the average monthly cost in the disposal of faecal and other solid wastes and the average monthly WTP for improved services

H_{04}: $C_{f/s} = WTP_{f/s}$

H_{a4}: $Cf_{f/s} \neq WTP_{f/s}$

5. The level of authority intervention, notably WCC (proxied by the amount services received or enjoyed) does not necessarily influence residents' WTP for improved services.

The WHO (1964) has set ball rolling by recognising that the improvement of human health as the ultimate goal and that an improved water and sanitation services play a

central role towards attaining that goal. Therefore, any research on environmental sanitation service in any setting whether rural or urban in Kenya is vital. More particularly, this study in Wajir is justified on a three-tiered perspective namely: the importance of sanitary services as a basic human need; the seriousness of deteriorating environment and the identifiable gap in the body of appropriate solution in existing technology.

Based on the severity of the sanitation problem in Wajir town, the study is important in the sense that it provides information to the local community. The findings of the study are vital in revealing people's preferences with regard to WTP in improving the situation. By this token, the study is exceptionally important because it attempts to assign an economic value (monetary measure) of utility change to non-market goods – environmental quality (environmental sanitation)[6] using contingent valuation in a rural town where a study of this is seldom carried out.

[6] Improved environmental sanitation (including faecal management from bucket latrines to septic tanks and solid waste management) is an improvement in environmental quality from the point of view of envisaged reduction in sanitation-related diseases and hence bears public good characteristics (non-excludability of the improved environment.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Non-market valuation, through the economic measures of willingness-to-pay (WTP) and willingness to accept compensation (WTAC), has continually been accorded a considerable amount of attention in environmental economics literature. However, specific literature related to sanitation improvement, as an environmental quality is limited. For this reason, much as we attempt to cover sanitation *per se*, we would also cite and review other related literature; literature relating to WTP of and improvement in environmental quality in general.

Attempts will be made to analyse studies that assign economic values to non-market goods such as sanitation improvement which help in combating and controlling the spread of pathogens responsible for many water and sanitation related diseases (Kalbermatter et al 1980 pp 7-19). There are many existing literature on general environmental quality changes, which utilize both direct and indirect methods. The contingent valuation method (CVM) will be reviewed in this study to access the WTP for environmental quality improvement in general and environmental sanitation improvement in particular.

2.2 Environmental Sanitation and Technologies

World Health Organisation (1964) and World Bank (1980) both argued that the improvement of environment and particularly the achievement of proper sanitation environment require a community well versed in public health education. Nonetheless,

they point out it is not merely the knowledge that is crucial but the putting of the knowledge into practice. WHO (1964) on housing programme regarding the role of public health agencies recognised the improvement of human health as the societal ultimate goal and that an improved water and sanitation services play a central role towards attaining that goal. In addition, WHO found out that community participation as a valuable force in the improvement of housing conditions and the general environmental health.

Kalbermatter (1980) argued that there are un-quantifiable costs associated with alternative sanitation technologies. He maintained that although it is generally possible to assess qualitatively the environmental consequences of installing particular systems, it is very difficult to quantify them since "no market" exists for such public goods. Further, he posited that it is more difficult to compare consequences of installation with the environmental sanitation that would develop without the project's implementation, thus to determine net benefit or net cost figures. Much as these arguments are valid in the sense of the time of the study, dynamism and the sophistication of environmental economics makes the argument less convincing. Through such techniques as contingent valuation we are able to create at least a hypothetical market for public goods hence their quantitative costs and benefits can be generated.

Kalbermatter also maintains that income of individuals generally imposes constraint on the demand and/or WTP for sanitation services. This is so particularly in areas where improved sanitation is not a high priority of the inhabitants. As a result, the willingness of

the potential users to pay for any new system is probably low. He added that in poor areas, unless the residents have secure tenure on their property, they might be unwilling to pay anything for sanitation improvement. He concludes that if the estimation of demand does not take into account factors such as the above, it cannot provide a sound basis for the selection of an alternative technology.

OXFAM, Great Britain (1981) in its community services involving sanitation and water in developing countries reported that while most communities welcome the provision of new water supplies, they are often less susceptible to changes of habit and technology in the disposal of faeces, which after all is a more private affair. In its assessment of projects, OXFAM further argues that, like many forms of development, sanitation to be effective needs both an appropriate technology and motivation. In order to remain flexible an understanding of, an involvement by, the local people is vital. Only then can people's willing to pay for an improvement in the sanitation be captured.

OXFAM (1981) further made a distinction between rural and urban areas with regard to willingness to pay of communities. In the urban areas, for example, the conditions are such that the problem of faeces is left in the streets, so by and large motivation is less important than in rural areas. Conversely, an appropriate technology is much more important under urban conditions especially where the constraint of cost operate. This, according to OXFAM, will result in differentiation of WTP for an improvement or alternative sanitation.

Mairura (1988) while writing on the development of water and sanitation infrastructure in unplanned low-income urban settlements in Nairobi (Kanuku and Kinyago slums), found appalling sanitary conditions. In a household survey he noted there were no formal toilets in those areas and that widespread defecation took place all over the settlements in the open ground. This posed a lot of strain on households making them feel socially dejected. The study further noted that residents were not even getting the 'God-given" free air because of the pungent smell in the air. Consequently, he noted an overwhelming demand for sanitary services owing to the amount and type of waste produced particularly human waste. As hypothesised the study found 83 percent of the surveyed households indicated the provision of toilets to be a top priority against 17 percent who saw water as their main priority. Roads and electricity were accorded zero preferences confirming that in such settlements these social overheads were not necessities

2.3 Association of sanitation to diarrhoeal morbidity

There are various studies that show the association between improvements in water and sanitation and morbidity occasioned particularly by diarrhoea. The results of some of these studies are by no means consistent. Some show strong positive results while others show the opposite i.e. the reverse of the expected benefits.

Rubenstein et al (1969) in a study on the effects of improved sanitary facilities on infant diarrhoea in two Indiana villages in Arizona in USA, using one village as treatment village and the other as controlled found a strong association between improved sanitary services and decline in morbidity. In particular, they noted the hospital admissions of the infants with diarrhoeal disease reportedly declined in the village where indoor plumbing

was installed. This study to them was statistically significant but there are number of major confounding issues. For example, there was no random assignment to the treatment group. One village simply cooperated when the Public Health Service wanted to construct indoor plumbing facilities, while the control group resisted all the attempts to improve their condition. Therefore the reported differences cannot be ascribed to plumbing conditions alone. The participants, especially their interest in or attitudes toward health and environment, may also relate them to characteristics of self-selection.

Bruch et al (1963) in study on diarrhoeal disease in Guatemalan villages in Central America reported no difference in diarrhoea attack rates among infants from families with and without outdoor toilets. On the other hand, the study found that children between 1-5 years of age from families with toilets were reported to have lower attack rates than children from families without toilets. But the results are inconclusive. A protracted epidemic occurred while the study was conducted, which the researchers believed might have been measles. Since measles has a high attack among infants, a measles epidemic, unrelated to water and sanitation, may have masked results in the infant age group.

Kumar, et al (1970) on a study that examined the effects of Borehole latrines on diarrhoea prevalence among children in a rural community in India reported that diarrhoea was lowered by the introduction of the latrines, although no statistical tests were done. But seasonal changes in diarrhoea rates could have produced this reduction with or without the latrine improvements.

Esrey and Habicht (1986) in a study on epidemiological evidence for the health benefits from improved water sanitation in developing countries showed that safer excreta disposal led to a reduction in childhood diarrhoea by up to 36 percent. They further posited that hygiene mainly; hand washing brought a reduction in infant diarrhoea of 33 percent. In another study, Esrey, Potash, Roberts and Shiff (1991) writing on the effect of improved water supply and sanitation on ascariasis, diarrhoea, dracunuliasis and hookworm argued that water and sanitation related diseases account for a significant proportion of morbidity and mortality worldwide. They argued that diarrhoea alone accounted for 4.6 million deaths per year. They further maintained that when combined with other related diseases like hookworm there are 3279 million cases each year which cause debilitation rather than death.

2.4 Link between Water and Sanitation and Mortality

There are numerous studies that examine the association of water and sanitation with infant and childhood mortality across the world and more particularly in the developing world. Most of these conclude that although mortality is a more distal response indicator than morbidity to water and sanitation conditions, reduction in mortality should follow improvements in water and sanitation since sanitation-related diseases are the leading causes.

Anker and Knowles (1980) in an empirical analysis of morbidity differentials in Kenya at the micro and macro levels found that water supply and sanitation improvements were key determinants of childhood mortality at the district and household levels. The district

analysis used the 1969 population census data to predict the probability of a child's surviving to the age two. The source of data for the household analysis was the 1974 ILO/University of Nairobi household survey. A general finding at the micro level was that a benefit from sanitation was reported at the household level.

At the district level analysis, the percentage of adult literacy (PAL) was used as a proxy for type of drinking water, toilet facilities, personal hygiene and nutrition. In this study it was reported that PAL had a statistically positive effect on children's life expectancy except when the number of hospital beds per 1,000 persons was taken into consideration, which suggested that medical care may be more important than water supplies or toilet facilities. At the household level analysis, only pit latrines improvements were reported to associate with reduced mortality and this was highly significant more in the urban areas than rural areas.

Weir (1952) in an evaluation of health and sanitation in Egyptian villages used control examined neonatal and infant mortality rates in a control village that had no improvements of any kind and in four other areas that had one or more of four improvements: wells and latrines, fly-control measures, preventive medical care and installation of refuse disposal. The study found that only fly-control reduced the rate of mortality. This study, however, suffered from several flaws. Failure to randomise, to replicate villages within a treatment and to verify exclusive use of improved facilities. Another explanation of the negative findings is the overall poor condition of the all the villages in the study. That is, an objective sanitation score indicated that despite the

improvements examined in the study, poor conditions continued after the interventions. In other words, any expected reduction in mortality rates may have been offset by the deplorable conditions in general. This is to tantamount to saying that no intervention occurred, since no improvement was able to reduce mortality.

Patel (1980) in examining the effects of the health services and environmental factors on infant mortality in Sri-Lanka reported the association between regional variations in water and sanitation conditions and infant mortality rates. The study found that the region with the highest percentage of households possessing latrines (42 percent) had the highest infant mortality rate of all regions in Sri Lanka, while the region in which only 3 percent of households had latrines was 60 percent lower.

2.5 Studies on Solid waste Management

Abebe and Kebede (1999) while assessing awareness and practice of solid wastes in Addis Ababa maintained that communities particularly the rural folk expect the municipal cleaning and collection service hence their WTP is not only low but also negative at times. However, in a study on willingness to pay for community-based solid waste management and its sustainability in Bangladesh, Salequzzaman and co-authors (2000) maintained that where a community perceives that new facilities provide a service level that is much higher than the existing management, they will be more enthused to pay a higher contribution. This, according to them, is particularly the case, if the users are not satisfied with their present service level. This argument, however, has one main limitation, that is, it assumes that residents have perfect knowledge about the perceived or envisaged alternative sanitation technology for them to be enthused to make higher

payments. This is not always the case particularly among the rural folks, who in the first place do not understand the extent of the environmental problem leave alone the alternative sanitation.

Salequzzaman and et al (2000) further argued that communities with low incomes and low ability to pay are less willing to pay for improved services because they need their financial resources for other basic needs such as food, health care, education and shelter. This argument, though sheds light on the ability to pay (measured in terms of income) as a determinant of WTP, again has a major drawback, that is, the ability to pay measure assumes that residents with the same income have the same preferences for the service. It could be the case that individuals with the same income have different preferences hence varying levels of WTP.

Beyene (1999) while investigating management of solid waste in Addis Ababa argued that creating healthy environment does not only depend on raising public awareness but also on the creation of mechanisms of controlling generation of waste at the source and sharing of responsibilities between the general public, local institutions, business community, non-governmental organisations and governmental institutions. His argument is consistent with the findings of Snel (1999) who maintained that social stigma on waste disposal can be reversed if responsibilities are shared

Similarly, Olley and Olbina (1999) argued that involvement of professional collector teams or residents' committee workers can prove effective in solid waste management

rather than involving only one institution. In the same vein, Coker and Sikiru (1999) posit that private institution is better placed in the management of solid waste than public institutions. Osuocha (1999) on improving refuse management in urban Nigeria also argues in a similar way. He maintains that one of the major problems of refuse management is institutional framework, which is attributed to lack of understanding of the magnitude of refuse job.

Fullerton et al (1993) presented a theoretical model where illicit burning and dumping options for municipal solid waste disposal and the resulting environmental damage was greater than from sanitary landfills or incineration. They argued that in such circumstances, a deposit-refund scheme for recycling waste might be more efficient policy than charging levies for waste generation. The advantage of this method is that it gives incentives to households not to dump and burn wastes indiscriminately. Moreover, the method may be cheaper to manage than monitor the disposal behaviour of households.

Ohnesorgen (1993) maintained that public cleaning of streets and open area is critically important in areas where waste is indiscriminately dumped along roadsides and that inefficient collection techniques may exacerbate this problem. Ward and Li (1993) also argue that the use of uncovered trucks spill some of their loads back onto streets and roads thereby complicating the garbage collection. Cointreau-Levine (1994) while writing on waste collection in developing countries maintained that in such countries the cost per metric ton of cleaning waste off the streets is estimated to be between two and

three times the cost of collection. He therefore recommended that covered trucks or other more costly collection equipment that reduce spillage would probably be more efficient.

In an analysis of per unit charges for waste collection, Repetto et al (1992) estimated that environmental damage and the amount of waste households set out for collection would be substantially reduced by charging households a fee that fully reflected the costs of collection and disposal. The study used 1980-1989 data on municipal solid waste collection charges and tonnage of waste collected and deposited in landfills by a sample of fourteen communities in the United States. The result suggested that a $ 1.50 charge per 32-gallon container (which typically weighed 9.5 kg) induced households to cut the waste they put out for collection by an average of 18 percent per capita (0.2 kg per capita per day). Further the study showed that when the fees were combined with a program for collecting recyclable materials from households the average reduction increased to more than 3 percent.

Bartone etal (1991) while writing on private sector participation in municipal solid waste services propose that a flat benefit tax charged to all households as part of their utility or property tax bill may be the most effective for cities in developing countries to pay for municipal solid waste management, reduce incentive to dump waste illegally and possibly subsidize management services for poor neighbourhoods. However, without strict supervision this method does not provide an incentive to reduce solid waste. Nonetheless, most of the recyclables or reusable materials may be covered by the time waste is put out for collection.

In developing countries, the least costly options for disposal of waste dumping in public spaces or burning it openly-are often the most popular (Bartone and Bertntein, 1993). They argue that although inexpensive in terms of out-of-pocket costs and environmental effects to those who dump or burn waste, these acts may impose large costs on society. Aesthetic, environmental and health problems may result, especially in densely populated urban areas.

2.6 Contingent Valuation Studies

Direct elicitation of responses from consumers about their willingness to pay to acquire a commodity (or to avoid it) or willingness to accept compensation (or accept it), also known as contingent valuation, has received much attention in recent past decades. The method is called contingent valuation because the elicited WTP approaches are contingent upon the particular hypothetical market described to the respondent (Randall 1974). WTP is also referred to as relative preferredness by Krutilla and Fisher 1975), while WTAC is referred to as willingness to 'sell'. The CVM was first formally came into existence in the early 1960s when Davis (1963) used questionnaires to estimate the benefits of outdoors recreation.

Whittington, et al (1992) carried out a study on demand for improved sanitation services in Kumasi Ghana. The Contingent Valuation study found that most households were willing to pay more for improved sanitation than they were currently paying but in absolute terms the potential revenues were not large, confirming that conventional sewerage is not affordable to the vast majority. On the other hand, they concluded that

improved ventilated pit latrines, which were much cheaper, would need only modest government subsidies.

Whittington et al (1993) using a Contingent Valuation conducted a study to estimate households WTP for this type of improved sanitation services. Improved ventilated pit latrines and water closets connected to a sewer system. Most households were willing to pay more for improved sanitations than they were currently paying for the existing sanitation system (mostly public and bucket latrines), but potential revenues from households are not large. The study confirms that conventional sewerage system is not affordable to the vast majority of households without massive government subsides. However, only modest subsidies are required for on-site sanitation (ventilated pit latrines): WTP is above as high as it is for water closets and ventilated pit latrines are much cheaper to supply. The study involved 1200 households and a dangerous public health was found from existing sanitation system. For example, the study found that only 10 percent of generated human waste is removed from the city. Expenditure on sanitation services was on US$1.50 per capita per year and correspondingly, households were getting very poor services. Households were quite open to the idea of simple, low cost, on-site solution to their sanitation problems.

Randall et al (1974) in one of early empirical studies on application of the survey approach, designed survey instruments exploring alternative mechanisms within the instruments for eliciting WTP. In this study, the benefits of abatement of aesthetic environmental damage resulting from air pollution (visibility), power plant and mine

using the bidding game technique were estimated. They established a relationship between WTP and household income. Their findings indicated the existence of substantial benefits from abatement of this aesthetic environmental damage.

Shechter et al (1991) in a study in the city of Haifa in Northern Israel valued air quality in terms of its human health effects. Evidence accumulated over some time has indicated a noticeably higher occurrence of respiratory illness in the polluted sections of the Haifa region, especially in relation to respiratory symptoms and diseases. The study used three contingent valuations elicitations formats namely, open-ended, modified iterative, bidding game and referendum-style binary choice. The focus of the study was to capture the WTP. The WTP measures reported here probably do not cover the direct costs of air pollution because households are covered by subsidized medical insurance and almost universal paid sick leave. Such components therefore do not enter (directly of course) into the household's maximization process. A prime finding of this study was that of the gross WTP exceeds the abatement costs, the improvement can be considered socially profitable, setting aside the income distribution issue. Shechter and co-author, however, make an important point that in formulating the WTP questions one must be careful to specify what individuals are supposed to pay for. Otherwise, it may be difficult to avoid double counting of some benefits and/or costs in a cost-benefit-analysis CBA.

Once CVM is adopted, there is often the problem of how to value preferences for commodities or goods. Should the preferences be measured by WTP or WTAC and why?

Many studies both theoretical and empirical have since been devoted to this particular question and few will surface here.

Randall and Stoll (1980) while examining the duality theory associated with fixed quantities in the utility function argued that WTP and WTAC for changes in environmental goods should not differ greatly unless there are unusual income elasticity effects. Recent empirical works using types of interviews procedure have shown some evidence of large disparities between WTP and WTAC measures Cummings et al 1986, Fisher et al 1988, Hanemann 1991)

Hanemann (1991) in particular, while attempting to show how much the two can differ and trying to reconcile the theoretical and empirical works maintained that for quantity changes in environmental goods, there is no presumption that WTP and WTAC must be close in value. Unlike in price changes, the difference between the two depends not only on income effect but also on a substitution effect. Hanemann maintained that holding income effect constant, the smaller the substitution effect (i.e. the fewer substitutes available for the amenity) the greater the disparity between WTP and WTAC. This means that if the amenity has almost no substitutes (i.e. involving one's own life), there is no reason why WTP and WTAC could not differ vastly and in the limit WTP could equal the individual's entire (finite) income, while WTAC could be infinite.

Pearce and Markandya (1994) grappled with the problem of CVM with regard to how to value preferences for environmental commodities. The core of their discussion was –

should the preferences be measured by WTP or WTAP and why? They submit that choice of the method is determined by the choice decision in question. Removal of a "bad" necessitates the use of willingness to accept payment (WTAP) while the introduction of "good" calls for the application of WTP. They argued that suppose a project that has adverse health effects on residents is introduced in an area. If the project must progress, residents would need to be compensated in some form for their loss in welfare. The measure of the minimum compensation that would fully indemnify their welfare losses is termed WTAP. On the other hand, suppose now that, the project was socially beneficial and residents were campaigning to obtain it. The maximum amount each resident would pay to express his/her need of the project is termed as WTP.

Jorge Rogat (1995) undertook a study that involved 455 households to determine the WTP for air quality improvement in Santiago in Chile. Despite the intensity of the problem, only 17 percent of the respondents considered environmental pollution a priority of most concern. He analysed the influence that different individual attributes have on WTP for quality air improvement in Santiago Chile. Income, education and number of children in the household are some of the factors that influenced WTP positively at the time of decision. Other factors such as sex, education and whether members of the household are suffering from pollution related diseases or not, seem to have had less influence on WTP. That result however, looked somewhat confusing due to the fact that the problem of air contamination affecting Santiago was so critical that it could also imply that people perceive the problem with the same intensity.

Belhaj (1996) used Contingent Valuation method to assess the WTP to pay for reduction in air pollution by 50 percent caused by road traffic in Rabat-sate (Morocco). He used a stratified random sample in a 500 households in Rabat to give the maximum WTP to reduce air pollution. Belhaj's major findings were that there existed awareness toward environmental problems in Morocco and that the willingness to pay to reduce air pollution in Rabat was positive and not negligible. He found that in the iterative bidding approach 70 percent of the respondents had a positive WTP while in the dichotomous choice the proportion of yes answers was only 56 percent. He however, cautions regarding the estimated values because they were not only contingent upon the hypothetical market scenario presented to the respondents, but also upon the statistical analysis as well.

Although the CVM can be a very important technique in valuing public goods, many economists are sceptical about the authenticity of the method particularly in cases where the declared intentions do not correspond to the behaviours of individuals (Randall 1974, Dixon 1988, Pearce and Turner, 1990; Dale 1990). The authors pointed out six major biases among others.

- The strategic bias, which arises when the individual thinks he may influence a decision, say, of investment, by not answering the interviewer's questions truthfully and honestly.
- Information bias-may arise from lack of or too much information at the level of the respondent. This may be procedural bias, starting point bias or specification bias.

- The hypothetical bias- arises from the fact that the respondent is presented with a hypothetical contingent market scenario.
- The constant budget bias: this may arise principally for two reasons. First, if the respondent may not understand or correctly perceive the characteristics of the goods being described by the interviewer. Second, it may arise due to the fact that certain individuals who have been interviewed on the same topic many times may have in their minds a fixed budget allocated to a problem of this nature.
- The sampling bias or non-respondent bias
- The status quo bias can also permit to enlarge the estimation of the willingness to pay.

2.7 Overview of the Literature Reviewed

What seems to emerge from the literature review is that empirical literature particularly on sanitation that utilise contingent valuation method is limited. However, there exists a significant body of literature on associations between improved sanitary facilities and diseases, although most of the literature reported conflicting and confounding effects leading to inconsistent results. Generally, the studies reveal that improved waste disposal facilities may be more important insofar as general environmental quality improvements are concerned.

Another aspect worth noting about the literature surveyed is that most empirical studies on willingness-to-pay, are generally about environmental quality changes in air, water and other goods. The studies utilise the Contingent Valuation Method using household

surveys in determining the existence of demand for environmental quality changes. Although most of the literature reviewed show that individuals place a positive monetary value or probability regarding WTP, this nevertheless depend much on the manner in which the survey is presented and analysed.

This study therefore followed the CVM literature on environmental quality changes in basing our theoretical and empirical results and to extend the method in the area of environmental sanitation in a rural setting in a developing country.

CHAPTER THREE

THEORETICAL FRAMEWORK AND METHODOLOGY

3.1 Theoretical Framework

From economic theory two basic theoretical approaches are available for making reliable estimates of household's WTP; direct and indirect valuation methodologies First the 'indirect' approach, which uses data on, observed goods or services use behaviours (such as quantities used, travel times, perception of the goods or services quality etc) to assess the response of consumers to different characteristics and improved accessibility of the goods or services. Several models approaches fall in this category. Chief among these are hedonic property pricing, travel cost method etc.

The second approach, which this study heavily borrows from, is the direct approach. This approach simply asks an individual how much he or she would be willing to pay for the improved use of the good or service (Whittington et al 1990, 1992; Mitchell and Carson, 1989, Belhaj 1996). Generally, economic theory predicts a positive relationship between individuals' income and their WTP amount (Varian 1984, Whittington et al 1993)

$$WTP_i = f(Y_i);\ \partial WTP/\partial Y > 0 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.1$$

Where WTP_i is the maximum amount of money that individual i is willing to pay for a change in good or service and Y_i is the income level.

WTP of individuals is also related to other socio-economic, demographic and environmental condition factors. Studies by Knetsch and Davis (1966), and Whittington

(1993). In particular they single out such factors as the cost of obtaining the environmental good or service, education level, age family size religion etc explain the variations in respondent's WTP for environmental goods.

$WTP=f(Y, C, Fs, Ed, Age; V_i)$ ……3.2a

$\partial WTP/\partial Y>0$; $\partial WTP/\partial C_{f/s}<0$; $\partial WTP/\partial Fs><0$;

$\partial WTP/\partial Ed>0$ and $\partial WTP/\partial Age>0$ ……3.2b

3.2 Model Specification

From the theoretical exposition, we specified a general model that takes form:

$WTP_{f/s}=f(Inc., C_{f/s}, Fsiz, Ed, Age, V_i)$ ……3.3

Where V_i is a vector of social, demographic and environmental dummy variables.

Depending on the data collected, the specific model was specified as:

$$WTP_{f/s}=\alpha_0+\alpha_1 Inc.+\alpha_2 C_{f/s}+\alpha_3 Fsiz+\alpha_4 Ed+\alpha_5 Age$$
$$+\beta_1 gen+\beta_2 hbl+\beta_3 Eva+\beta_4 ms+\beta_5 Aumn+\varepsilon_i \quad \text{……3.4}$$

where

WTP_f=willingness to pay for faecal disposal improvement

WTP_s=willingness to pay for solid waste improvement

$Cost_f(C_f)$ = current monthly faecal disposal costs

$Cost_s(C_s)$ = current monthly solid waste disposal costs

Inc.=household monthly income

Fsiz.=Family size

Age=age of the respondent

Edu.=Education level of the respondent (Actual number of years in formal school)

Gn =gender of the respondent (1=male, 0= Female)

Hbl= (1=Household owning Bucket latrine, 0=Otherwise)

Eva= (1=individual aware of environmental problem, 0=Otherwise)

Ms= (1=married, 0=Otherwise)

Aumn= (0=No authority intervention; 1= If there is minimum authority intervention in service delivery; 2= maximum intervention-proxied by service received).

ε_i =is a random term with constant variance and zero mean.

α_0 =is the intercept and α_i and β_i are the respective coefficients

Based on the theoretical underpinnings and on the behavioural relationship hypothesized, we also estimated a Probit model of willingness-to-pay. In the Probit model, the probability of giving a positive WTP (Pi) is the dependent variable and thus, we predicted the likelihood of the WTP given a set of household characteristics or attributes. This was specified as in equation (6).

$$P_i=F\ (=\alpha_0+\beta_i V_i)\ +\varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.5$$

Where

P_i=is the probability of obtaining a positive WTP for both faecal and other solid wastes disposal improvements (1=Yes, 0=otherwise) given V_i

F= a cumulative probability distribution function assuming a normal distribution

α_0= The intercept term

β_i=Respective variable coefficients

Vi= a vector of socio-economic, demographic and environmental characteristics which on a *priori* ground is expected to have either positive or negative influence (or uncertain) on the probability of obtaining a positive WTP from a respondent.

ε_i =is a random term with normal distribution , $\varepsilon_i \sim N(0,1)$

3.3 Estimation Techniques

The study employed two econometric techniques namely Ordinary Least Squares (OLS) and Probit model methods. The OLS was used in the empirical analysis of the impact of socio-economic, demographic and environmental variables on individuals WTP bids whereas the Probit model was utilized for the discrete (binary 'Yes' or 'No') case with regard to an individual giving a positive WTP to establish the influence that different variables have on the probability of obtaining a positive WTP answer. In the Probit model maximum likelihood estimation (MLE) method was employed to estimate the conformable parameters α_0 and β_i. In both models Stata Version 6.0 was used for the estimation and analyses.

3.4 Data Type and Source

The study employed primary data, which was gathered by use of questionnaires from a sample of Wajir residents (196 households). A standard survey designed as a recording schedule was used to collect the said data. The survey consisted of both closed and open-ended questions, which were used to elicit relevant information. The questionnaire was in three parts - Section A, B and C. Section A, attempted to get information on sanitation and environmental issues in the study area. Section B presented the contingent market of the goods being valued in a more explicit way so as to elicit the WTP bids the respondents will place on environmental sanitation improvement (Sanitation is considered as environmental good). Finally, section C extracted information regarding socio-economic and demographic profiles of the respondents.

3.5 Sampling Procedure and Sampling Size

The study used stratified systematic random sampling. The residents of Wajir town (the study area) were grouped into eight strata according to residential estates (see table 3.1).

Table 3.1: Residential Estates of Wajir town.

Estates	Target Sub-sample	Actual Sub-sample
Medina	25	25
Wagberi	25	24
Hodan	25	25
Power	25	25
South C	25	25
Township	25	25
Jogoo	25	24
Barwako	25	23
Total	200	196

Source: Field data

With regard to the sample size, the contingent valuation study *per se* does not stipulate *a priori* the appropriate sample. However, Long (1997) suggests that for across-section data and more so for survey, it is important to use a sample size equal to ten times the number of variables under investigation. On the basis this, the target of our sample size was not less than 180.

We targeted about 200 but due to constraints both in terms of time and money, we managed to cover about 200 households. However, due to problems in completing questions and non-return of some of the questionnaires administered, 196 complete questionnaires were considered for the final analysis. This is fairly large and representative of the population.

3.6 Question Pre-testing and Field Survey

A pre-test consisting of 50 personal interviews was conducted with the aid of three field assistants who were properly inducted. In this pre-test, additional information regarding the formulation of the question was sought from the would-be respondents. This was with the sole aim of simplifying the understanding of the survey. After the analyses of the pre-test, necessary modifications were made and incorporated in the final survey. It was the pre-testing that helped us in pointing out where necessary and supplementary questions were to be asked. In addition, average time a person will take to complete the questionnaire was also established. An average literate person took between 30-40 minutes complete the questionnaires. An average illiterate person for example, would take an average of an hour.

The final survey consisting of structured and open-ended questionnaires was administered between 7th June and 20th June 2002. With the aid of three field assistants, the questionnaires were used in personal visits to the respondents' homes/houses. From the pre-test visits, it was established that majority of the residents were illiterate. Literate persons were given questionnaires to fill. Semiliterate persons were only allowed to give oral answers. In both cases interviewers to ensure completeness of the questions guided the respondents. In the case where the respondents were completely illiterate, which was the case among the majority, one to one translations were done by the interviewers in the language respondents best understood. There were however, cases of semiliterate individuals who insisted on filling the questionnaires themselves to avoid intrusion of their privacy.

The interviewers visited households at a time convenient to find members of the households. Any randomly selected member was interviewed provided he or she was an adult and could give valid and complete information about the household characteristics. These were cut across household heads (both gender), spouses, brothers, sons, daughters and other relations. Implicit here were two strong assumptions. First, all household members have homogeneous preferences and that their responses regarding household characteristics is more or less the same. Second, persons under 18 of age are excluded from the survey because they cannot make valid decisions and information although their preferences could be the same as those of other members.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter reveals in detail the procedures followed in data presentation and analyses. It presents description of how data were transformed from the survey questionnaire and into study source variables as formulated in chapter three. This transformation yields the descriptive statistics as well as empirical results from which conclusions are drawn.

4.2 Nature of faecal and solid waste management in Wajir

Both faecal and solid waste disposal managements in Wajir town are done on both private and public bases. Most households, who do not pay service rents to Wajir County council (WCC) as a result of discontentment, engage private soil men to dispose faeces at night. However, such private arrangement has major limitation in that disposal is done on any available space in the residential areas. Other households who pay annual service charge regularly receive services from WCC. But because of poor remuneration for the soil men and inadequate equipment, disposals are not done as regularly as they are required. There are cases of households paying annual service charges yet they do not receive regular services and hence also engage private individuals to safeguard their interests.

The town has approximately 4000 households out of which 2500 have registered plots and bucket toilets. The rest either do not have bucket latrines or are not registered with WCC. In estates where WCC intervenes, disposal of bucket latrines are done twice a week. This does not take into account the rate at which a household can fill a bucket

(whose volume is approximately $20m^3$), which again depends on the size of the family. Buckets are emptied into trucks mounted with tanks. Surprisingly, only one truck was serving the entire town at the time of the survey. The trucks dump faeces in a designated site, which is approximately 6km away from the central part of the town. But due to encroachment of unplanned settlements, the site is being fast engulfed. Other interventions are seldom but an NGO (Medical emergency relief) is now on the ground in partnership with WCC to manage faecal disposal.

With regards to solid waste, Wajir town generates more solid waste than it can collect or dispose. Most households dispose the waste they generate on their own. They dig pits where they burn rubbish or dump indiscriminately in the open on any available space and remain uncollected. Some of the solid wastes are hazardous in content including broken bottles, clinic or hospital wastes, thorns etc. Other solid wastes are mainly plastic and vegetable matter with very limited recycling and composting waste. There are public arrangements however. More particularly, around the central part of the town, WCC whose job it is to dispose and manage wastes intervenes. This intervention is not only irregular but also minimal owing to inadequate manpower, funds and equipment. Other interventions from Public Health department or from nongovernmental organisations notably Oxfam GB do exist.

Two-thirds of the households in Wajir town receive minimal or no intervention from governmental or nongovernmental authorities. The rest receive interventions from authorities either governmental or nongovernmental. However, these interventions were

very minimal and often irregular. Intervention was particularly noted among the households living in the central part of the town. It was therefore observed that the further away a plot is from the central part, the less services in terms of solid waste disposal the household receives. To put differently, the authorities' minimal efforts in solid waste collection and disposal is concentrated in and around the central part. Ironically, the township appears to be less clean. Most households generate significant volumes of wastes but typically receive very minimal services probably because of two reasons. First, plots are without plans and congested such that collection is not only difficult but also impossible. Even where the WCC want to do some cleaning often remains a problem. Second, households do not place waste in a designated for collection.

Generally, there was high level of awareness among the interviewed households with regards to environmental sanitation problems (including faecal and solid waste disposals) in the town. Nearly all of the interviewed households (95.5 percent) were fully aware of the disposal problems with regard to faecal and solid waste. The rest could not tell or comprehend the risks and/or hazards posed by such disposal problems. This shows that there is some lapse in bridging this gap on the part of the concerned authorities namely WCC and public health departments.

Table 4.1: Ranking of faecal disposal problem

Rank of faecal disposal problem	Frequency	Percent	Cumulative (%).
0(otherwise)	11	5.61	11(5.61)
1(problem is severest)	185	94.39	196(100.00)

Source: Field data

Table 4.2: Ranking of other solid waste disposal

Rank of solid waste disposal problem	Frequency	Percent	Cumulative (%)
0(i.e. Otherwise)	49	25.00	49(25.00)
1(i.e. problem is severest)	147	75.00	196(100.00)

Source: Field data

The level of environmental problems awareness among the residents of Wajir is consistent with the manner in which households ranked both faecal and solid waste disposal problems in the town. About 94.39 percent (185 persons) ranked faecal disposal and management as the most severe problem that required urgent redress see Table 4.1). This problem has come well above problems such as solid waste, water supply and insecurity among others. In addition, 75 percent of the covered individuals ranked solid waste as either the first or second-most severe problem in Wajir town (Table 4.2). This problem, according to them required an urgent redress as well. Though most households considered solid waste as a problem of concern, they nevertheless dispose the wastes they generate in the open. The rest either burn rubbish in dustbins, drums or burn in the open.

The high ranking and awareness of the environmental sanitation problems among the interviewed can also be attributed to the risks and hazard residents suffer. More than half (55 percent) of the households interviewed indicated that at one point or another, members of the households have suffered from environmental sanitation-related diseases. Chief among these diseases were malaria, typhoid, dysentery and cholera.

As a result of the hazards posed by environmental sanitation problems directly or indirectly, there was an overwhelming interest in the improvement and proper management of both faecal and solid waste disposals in the town and it environs.

4.3. Costs of faecal and solid wastes management

The disposal and management of both faecal and solid waste whether done on private or public basis was not without economic costs both direct and indirect. While the direct costs can easily be captured, it is often difficult to make a cost analysis for indirect costs, which include cost of diseases among others. From table 4.5 the highest monthly cost a household incurs in return for disposal services was reported to be Kshs 1500.00 whereas the minimum cost reported among the interviewed households was zero. The latter group i.e. those who do not incur direct costs are the households who do not own bucket latrines or other forms of toilets. They either share with neighbours, relatives or even go to the open for calls of nature. Open spaces was however possible for households living on the periphery of the town. The average monthly faecal disposal direct cost for the households interviewed was Kshs 222.50.

With regard to solid waste which according to this study is any rubbish outside faeces including papers, plastics, paper-bags, broken bottles, bones animal dung, sticks, banana leaves and wraps, rugs etc, the minimum household monthly costs for solid waste disposal is zero while maximum amount is Kshs 1500.00. The average monthly cost for solid waste disposal is Kshs 69.30. In both cases (i.e. faecal and solid waste disposal), the average monthly costs were well below what households are willing to pay for the improvement of environmental sanitation.

4.4 Profiles of Surveyed Households

4.4.1 Socio-Economic profiles

Income is considered as one of the main determinants of households' willingness to pay for improved environmental sanitation. Income as a variable was captured in section C via question 21(C) of the questionnaire. The household income was disaggregated into wage employment and non-wage employment. The final household incomes were arrived at by aggregating wage and non-wage employment incomes. Implicit in this, was the assumption that individuals being interviewed have the same preferences with other household members in addition to having full knowledge of the households' incomes.

As it is in some instances, individuals tend to conceal their actual monthly incomes. To avoid biasedness in revealing true incomes, income brackets were suggested where a particular individual or household would fall.

From the statistical summary of Table 4.3 the minimum household income reported was Kshs 1,000.00 while the maximum amount reported was Kshs 30,000. The mean households income is Kshs 8137.75. Given that the income captured was that of the household, it therefore means that the average household income Kshs 8137.75) is low. Considering the average family size of 9 persons in the town, it translates into approximately Kshs 900.00 per individual per month. This is slightly below the reported North Eastern Province monthly poverty line that stands at Kshs 1100.00 (Mwabu et al, 2000). This again translates into Kshs 30.00 per day for an individual, which is far below the national poverty line.

Table 4.3 . Socioeconomic summary

	Mean	Median	Mode	Min.	Max.	Skewness	Kurtosis	Range
Income	8137.75	8000	6000	1000	30000	1.06	1.1	29000
$Cost_f$	222.50	150	0	0	1500	1.8	4.3	1500
$Cost_s$	69.30	0	0	0	1500	5.2	36	1500
Education	5	0	0	0	17	0.4	-1.6	17

Source: Field data

In Table 4.3, it is evident that income is positively skewed (mean>mode), which implies that some households have incomes much higher than the majority of other households.

Education is an important social indicator of development. In this study it was included as a variable affecting household WTP for improved environmental sanitation. Table 4.4 shows the summary of the levels and frequency among the interviewed persons.

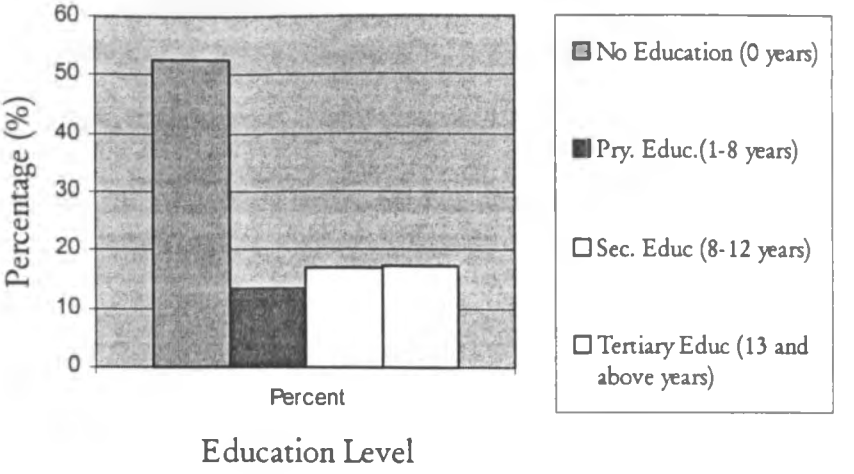
Table 4.4: Education level of the respondents

Education Level (In years)	Frequency	Percent	Cumulative (%)
No formal Education (0 years)	103	52.55	103 (52.55)
Primary Education (1-8 years)	26	13.27	129 (65.82)
Secondary Education (8-12 years)	33	16.83	162 (82.65)
Tertiary (College/University (13 and above years)	34	17.35	196 (100.00)
Total	196	100.00	

Source: Field survey.

Fig.1

Percent of Level of Education among the Interviewed inWajir Town.



Education Level

The graph shows that 52.55 percent, 13.27 percent, 16.83 percent and 17.35 percent of the interviewed individuals had no formal education, primary education, secondary education and tertiary education respectively. Although the survey was limited to the residents of Wajir town (central division), nonetheless the result shows that majority of the interviewed individuals had no formal education (52.55 percent). From the survey, the highest educated person interviewed had University education of 17 years. The least educated person had no formal education and this is the level where the majority fell (52.55 percent). The mean education level (in years) among the interviewed individuals was 5 years. This again shows that the residents of Wajir are lowly educated. Ironically, the central division that was expected to have relatively highly educated population turned out to be having lowly educated households. The other parts of the district are believed to be having higher proportion of non-educated residents.

4.4.2: Demographic Profiles

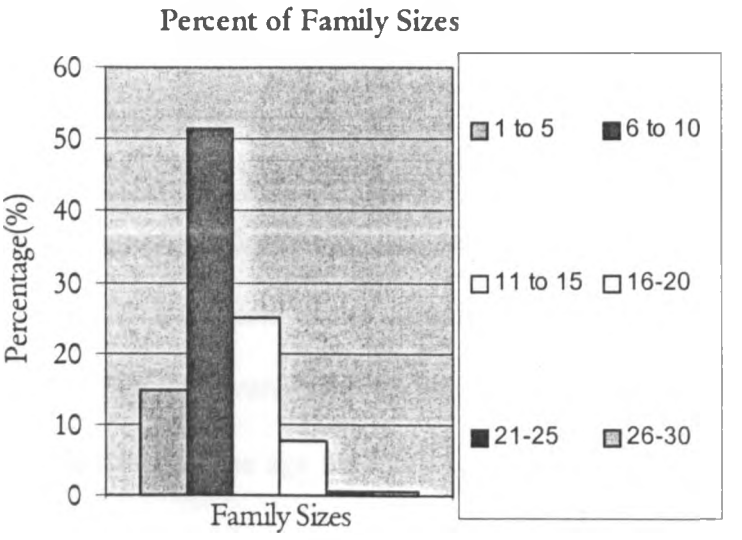
Most of the interviewed households had family size of between 6-10 persons (51.53 percent). Among the interviewed households, the maximum family size reported was 30 while the least was 1 person. The average family size was 9 persons. By any standards, the average family size is large confirming the extended family social set-ups among the residents of Wajir town. The data on family size is summarized in the Table 4.5.and figure 2.

Table 4.5: Family sizes of the respondents' households

Family size	Frequency	Percent	Cumulative (percent).
1 – 5	29	14.80	29 (14.80)
6 – 10	101	51.53	130 (66.33)
11 – 15	49	25.00	179 (91.33)
16 – 20	15	7.65	194 (98.98)
21 – 25	1	0.51	195 (99.49)
26 – 30	1	0.51	196 (100.00)
Total	196	100.00	

Source: Field data

Fig.2



The descriptive statistics of age as a variable is summarized in Table 4.6

Table 4.6: Age brackets of the respondents

Age of respondents	Frequency Distribution	Percent (%)	Cumulative (%)
21 – 30	65	33.16	65 (33.16)
31 – 40	61	31.13	126 (64.29)
41 – 50	46	23.47	172 (87.76)
51 – 60	24	12.24	196 (100.00)

Source: Field data

Age was included because it is an important variable in determining an individual's decision-making and hence households' willingness to pay towards improved environmental sanitation. For this reason, individuals under 18 years of age were excluded from the sampling frame for the same reason that they might not make valid, coherent and complete decisions about a household. The eldest reported person among the interviewed individuals was 60 years of age whereas the youngest was aged 21 (see Table 4.7). The average mean age was 36 years, which was quite important age to make valid decisions.

From Table 4.6, the highest frequency (65 persons) was reported among the age bracket 21-30 years of age representing 33.16 percent of the interviewed individuals. Majority of the interviewed individuals (61 persons) were between the ages 31-40 representing 31.13 percent of the interviewed individuals. The age brackets 41-50 and 51-60 had 46 and 24

persons representing 23.47 percent and 12.24 percent of the interviewed individuals respectively.

Of the 196 interviewed persons 102 were male representing 52.04 percent while 94 were female representing 47.96 percent. Being household head was also considered important in decision-making. Both genders featured as household heads. However, in a patriarchal society like the residents of Wajir town, males are in most cases the household heads. Among the interviewed individuals 52.55 percent were household heads comprising both males and females. The other 47.45 percent were related to the household heads as spouses, brothers, sons, daughters and other relations. Most of the interviewed individuals were married (76.02 percent) while the rest 23.98 percent were not married.

4.5: Willingness to pay and Willingness to accept compensation

4.5.1 Faecal disposal management

Willingness to pay (WTP) faecal management was one of the main variables under investigation. WTP was considered as a price, which was a function of improved environmental sanitation conditions and service levels to be enjoyed by the residents. The environmental sanitation conditions and service levels were considered as proxies for the quantities of the goods and/or amenities to be consumed or enjoyed. WTP for faecal management improvements was captured using direct elicitation of *Yes-or-No* and direct bidding method. WTP was captured in section B of the questionnaire. The section also captured the willingness to accept compensation (WTAC) of respondents for the hazards and/or risks posed by the poor environmental sanitation.

To elicit residents' WTP and WTAC, detailed introduction and information about the goods/services to be marketed namely faecal disposal and management was given. The current conditions of the said service, the possible hazards and/or risks posed by them and the envisaged nature of improvement was also brought to the fore in a hypothetical contingent market in order to elicit residents WTP and WTAC. This was fundamentally important because asking people about their WTP when they (residents) are not aware of the good/service being valued would make no sense in the CVM framework.

After the contingent market was made explicit, households were asked the maximum amount of money they would be willing to pay for an improvement in environmental sanitation management. The results of the descriptive statistics of the WTP and accept compensation for faecal disposal are summarized in Tables 4.7, 4.8 and 4.9.

Table 4.7: WTP bids for faecal disposal improvements

WTP_f bids (Kshs)	Frequency.	Percent	Cumulative (percent).
0	9	4.59	9 (4.59)
20	2	1.02	11 (5.61)
50	7	3.57	18 (9.18)
100	38	19.39	56(28.57)
120	2	1.02	58(29.59)
140	1	0.51	59(30.10)
150	19	9.69	78(39.80)
180	1	0.51	79(40.31)
200	49	25.00	128(65.31)
250	8	4.08	136(69.39)
300	20	10.20	156(79.59)
400	6	3.06	162(82.65)
420	1	0.51	163(83.16)
450	2	1.02	165(84.18)
500	16	8.16	181(92.35)
600	4	2.04	185(94.39)
800	3	1.53	188(95.92)
1000	5	2.55	193(98.47)
1200	2	1.02	195(99.49)
1500	1	0.51	196(100.00)
Total	196	100.00	

Source: Field data

Table 4.8: Yes-or-No WTP bids for faecal disposal improvement

Dichotomous WTP_f Bids (Yes or No)	Frequency.	Percent	Cumulative (%)
No (0)	8	4.08	8(4.08)
Yes (1)	188	95.92	196(100.00)
Total	196	100.00	

Source: Field data

Table 4.9: WTAC bids for faecal disposal condition

$WTAC_f$ bids (Kshs)	Frequency	Percent	Cumulative (percent).
0	8	4.08	8(4.08)
100	1	0.51	9(4.59)
200	1	0.51	10(5.10)
300	1	0.51	11(5.61)
400	1	0.51	12(6.12)
500	12	6.12	24(12.24)
600	2	1.02	26(13.27)
1000	28	14.29	54(27.55)
1200	1	0.51	55(28.06)
1300	1	0.51	56(28.57)
1500	8	4.08	64(32.65)
2000	29	14.80	93(47.45)
2500	2	1.02	95(48.47)
3000	23	11.73	118(60.20)
3500	2	1.02	120(61.22)
4000	8	4.08	128(65.31)
5000	24	12.24	152(77.55)
6000	8	4.08	160(81.63)
7000	3	1.53	163(83.16)
8000	1	0.51	164(83.67)
9000	1	0.51	165(84.18)
10000	23	11.73	188(95.92)
15000	1	0.51	189(96.43)
20000	7	3.57	196(100.00)
Total	196	100.00	

Source: Field data

Willingness to accept compensation (WTAC) bids for faecal disposal ranged from zero to Ksh 20,000 (see Table 4.9 and 4.10). The average monthly WTAC bid was Ksh 4146.40 and mode was Ksh 2,000 (see Table 4.10)

In the *Yes-or-No* direct elicitation method where individuals were asked whether they would be willing to pay for the enhancement of the sanitary conditions from the bucket

system to septic tank systems, 188 persons representing 95.92 percent responded "YES" while 8 persons representing 4.08 percent responded "NO". In the direct method, majority of the respondents (25%) were willing to pay Kshs 200 a month for change of bucket system to more modern septic tanks. The highest monthly WTP bid is Ksh 1500 whereas the minimum bid is zero (Table 4.10). The average monthly WTP is Ksh 259.30, which is fairly above the average current monthly costs (Ksh 222.50) households incur in the disposal and management of the bucket system.

Table 4.10:Statistical summary for Willingness to pay (WTP) and accept compensation (WTAC)

	Mean	Median	Mode	Min.	Max.	Skewness	Kurtosis	Range
WTP_f	259.30	200	200	1500	0	2.3	6.7	1500
$WTAC_f$	4146.40	3000	2000	0	20000	2	4.3	20000
WTP_s	129.60	70.00	50	0	1500	4.2	26.7	1500
$WTAC_s$	2650.50	1500	1000	0	40000	5.18	38.7	40000

Source:Field data

4.5.2 Solid waste management

Using the *Yes-or-No* direct elicitation method, 186 persons responded, "YES" (i.e. were willingness to pay) for improved solid waste management, representing 94.9 percent (Table 4.12). In the direct bid method majority (51 persons) of the respondents were willing to pay Ksh 50.00 representing 26.02 percent (table 4.11). The highest monthly WTP_s bid was Ksh 1500.00 whereas the minimum bid was zero. The average monthly WTP was Kshs 129.60, which is almost twice as much as the average current monthly

costs (Ksh 69.30) households incur in the disposal and management of solid waste (Table 4.10).

Table 4.11: WTP bids for solid waste improvement

WTP_s bids (kshs)	Frequency	Percent	Cumulative (percent)
0	17	8.67	17 (8.67)
10	2	1.02	19 (9.69)
20	4	2.04	23 (11.73)
30	7	3.57	30 (15.31)
40	11	5.61	41 (20.92)
50	51	26.02	92 (46.94)
60	5	2.55	97 (49.49)
70	2	1.02	99 (50.51)
100	36	18.37	135 (68.88)
150	9	4.59	144 (73.47)
200	26	13.27	170 (86.73)
240	1	0.51	171 (87.24)
250	4	2.04	175 (89.29)
300	4	2.04	179 (91.33)
320	1	0.51	180 (91.84)
350	2	1.02	182 (92.86)
400	7	3.57	189 (96.43)
500	4	2.04	193 (98.47)
750	1	0.51	194 (98.98)
1000	1	0.51	195 (99.49)
1500	1	0.51	196 (100.00)
Total	196	100.00	

Source: Field data

Table 4.12: Yes or No WTP bids for solid waste disposal improvement

Dichotomous WTP_s bid (Yes or No)	Frequency.	Percent	Cumulative (percent)
No (0)	10	5.10	10(5.10)
Yes(1)	186	94.90	196(100.00)
Total	196	100.00	

Source: Field survey

Like WTP_f, WTP_S bids, individuals who had zero or very low bids were either from households whose monthly income against their family size were very low relative to regional (North-Eastern Province) and national poverty line or believed that the authorities should solve the in question.

Table 4.13: WTAC bids for solid waste disposal condition

$WTAC_s$ bids (Kshs)	Frequency	Percent	Cumulative (percent).
0	15	7.65	15(7.65)
100	3	1.53	18(9.18)
150	2	1.02	20(10.20)
200	4	2.04	24(12.24)
250	3	1.53	27(13.78)
300	5	2.55	32(16.33)
400	1	0.51	33(16.840
500	22	11.22	55(28.06)
600	3	1.53	58(29.59)
700	1	0.51	59(30.10)
750	1	0.51	60(30.61)
800	3	1.53	63(32.14)
1000	30	15.31	93(47.45)
1300	1	0.51	94(47.96)
1500	5	2.55	99(50.51)
2000	27	13.78	126(64.29)
2500	6	3.06	132(67.35)
3000	21	10.71	153(78.06)
4000	9	4.59	162(82.65)
5000	17	8.67	179(91.33)
6000	4	2.04	183(93.37)
7000	1	0.51	184(93.88)
8000	2	1.02	186(94.90)
10000	5	2.55	191(97.45)
15000	2	1.02	193(98.47)
20000	2	1.02	195(99.49)
40000	1	0.51	196(100.00)
Total	196	100.00	

Source: Field data.

In the case of solid waste the Willingness to accept compensation ($WTAC_s$) bid for management ranged from zero and Ksh 40,000 (Table 4.13). The average monthly WTAC bid is Ksh 2650.50 and the mode is Ksh 1,000. This is far much lower than faecal management.

Overall, therefore, individuals WTP towards enhancement of environmental sanitation out of the household budget is very minimal. From the theoretical framework, it was argued that the rational household would obtain a level of utility U*, with an optimal level of consumption of private goods X*, and an optimal level of sanitation quality S*. The environmentally conscious household is therefore confronted with a trade-off between private goods consumption and sanitation quality. From the results of the statistics above, it appears that households in Wajir town have undesirable environmental consciousness in the sense that their low WTP bids for both faecal and other solid waste disposal enhancements reveals trading consumption goods for an improvement in environmental sanitation. The comparison of the two methods (direct and dichotomous choice) are summarised in Table 4.14.

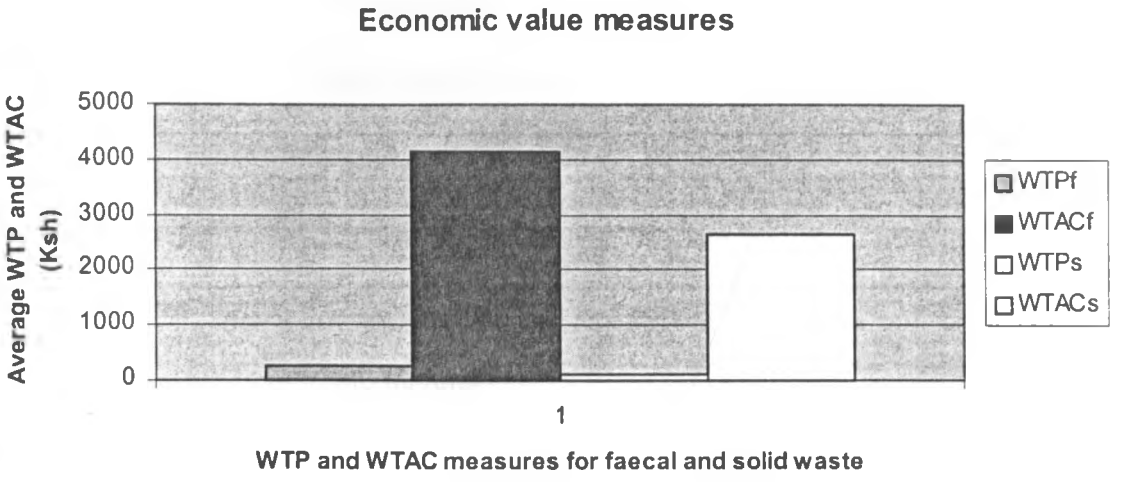
Table 4.14: Comparison of direct bid elicitation method and Yes-or-No direct bids

	Direct WTP bid			Yes-or-No bids		
	0 bids	Positive (>0) bids	Total	No (0)	Yes (1)	Total
Respondents	9	187	196	8	188	196
Percent	4.59	95.41	100.00	4.08	95.92	100.00

Source: Field data

For comparison purpose the average monthly individual's economic values of the two goods are show in figure 3.

Fig. 3



4.6: Variables, Descriptive Statistics and Correlation Analysis

Tables 4.15 and 4.16 depict the definition of variables and descriptive statistics for key variables in the study. The independent variables to be used for the empirical analyses for both goods namely faecal disposal and solid waste management, are subjected to correlation analysis shown in table 4.17

Table 4.15: Definition of Variables

Variables	Meaning of Variable
WTP_f	Willingness to pay for faecal disposal improvement
WTP_s	Willingness to pay for solid waste improvement
$DWTP_f$	Yes-or-No direct willingness to pay bids for improved faecal disposal
$DWTP_s$	Yes-or-No direct willingness to pay bids for improved solid waste disposal
$WTAC_f$	Willingness to accept compensation for faecal disposal hazards/risks
$WTAC_s$	Willingness to accept compensation for solid waste disposal hazards/risks
$Cost_f (C_f)$	Current monthly faecal disposal costs
$Cost_s (C_s)$	Current monthly other solid waste disposal costs
Inc.	Household monthly income
Fsiz.	Family size
Age	Age of the respondent
Edu.	Education level of the respondent (Actual number of years in formal school)
Dummy Variables	
Gn	Gender of the respondent (1=male, 0= Female)
Hbl	(1=Household owning Bucket latrine, 0=Otherwise)
Eva	(1=individual aware of environmental problem, 0=Otherwise)
Ms	(1=married, 0=Otherwise)
Au	(0=If there is no authority intervention in faecal and solid waste disposal – proxied by service received, 1=minimum and 2=maximum)

Source:Field data

Table 4.16 Statistical Summary of the Variables

Variable	Mean	Median	Mode	Min	Max	Skewness	Kurt.	Range
WTP_f(Ksh)	259.30	200	200	0	1500	2.3	6.7	1500
Inc.(ksh)	8137.75	8000	6000	1000	30000	1.06	1.1	29000
Age	37	38	38	21	60	0.4	-0.7	39
Fsiz.	9	8	6	1	30	1.2	2.3	29
Edu.	5	0	0	0	17	0.46	-1.56	17
Male	0.5	1	1	0	1	-0.1	-2.0	1
Hbl	0.69	1	1	0	1	-0.85	-1.3	1
Eva	0.99	1	1	0	1	-14	196	1
Ms	0.76	1	1	0	1	-1.2	-0.5	1
WTP_s(Ksh)	129.60	70	50	0	1500	4.2	26.7	1500
$WTAC_f$(Ksh)	4146.40	3000	2000	0	20000	1.98	4.3	20000
$WTAC_s$(Ksh)	2650.50	1500	1000	0	40000	5.2	38.7	40000
$Cost_f$(Ksh)	222.50	150	0	0	1500	1.8	4.3	1500
$Cost_{sf}$(Ksh)	69.30	0	0	0	1500	5.2	36.5	1500

N=196
Source: Field data

Table 4.17: Correlation coefficient matrix for variables affecting WTP

	$Cost_f(C_f)$	$Cost_s(C_s)$	Inc.	Age	Fsiz.	Edu
$Cost_f(C_f)$	1.0000					
$Cost_s(C_s)$	0.4908	1.0000				
Inc.	0.2898	0.1574	1.0000			
Age	-0.0910	-0.0649	-0.1402	1.0000		
Fsiz.	0.1431	0.1275	0.2424	0.0782	1.0000	
Edu.	0.2955	0.1773	0.4522	-0.3782	0.0551	1.0000

Source: Field data

To signal against spurious regression results, it is important that the data is subjected to some diagnostic statistical tests such as correlation analysis, between and among explanatory variables, heteroscedasticity among others. For this reason, the key independent variables used for the regression were subjected to correlation test to find out

whether they were inter-correlated. From the results there were no variables, which were seriously correlated in either direction, i.e. positively or negatively.

The highest positively correlated variables were current monthly cost for faecal disposal and current monthly cost for other solid disposal (0.4908); other positively correlated variables included education level and household income (0.4522). The highest negative correlated variables were education level and age (-0.3782). Using the rule of the thumb, we conclude that there is no significant correlation between the explanatory variables as their correlation coefficients are less than the cut-off mark of ±0.5 and hence correlation was not a major problem and is therefore envisaged not to affect the results. In addition to correlation analysis, we tested for heteroscedasticity using Cook-Welsberg test in order to obtain unbiased, consistent and efficient parameter estimates. The χ^2 Values were 90.94 and 125.24 all at (prob>χ^2) for faecal and solid waste models respectively. This implies that in the both the OLS models for faecal and solid waste improvements, the error terms were not having constant variances. To eliminate heteroscedasticity, the robust form of the OLS estimations are summarised in Table 4.18 and Table 4.19.

4.7: Modelling WTP for Improved Environmental Sanitation

4.7.1: OLS Estimates For WTP Model For Improved Faecal Disposal

In this study we fitted a multiple linear regression model where we regressed WTP bids for both faecal disposal and solid waste disposal improvements on individual's socio-economic, demographic and environmental attributes. The results are presented in the Table 4.18.

Table 4.18: OLS results for WTP Model for faecal management

WTP_f	Coefficient.	Robust Std. Err.	t	P>|t|
Intercept	-163.80	68.47957	-2.392**	0.018
$Cost_f$	0.25	0.0859192	3.079*	0.002
Inc.	0.01	0.0048511	2.914*	0.004
Age	-2.10	1.622279	-1.818***	0.065
Fsiz.	0.30	3.95527	0.085	0.933
Edu.	-2.35	4.910184	-0.479	0.633
Gender.	-26.45	41.57112	1.836***	0.061
hbl	28.20	30.65368	0.920	0.359
Eva	300.70	45.21272	6.651*	0.000
Ms	7.70	38.27891	0.202	0.840
Aumn	-2.50	33.84902	-0.075	0.940
n = 196				
F(9, 185) = 59.54				
Prob > F = 0.0000				
Adjusted R^2 = 0.2937				
Root MSE = 205.13				

Source: Field survey

Note: *The coefficient is significant at 1% level
**The coefficient is significant at 5% level
***The coefficient is significant at 10% level

Most of the regressors have expected signs save for age and education level. From the result it can be seen that a unit /shilling increase in the household's income (Y) and current monthly faecal disposal cost ($Cost_f$), while holding other variables constant, will increase the willingness to pay for faecal disposal improvement (WTP_f) by a cent and 25 cents respectively. The coefficients are positive and highly significant at 1% level, implying that household income and current monthly disposal costs are important determinants of expected WTP_f.

The coefficients of education level and age of individuals are not only having the wrong theoretical and expected signs but also insignificant at 5% level. Increasing the education level and the age of an individual by one year each is expected to reduce the willingness to pay value for the enhancement of faecal disposal (WTP_f) by Ksh 2.35 and Ksh 2.10 respectively, *ceteris paribus*. However, age is significant at 10% level. According to this model, education is not important determinant of WTP_f. This can be attributed to the fact that educated individuals are less willing to pay for improved faecal disposal management because they understand fully that the government via the local government is supposed to manage the sanitary system in the town. For age, the wrong sign can be attributed to the fact that older individuals are less conscious of their environment and hence are willing to pay less towards an improved system. This is relatively significant at 10% level.

Family size (Fsiz) as a variable has expected sign i.e. positive implying that increasing family size by one individual is expected to hike WTP_f by 30 cents a month. Males are expected to pay, on average, Ksh 26.45 a month less than females while married individuals on average are expected to pay Ksh 7.70 a month more than non-married. Whereas the coefficient of gender is significant at 10% level, that of marital status is insignificant.

Individuals owning bucket latrines and those who are environmentally aware of the problem being investigated, are on average expected to pay Ksh 28.20 and Ksh 300.70 a month respectively more than those without bucket latrines and those without

environmental awareness, *ceteris paribus*. The coefficient for environmental awareness (Eva) is highly significant at 1% level indicating that this variable is an important determinant of individuals' WTP_f.

Finally, individuals/households who receive minimum services with regards to faecal disposal and management from the authorities notably WCC and NGOs are on average, expected to pay Ksh 2.50 a month less than those who do not receive minimal or no services at all. This can be attributed to the fact that those households who are relatively enjoying some level of services are sceptical of the envisaged improved systems and hence are less willing to pay.

Overall, the existence of the correct signs for most explanatory variables is consistent with economic theory specified a *priori* and the empirical studies (Belhaj 1996, Deffar 1997) reviewed in chapter two. According to the model 30% of the variations in WTP for faecal disposal improvement are explained by the independent variables included in the model. According to this linear multiple regression model, the coefficients of most variables save for household income (Inc.), current monthly disposal cost ($Cost_f$) and environmental awareness (Eva), age and gender are insignificant. This implies that except household income, cost of disposal and level of environmental awareness, other factors are not important determinants of WTP_f. Nevertheless, the other variables have expected signs save for education, age and gender . The overall significance of the model is highly significant as shown by the F-statistics. Since the computed F-value is greater than the

critical value (adjusted for degrees of freedom), then we conclude that the model has overall significance.

4.7.2 OLS Estimates For WTP Model for Improved Solid Waste Disposal

Most of the variables in the WTP model for improved solid waste disposal (WTP_s) have the expected theoretical signs except age. The direction of influence on the WTP is however varied. From the model (see table 4.19), it implies that increasing the average monthly solid waste disposal cost ($Cost_s$) by a unit (i.e. a shilling) increases the expected willingness to pay for improved solid waste management (WTP_s) by 20 cents. The increase of household income by a unit increases the WTP_s marginally by a cent. The coefficients of income and $cost_s$ are significant at 5% level indicating that the two variables are important determinants of WTP_s just like they are in the WTP_f for faecal improvement.

Table 4.19: OLS with results for WTP Model for solid wastes management

WTP_s	Coefficient.	Robust Std. Err.	t	P>|t|
Constant	42.35	51.01537	0.830	0.408
$Cost_s$	0.20	0.0861881	2.142**	0.033
Inc.	0.01	0.0029912	2.848*	0.005
Age	-2.10	1.175568	-1.822***	0.070
Fsiz.	2.80	2.109675	1.325	0.187
Ed	1.50	3.802742	0.401	0.689
Gender	-45.10	33.49919	-1.846***	0.078
Eva	61.85	23.79419	2.600**	0.010
Ms	21.35	32.44669	0.658	0.511
Aumn	-60.46	24.83894	-2.434**	0.016
n = 196 F(8, 186) = 24.39 Prob > F = 0.0000 Adjusted R-squared = 0.2185 Root MSE = 151.1				

Source: Field survey

Note: * The variable is significant at 1% level.
** The variable is significant at 5% level.
*** The variable is significant at 10% level.

The education level and family size coefficients are having the expected theoretical signs. Both have positive influence on the WTP_s. This implies that an increase in the education level of an individual by one year is expected to increase the WTP_s by Ksh 1.50 a month, *ceteris paribus* while increasing family size by one individual is expected to hike WTP_s by Ksh 2.80 a month, all else being equal.

The coefficient of age is having the wrong sign contrary to theoretical expectation but is not significant at 5% level. Age appears to have a negative impact on the WTP_s for solid waste improvement, as was the case in WTP_f for faecal disposal management. Increasing the age of an individual by one year reduces the WTP_s for the improvement of solid waste disposal by Ksh 2.10. The wrong sign can be attributed to the fact that older individuals are less conscious of their environment and hence are willing to pay less towards an improved system.

Males are expected to pay, on average, Ksh 45.10 a month less than females for the improvement of solid waste in Wajir town and this is significant at 10% level. This can be explained by the fact that women bear the brunt of problems of the hazards/risks posed by solid waste as they are often confined to homes. Their economic abilities notwithstanding, women are more conscious of the problems of solid waste conditions than men and hence are more willing to pay for a change. Women also ensure that solid wastes are disposed off while men are merely the breadwinners and often out of homes.

The coefficient of married individuals and individuals who are environmentally aware of problems are having the correct signs. From the results, married individuals are on average expected to pay Ksh 21.35 a month more than non-married although this is not significant. Individuals who are environmentally aware of the problem being investigated (solid waste disposal), are on average expected to pay Ksh 61.85 a month more than those without environmental awareness, *ceteris paribus*. The coefficient for environmental awareness (Eva) is highly significant at 1% level. This means that the level of environmental awareness with regard to the problem at hand, significantly influences the WTP_s of households towards an enhancement in the environment. Inline with theory, environmentally conscious households will have a trade-off between consumption goods and environmental quality. Given that households are willing to pay toward an improvement when they are more aware of the environment, then it means that households are conscious of the immediate environment and hence would like to have desirable environmental quality.

Finally, individuals /households who receive services with regards to solid waste disposal and management from the authorities notably WCC and Non-Governmental Organisations (NGOs) are on average, expected to pay Ksh 60.45 a month less than those who do not receive minimal or no services at all. This means that households that receive services are indifferent to further improvement of solid waste.

The intercept for the regression bears a positive but is not significantly different from zero at 5% level, showing that WTP_s without the fitted variables is positive. That is, if all the explanatory variables are set to zero, WTP_s is positive. According to the model 22% of the variations in WTP_s for solid disposal improvement are explained by the independent variables included in the model. Like in the faecal disposal model, household income, current monthly disposal costs and the level of environmental awareness exert significant influence on the WTP for solid waste improvement. Other variables are not important determinants of WTP according to this linear multiple regression model. Like the faecal disposal model, the overall significance of the solid waste model is highly significant as shown by the F-statistics. Since the computed F-value is greater than the critical value (adjusted for degrees of freedom), then we conclude that the model has overall significance.

4.7.3: Probit Model Results For Improved Faecal Disposal

The Probit model is used in this study to estimate the Yes-or-No WTP bids responses. After the contingent market was made explicit, the respondents were then asked to answer "YES" (WTP>0) or "NO"(WTP=0) to the "*take-it-or-leave-it*" offer the goods being valued. From the theoretical model, it was assumed that P=1 if the respondent has a positive WTP and P=0 otherwise. We also assumed that the probability of a positive WTP response would depend on a vector of independent variable V, representing respondents' socio-economic, demographic and environmental characteristics. The results are presented in Table 4.20.

Table 4.20: Probit Model results for Binary Yes-or-No WTP bids for faecal disposal

$DWTP_f$	Coefficient.	Robust Std. Err.	z	P>|z|
Intercept	1.93	0.5024577	3.840*	0.000
$Cost_f$	0.001	0.0009804	1.976**	0.032
Inc.	0.00005	0.0000384	-1.986**	0.031
Age	-0.0093	0.0173161	-1.838***	0.063
Fsiz.	0.051	0.0273105	1.868***	0.062
Ed	0.081	0.0399359	2.040**	0.041
Gender.	-0.84	0.4075064	-2.061**	0.039
Hbl	0.098	0.4719589	0.208	0.835
Ms	0.54	0.4365367	1.245	0.213
Aumn	-0.48	0.385196	-1.258	0.209

n = 195
Wald chi2(9) = 27.58
Prob > chi2 = 0.0011
Pseudo R2 = 0.1421
Log likelihood = -25.87716

Source:Field data

Note: * The coefficient is significant at 1% level
** The coefficient is significant at 5% level
***The coefficient is significant at 10% level

According to the model the coefficient of household income is positive consistent with theoretical and empirical expectation of most environmental studies which posit that the probability WTP for environmental goods and services is an increasing function of individuals or households income (see Jorgat Rogat, 1995; Deffar, 1997;Belhaj 1996;, Whittington 1992). This implies that an increase in income by Ksh 1000.00 is expected to increase the probability of WTP_f by 0.05. The coefficient is significant at 5% level. Current monthly costs (C_f) for faecal disposal affects the probability of WTP_f response positively as expected.. It therefore means that increasing the C_f by Ksh 100.00 is expected to increase the probability of WTP_f by 0.01. This coefficient is also significant at 5% level.

The variable family size (Fsiz) has positive sign though not significant at 5% level implying that an increase in the size of a household by one individual increases the probability of WTP_f by 0.051. This means that households with larger members have higher probability of WTP. As postulated, it therefore means that family size has significant positive influence on the probability of WTP_f at 10% level.

Education is having the correct theoretical expected sign. This implies that education level of an individual positively influences the probability of WTP. An increase in the education level of an individual by one year increases the probability of WTP_f for the enhancement of faecal disposal by 0.081. The variable is significant at 5% level implying that it is an important determinant of WTP_f.

Age variable is having the wrong theoretical expected sign but is insignificant at 5% level. The direction of influence on the probability of WTP for improved faecal management is negative implying that an increase of the age of an individual by one year increases the probability of WTP_f by 0.0093. This coefficient is however significant at 10% level.

According to the model, to be a male reduces the probability of a positive WTP_f by 0.84 compared to a woman. This is highly significant at 5% level. This implies that women are more important in determining the probability WTP_f. With regard to the residents of Wajir town, this can be explained by the fact that women bear the brunt of problems of

the hazards/risks of bucket latrines as they are often confined to homes. As a result, they are more than willing to pay for an improvement, their economic abilities notwithstanding. Women also ensure that bucket latrines are clean and disposed off while men are mainly the breadwinners and go out quite often.

The probability of WTP_f increases with household owning bucket latrines and with married individuals. Owning bucket latrines increases the probability of WTP_f by 0.098 whereas to be married increases the probability of WTP_f by 0.54. But the coefficients are insignificant at 5% level.

Finally, the probability of WTP for improved faecal management is reduced by 0.48 if households receive services from the authorities (WCC and NGOs) compared to those who do not receive services. The coefficient is however not significant. The negative influence is due to the fact that with the present technology (i.e. bucket latrines) those households who receive regular services from WCC and NGOs, are relatively contented and hence their WTP_f for an enhancement is lesser than those who do not receive regular services.

4.7.4: Probit Model Results For Solid Wastes

The Probit model for Yes-or-No direct WTP bids for better solid waste management evidently shows that the current monthly cost in the disposal of solid waste (C_s) and household income do not influence the probability of willingness to pay (WTP_s). Unlike in the faecal disposal management where current monthly disposal cost exerts positive influence on WTP, the current monthly for solid waste disposal influences WTP

negatively. For example, an increase in C_s by Ksh 100.00 a month reduces the probability WTP_s by 0.04. In the case of household income, it influences the probability of WTP for solid waste disposal much the same way as faecal disposal improvement. Increasing the income by Ksh 1000.00 a month, increases the probability of WTP_s by 0.01 (see Table 4.21). The coefficient is significant at 5% level.

Table 4.21: Probit Model results for Yes-or-No direct WTP bids for improved solid wastes.

WTP_s	Coefficient.	Robust Std. Errors.	z	P>|z|
Intercept	0.80	0.7352595	1.065	0.287
$Cost_s$	-0.0004	0.0006928	-0.556	0.578
Inc.	0.00001	0.00004	-1.966**	0.046
Age	0.013	0.0197771	1.941***	0.056
Fsiz.	0.06	0.0278915	2.165**	0.030
Ed	0.05	0.0292454	1.825***	0.068
Gender	-0.3	0.3241487	-1.848***	0.066
Ms	0.1	0.4121786	0.285	0.775
Aumx	-0.99	0.4564091	-2.177**	0.029
n = 195				
Wald chi2(8) = 17.65				
Prob > chi2 = 0.0240				
Pseudo R2 = 0.0778				
Log likelihood = -33.632438				

Source:Field data

Note: ** Coefficient is significant at 5% level
*** Coefficient is significant at 10% level

The differences in family sizes and the education level of the individual do have positive impact on the probability of WTP_s. The direction of influence on the probability notwithstanding, the significance of the variables are quite mixed. Whereas family size is significant at 5% level, education is significant at 10% level. This implies that family size and the education level of an individual are important determinants of WTP_s. The age of

an individual as in the other models has negative impact on the probability of WTP_s. This is relatively significant at 10% level.

According to the model, increasing the family size by one-person increases the probability of WTP_s by 0.06. This means that the larger the family size the higher the probability of WTP_s. The education level of an individual influences positively the probability of WTP for an improvement in solid waste disposal in Wajir town much the same way as WTP for improvement of faecal disposal. Increasing the education level of an individual by one year increases the probability of WTPs by 0.05, *ceteris paribus*. The age of an individual influences the probability of WTP for solid waste and faecal disposal much the same way. The impact is negative in all the models for both faecal and solid waste improvements. In the latter case (solid waste), increasing the age of an individual by one year reduces the probability of WTP_s by 0.013. This coefficient is however not significant at 10% level, implying that age is relatively important determinant of WTP_s in the area of study.

From the model, it is evident that to be a male impacts negatively on the probability of WTP_s. This means that the probability of WTP_s reduces with men than women. For example, to be a man reduces the probability of WTP_s by 0.3 and this coefficient is significant at 10% level. This can be attributed to the fact that women bear the brunt of the problem of solid wastes in and around homesteads as they mostly stay at homes. As a result, they are more than willing to pay for an improvement in solid waste than men. This is consistent with other studies, which posit that most rural communities in Kenya,

women and girls are the caretakers of homes (Ndiba, 1999). They are responsible for construction and maintenance of homes and by extension the latrines and solid waste cleanliness. He also maintains that sanitation problems affect men and women differently, but generally being worse for women. Problems of privacy during urination and defecation are particularly acute for women and adolescent girls. It is against such background that females are more willing towards sanitation enhancement.

To be married increases the probability of WTP_s by 0.1. This coefficient is not however significant. Married individuals are important decision makers in a family and their positive higher WTP_s can be attributed to the fact that they are more concerned with regard to the problem being investigated namely solid waste.

Finally, the probability WTP for improved solid waste is reduced by 0.99 if households receive solid waste disposal services from the authorities (WCC and NGOs) compared to those who do not receive services. The coefficient is highly significant at 5% level. This means that households who receive services have lesser WTP compared to those who do not receive services because they are relatively contented with the present service levels.

4.8 Hypotheses Testing

In chapter one, we made five hypotheses from the research problem based on existing theoretical and empirical literature.

The first hypothesis tested was whether there is significant difference between willing to pay for improved faecal management (WTPf) and willingness to pay for improved solid waste management (WTPs)

H_{01} : $WTP_f = WTP_s$ against alternative hypothesis H_{11} : $WTP_f \neq WTP_s$

Table 4.22 Mean Comparison for WTP_f Vs WTP_s and $WTAC_f$ Vs $WTAC_s$

Mean Differences								
	Mean	Std. Dev	Std. Error Mean	5% level of the difference		t	df	Sig. (2-tailed)
				Lower	Upper			
H_{01} :$WTP_f = WTP_s$	129.70	172.40	12.30	105.40	1543.00	10.5	195	.000
H_{02} $WTAC_f = WTAC_s$	1495.90	3734.40	266.70	969.85	2021.95	5.6	195	.000

Source: Field Survey

Table 4.22 presents the test for hypothesis one and two. It is evident that the null hypothesis (H_{01} : $WTP_f = WTP_s$)i.e. there is no significant difference between average WTP_f and WTP_s is rejected at 5% level using the paired t-test (see the t-statistics =10.5). we therefore do not reject the alternative hypothesis that there is in deed significant difference the economic values of the two goods. Given that the average WTP_f is much higher than the mean WTP_s, the residents value more the improvement of faecal management than solid waste management, *ceteris paribus*

Second hypothesis tested was whether there is no significant difference between the average willingness to accept for faecal disposal conditions ($WTAC_f$) and average willingness to accept for solid waste conditions ($WTAC_s$).

H_{02}: $WTAC_f = WTAC_s$ against alternative hypothesis H_{12}: $WTAC_f \neq WTAC_s$

Table 4.22 also shows that the null hypothesis (H_{02} :$WTAC_f = WTAC_s$) is rejected at 5% level and instead the alternative hypothesis (H_{12}: $WTAC_f \neq WTAC_s$) is accepted at the same level significance. This means that there is significance difference between the average $WTAC_f$ and average $WTAC_s$ with the former (average WTP_f) being higher implying that the residents would wish to be compensated much higher with regard to faecal disposal conditions.

The third hypothesis was that there is no significant difference between the average WTP and WTAC for both faecal and solid waste disposal improvements. This hypothesis was based on the theoretical works of Randall and Stoll, 1980 and Hanemann, 1991. From the field survey we subjected the statistical significance of this hypothesis to test. After the descriptive statistics we by way of comparing means, employed paired-sample T-test.

$H_{03\,(a)}$: $WTP_f = WTAC_f$ against alternative hypothesis $H_{13\,(a)}$: $WTP_f \neq WTAC_f$

$H_{03\,(b)}$: $WTP_s = WTAC_s$ against alternative hypothesis $H_{13\,(b)}$: $WTP_s \neq WTAC_s$

Where the variables are as defined above.

The results of the test are summarized in Table 4.23

Table 4.23: Mean Comparison Test for willingness to pay and accept compensation

Mean Differences								
	Mean	Std. Dev	Std. Error Mean	5% level of the difference		t	df	Sig. (2-tailed)
				Lower	Upper			
$H_{03\,(a)}$ $WTP_f = WTAC_f$	-3887.10	4324.20	308.90	-4496.30	3277.90	-12.6	195	0.000
$H_{03\,(b)}$ $WTP_s = WTAC_s$	-2520.90	4055.30	289.70	-3092.20	-1949.60	-8.7	195	0.000

Source: Field Survey

From the results in Table 4.23, the null hypotheses (H_{03a} and H_{03b}) i.e. there are no significant difference between average WTP_f and $WTAC_f$ (i.e. WTP_f=$WTAC_f$) and WTP_s and $WTAC_s$ (WTP_s=$WTAC_s$) are rejected at 5% level using paired two-tailed test. This implies that the hypotheses of equal means of WTP and WTAC in the case of the two goods are rejected. In other words, the alternative hypotheses, that is, there is significant difference between average WTP_f and $WTAC_f$ (average $WTP_f \neq WTAC_f$) and WTP_s and $WTAC_s$ (average $WTP_s \neq WTAC_s$) are accepted. This is consistent with earlier empirical works that employed interview procedures, which have produced some evidence of large disparities between WTP and WTAC measures (Cummings et al 1986, Fisher et al 1988). The result of this hypothesis is also consistent with Hanemann (1991) who while attempting to show how much WTP and WTAC can differ, found that the two can differ significantly provided the change in the environmental amenity has small or zero substitution effect. He showed that holding income effect constant, the smaller the substitution effect (i.e. the fewer substitutes available for the amenity/public good) the

greater the disparity between WTP and WTAC. This implies that if the amenity being valued has almost no substitutes (which is the case if it affects lives of people), there is no reason why WTP and WTAC cannot differ vastly and in the limit, WTP could equal the individual's entire income (which is finite) while WTAC could be infinitely large.

The fourth main hypothesis tested was that there is no significant difference between the average monthly cost in the disposal of both faeces and solid wastes and WTP for the improvement of both faecal and solid wastes.

$H_{04\,(a)}$: $Cost_f = WTP_f$ against alternative hypothesis $H_{14\,(a)}$: $Cost_f \neq WTP_f$

$H_{04\,(b)}$: $Cost_s = WTP_s$ against alternative hypothesis $H_{14\,(b)}$: $Cost_s \neq WTP_s$

Table 4.24: Mean Difference Test for Cost of disposal and WTP

Mean Differences								
	Mean	Std. Dev.	Std. Error Mean	5% level of the difference		t	df	Sig. (2-tailed)
				Lower	Upper			
$H_{02(a)}$ $Cost_f = WTP_f$	36.80	278.90	19.90	-2.50	76.10	1.8	195	0.066
$H_{02\,(b)}$ $C_s = WTP_s$	60.10	205.15	14.65	31.40	89.20	4.1	195	0.000

Source: Field data

From the results in Table 4.24, the null hypothesis for the case of faecal disposal is accepted at 5% level. That is, there is no significant difference between the average monthly costs in the disposal of faeces and the average monthly WTP in the enhancement of faecal disposal system. Given that the computed t-value equals 1.848 (0.066), it is however significant at 10% level. This shows that there is relative marginal preference for the WTP for the improvement of faecal disposal.

In the case of disposal of solid wastes however, the null hypothesis is rejected at 5% level. In other words, the hypothesis that there is no significant difference between the average monthly costs in the disposal of solid wastes and average expected monthly WTP for solid wastes improvement is rejected at 5% level. The alternative hypothesis, that is, there is significant difference between the average monthly costs in the disposal of solid wastes and the average expected monthly WTP towards the enhancement of solid wastes disposal systems is accepted. Given that the average monthly solid wastes disposal costs are less than the average monthly WTP towards the improvement of disposal systems, then this reflects the true preference for the improvement of the system among the residents.

Finally, in chapter one we formulated the hypothesis that the level of authority intervention (WCC, Public Health or NGOs), proxied by the amount of services residents of a particular estate receive, does not significantly influence their relative WTP towards an improvement in environmental sanitation (including both faeces and solid wastes disposal in the broader sense). This hypothesis is accepted at 5% level as the regression

results show that the computed t-values in the case of both goods are less than the absolute critical value from the statistical t- test table (i.e. ±1.96). The direction of influence of the authority intervention (i.e. the amount of services presently enjoyed, on the WTP is varied in the case of the two goods. While the intervention influences positively on the expected WTP in the case of faecal disposal system enhancement, the impact is negative on the expected WTP for solid waste disposal improvements. The direction of impact notwithstanding, the influence is not significant at 5% level and hence the authority interventions in the provision of services do not influence significantly the expected WTP in the improvement of the present environmental sanitation conditions. The levels of services presently enjoyed by the residents of Wajir town notably from WCC are both minimal and irregular owing to combinations of many factors. First, there are limited funds, which in itself is occasioned by small exchequer budgetary allocation, inadequate revenue generation and some degree of financial improprieties on the part of the council officials. Second and reinforced by the first, is inadequate equipment and manpower, which affects the provision of adequate services. Finally, there is general apathy towards public services provisions on the part of Wajir county council.

4.9 Discussion of the results

4.9.1 Determinants of WTP for improved environmental sanitation

Generally, both the OLS and Probit models reveal important outcomes, with coefficients of most variables having the correct theoretical and empirical expected signs. The existence of the correct signs, consistent with economic theory specified a *priori* is one of the criteria used to assess the goodness of a model. A good model must be well specified

based on economic theory. Therefore on the strength of this, we can consider the results of the fitted models fairly plausible.

From theory the study specified that willingness to pay was influenced by socio-economic, demographic profiles and the characteristics of the environmental goods being valued. Most of the variables have the expected theoretical signs but the direction of influence were quite mixed, that is, some variables had positive impact while others had negative influence on the WTP. Other related studies had found similar conclusions (see for example, Whittington et al 1992, Whittington 1993; Belhaj 1996; Rogat 1995). The household incomes influences positively individuals WTP. Despite the fact that households' incomes were very low on average, thereby yielding low WTP bids, there was nevertheless an overwhelming willing to pay for improved services both in the management of faeces and solid wastes. But on average an increase in household incomes increased the WTP of households for improved services. This showed that environmental quality is probably like most goods where high-income households are likely to demand more of it than low-income households (Baumol and Oates 1988). Other studies elsewhere have shown related results. Salequzzaman et al (2000) on WTP for community management in Bangladesh found that communities with low incomes have low WTP bids for improved solid waste management services because they need their financial resources for other basic needs.

Surprisingly, in the OLS estimation education had quite varying influence on individuals' WTP for improved faecal and solid waste management. While the impact is positive in

the case of solid waste management, the influence was disappointingly negative in the management of faeces. The former (solid waste management) is consistent with theory and other similar empirical studies (Whittington et al 1993; Baumol and Oates 1988)) while for improved faecal management the outcome is unique. This means that with regard to faecal management education of household members does not have much influence as in the management of other solid wastes. Households in which members have education would like to have quality services in the management of solid waste

In the Probit estimation for goods (faecal and solid waste management) like OLS estimation for solid waste, education has significant positive influence on the WTP for improved management of the services. This can be explained by the fact that the complexity of the health and aesthetic implications of low quality environment make it likely that better educated households have stronger preferences for improved environmental sanitation quality in Wajir town (see also Baumol and Oates 1988). This reinforces the effect of income on the demand for improved environmental because higher incomes are associated with relatively higher levels of education.

The current monthly costs (computed from annual charges and other private costs) for the services received do have significant positive influence on households' WTP; other studies elsewhere (Salequzzaman et al 2000 and Whittington 1993) show similar results. This means that where the costs are high but services are good the individuals are willing to pay. Most households were willing to pay for the improved service management compared to what they are currently incurring. In other words, the present services are

both low and irregular and that by paying for an improved management the residents will receive much better services.

In the Probit model, the influence different individual attributes and socio-economic factors have on the probability of willing to pay were also quite varying. But generally household income, education, age, gender, family sizes and the level of services received from the authorities notably WCC and NGOs are the factors that influence WTP at the time of the decision.

4.9.2 Disparity between WTP and WTAC for Environmental Sanitation

The study shows that there is significant difference between WTP and WTAC measures with the regard to valuing the faecal and solid wastes management. Similar theoretical and empirical expositions on environmental valuation can be seen in the works of Randall and Stoll (1980), Cummings et al 1986; Fisher et al 1988 and Hanemann 1991. In the case of Wajir town, this can be explained by the fact that poor sanitary conditions affect the lives of the residents, which in reality cannot be traded off for anything. This means therefore, that the willingness to pay and willingness to accept compensation measures differed considerably and as a result, the WTP was a proportion of the sizes of households' meagre incomes while the WTAC was large enough indicating that individuals wanted to be compensated for the hazards/risks posed by inappropriate environmental sanitation. This according to the residents will fairly indemnify their welfare losses for the inappropriate environmental sanitation in the area.

4.9.3 Costs and Valuation of Environmental Sanitation

The study found that costs for the disposal of faeces and solid wastes do have significant influence on the willingness to pay for perceived improvements in those services; similar results are presented elsewhere by Whittington et al, 1992; Whittington et al 1993 and Salequzzaman et al 2000). In Wajir town, the costs households incur in the management of bucket latrines and disposal are not much different from what they are willing to pay for any envisaged improvement compared to the disposal of solid wastes. Nevertheless, the WTP for perceived improvement in the management of faeces and bucket latrines were higher on average than the current monthly costs. Similar results were presented by Whittington et al 1992 in Kumasi Ghana where most households were willing to pay more for improved sanitation than they were currently paying but in absolute terms the potential revenues were not large, confirming that conventional sewerage which was considered in that study was not affordable to the vast majority.

In the case of the management of solid wastes, the scenario was slightly different. The current monthly disposal costs (computed from annual service charges and other private costs), are considerably different from the average monthly WTP for perceived improvement in the management of the services. The average monthly WTP was much higher than the current monthly disposal costs. See Whittington et al 1993; Salequzzaman et al, 2000 for similar exposition. In Wajir town, this therefore means that the current solid waste management is very poor and that by paying for an improved management residents will receive a much better service. To put it differently, there is relative preference for the perceived improvement in the management of solid wastes in Wajir town.

CHAPTER FIVE
CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents the findings of economic analyses of contingent valuation study on improved environmental sanitation in a rural town in North-eastern Kenya (Wajir) where bucket latrines are mainly in operation and solid waste management are poor. Generally, the empirical results from the OLS estimation show that such socio-economic factors, as household income, disposal costs, education level etc are important determinants of individuals' WTP toward environmental sanitation improvement.

5.2 Faecal and solid waste disposal

In Wajir town, the existence of bucket latrine has worsened the faecal disposal and other solid wastes. The study found the problem was the most severe that required urgent redress. This has come well above an array of other problems including solid wastes, water supply and insecurity due to the high awareness level among the residents. In addition, the study found that such poor sanitary conditions present a number of environmental and health risks and/or hazards. In particular, there are occasional outbreaks of environmental sanitation-related diseases notably malaria, typhoid, dysentery and diarrhoea. This, as noted, was compounded by Wajir county council's lack of finances, equipment and general apathy towards public service delivery.

Furthermore, the study found that the management of environmental sanitation including faecal and solid waste disposal is supply-driven. In other words, it is limited to specific supply institutions notably the WCC, which have been much slower in adjusting to the

demands of the residents. However, WCC minimum intervention did not influence households' WTP positively.

5.3 Measuring Economic Values

One of the purposes of this contingent valuation study was to determine households' valuations of improvements in environmental sanitation in a rural town in Kenya. The study found that there is an overwhelming WTP for both faecal and solid waste disposal. To qualify this, the study found that the current average monthly costs for the disposal of both faeces and solid wastes were significantly lesser than the average monthly-expected WTP in the enhancement of these goods. These results therefore reflect true preferences for the improvements of the goods being valued.

The study also established that there is significant difference between average WTP and WTAC in the case of both goods (i.e. faecal disposal and solid waste). This, as pointed, is consistent with earlier empirical works that employed interview procedures, which have produced some evidence of large disparities between WTP and WTAC measures (Cummings et al 1986, Fisher et al 1988, Hanemann 1991)

The WTAC measure was much higher than the WTP in both faecal and solid waste management improvement. This was because the environmental sanitation conditions of Wajir town was so poor and therefore the residents would wish to be compensated for the health risks and/or risks involved. In addition, the residents valued the two goods differently. There was significant disparity between average WTP_f and average WTP_s

with former being higher. This means that the residents value the improvement of faecal management much more than solid waste.

The study found the average monthly WTP of the residents for improved faecal management is Ksh 259.30. This against the average individual monthly income is a significant amount (28% of individual average monthly income). When this is aggregated across the households in Wajir town gives Ksh 1.04 million, which is the economic value to the residents in a month. The average monthly WTP for solid waste is Ksh 129.60 (14% of individual average monthly income) which when aggregated across the residents yields the economic value of Ksh 518,400 a month.

The study also established that poor environmental sanitation has adverse environmental and health effects on Wajir residents. If the residents have to contend with the existing conditions, they need to be compensated in some form for the loss in welfare. The amount that would approximately indemnify the residents' welfare loss can also be aggregated across the population. This yields Ksh 16.6 million a month for faecal disposal and Ksh 10.6 million a month for solid waste.

The significant economic values notwithstanding, the estimated values of WTP and WTAC measures should be regarded as approximations because they are not only contingent upon the hypothetical market scenario presented to the residents, but also upon the statistical analyses. Although the WTP was overwhelmingly positive the mean WTP was very small. The study attributed this principally to three reasons. First, the low

WTP is dependent on absolute poverty among households and individuals. For example, households with average family sizes of nine persons have average monthly income of Ksh 8100.00, which translates into Ksh 900.00 per individual per month. In theory is income is assumed to be associated with constant error variance. The reason being that as incomes grow, people have more "discretionary income" and hence more scope for choice about the disposition of their income. But in this study it seems plausible that low-income individuals (which is the case among the majority) spend less towards an improvement in environmental sanitation. Second, the low WTP may have been motivated in some instances by strategic behaviour by some residents who believed that the authorities should solve the problem in question. This did not however come explicitly to appear like a bias. Finally, the low WTP bids was due to undesirable characteristics of households towards environmental goods such that they trade-off environmental improvements for other private consumption. These reasons notwithstanding, the existence of a positive WTP among the residents indicates that there are true preferences for an improvement in the goods in question.

The economic valuation of the goods consistent with economic theory was influenced by such socio-economic, demographic and environmental factors as disposal costs, household incomes, education levels, environmental awareness, age, gender and family sizes.

5.4 Policy Recommendations

On the basis of the findings of the study the following policy recommendations are suggested.

- The economic valuation measures of WTP and WTAC for improved environmental sanitation significantly differ. This may have some policy implication for the government. If the WTP measure has to be followed, then subsidization may be a possible solution in obtaining improved environmental sanitation. On the other hand, if WTAC measure is followed, then the government should set very stringent environmental standards for the safety of the residents.

- Given that environmental sanitation is a public good from the point of view of clean environment and that there is an overwhelming WTP reflecting true preference for the improvement of the services, the government should allow residents to adopt demand-responsive approach to sanitation enhancement. This is basically a market model in which different stakeholders determine their own providers such that management and control can be shifted from supply authorities notably the Wajir County Council to the community. This will be consistent with Government of Kenya-UNDP Country Cooperation 'Framework' (CCF) in environment and natural resources for the period 1999-2003, which focuses on local community participation linking poverty reduction to better environmental management as a way of furthering sustainable development.

- There is overwhelming willingness to pay for improved services particularly with regard to solid waste where the average monthly WTP is significantly higher than the current monthly disposal costs. In order to develop and sustain this spirit of payment, a system of payment should be devised on a community-NGOs-public participation basis in return for regular and better services.

- Relatively low-cost alternative technologies like the septic tank (which was made explicit in the hypothetical contingent market), should be introduced by the stakeholders (community, NGOs and Government) by subsidizing the costs involved in a well-targeted manner.

- Reducing poverty is both a moral imperative and a prerequisite for environmental sustainability. Therefore, the government and other stakeholders should prioritise poverty reduction so that the residents can participate fully in improved environmental sanitation given the strong correlation between willingness to pay and household income.

5.5 Limitation of the study and areas of further research

The study used contingent valuation method to value the environmental goods, which appears a relatively a good way of obtaining the necessary and to a certain extent, valid information required for this purpose. However, the reliability of the method and the validity of the responses depended much on the explicit presentation of the contingent

market to the interviewees. Much as the study made explicit the hypothetical market, the results are still considered as approximations.

Although as the study attempted to unravel the nature and intensity of the problem under investigation, it has concentrated much on the economic aspect of improved environmental sanitation. It would have been much interesting to capture or include other aspects of the problem. Such aspects should be investigated to suggest more broad-based solutions to environmental sanitation problem. Particularly, there is need to explore more comprehensively, low-cost, simple, appropriate technological options to the problem of bucket system in Wajir town and the effect would have on the socio-cultural, psychological, geographical and religious superstructure of the local community.

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APPENDIX 1

QUESTIONNAIRE FOR WAJIR TOWN RESIDENTS

Date: **Questionnaire Number:** **Interviewer's Name**

____May/June/2002 _____ _____

INTRODUCTION

Hello,
I am **Omar Bundid Da'ar**, a student from the University of Nairobi, Department of Economics and am carrying out research on environmental sanitation improvement in Wajir town. As you are aware Wajir town is faced with severe inadequate and poor environmental sanitation. These have been responsible for a number of environmental health hazards/risks including diseases.

You have been chosen through random sampling as one of the persons to participate in a survey regarding environmental sanitation problems, resultant environmental risks and possible improvement in the situation. All data and information collected will be kept strictly confidential. So please answer the questions as truthfully as possible.

SECTION A: ENVIRONMENTAL SANITATION

(FAECAL DISPOSAL AND SOLID WASTE DISPOSALS)

1. (a) Are you aware of any faecal and/or solid waste disposal problems in Wajir town?

[1] Yes [0] No

(b) If "NO", why? Please explain

_____
_____
_____

(c) If "YES", does the faecal disposal system pose any health hazards and/or risks?

[1] Yes [0] No

(d) If "YES", are there some diseases (arising from those risks) that are directly or indirectly related to the faecal disposal and sanitation in the town, please specify

if any

_____
_____
_____
_____

2. As a resident of Wajir, which of the following problems is of most concern to you? Please rank these problems from the most severe (Rank 1) to the least important (Rank 4)

Tick	Rank
[ ] Faecal disposal and management	[ ]
[ ] Water supply	[ ]
[ ] Solid waste disposal and management	[ ]
[ ] Insecurity	[ ]

3. (a) Indicate on a scale of 0-8 the seriousness of faecal disposal problem in your residential estate. Note: 0 represents very serious scenario (not even habitable) and 8 is excellent (not a problem actually). _____ Score: showing general perception for all possible conditions.

Illustration of Meaning of Scores

8: ***Excellent condition***

6 and 7: ***Fairly good and no cause for alarm***

4 and 5: ***Undecided***

2 and 3: ***Less severe but requires redress***

0 and 1: ***Very severe and requires urgent redress***

(b) Also indicate on a scale of 0-8 the seriousness of solid waste disposal problem in your residential estate. Note: 0 represents very serious scenario (posing a lot of hazards) and 8 is excellent (not a problem actually). _____ Score: showing general perception for all possible conditions.

Illustration of Meaning of Scores

8: ***Excellent condition***

6 and 7: ***Fairly good and no cause for alarm***

4 and 5: ***Undecided***

2 and 3: ***Less severe but requires redress***

0 and 1: ***Very severe and requires urgent redress***

4. (a) Have you ever suffered from any of those disease(s)

[1] Yes [0] No

(b) If "YES", please name this/these disease(s)

_____
_____
_____
_____

(c) If No, has anyone in your household suffered from any of those disease(s)?

[1] Yes [0] No

5. (a) Have you or anyone sought any medical attention for the disease suffered?

[1] Yes [0] No

(b) If "YES", for what purpose?

_____
_____
_____

6. (a) Are you interested in proper sanitation and faecal disposal and management in Wajir town?

[1] Yes [0] No

(b) If "YES", do you want a private body to manage it?

[1] Yes [0] No

(c) If "NO", why are you not interested?

_____
_____
_____

7. (a) Has there been any level of Authority intervention like county council or Ministry of Health over the issue of faecal disposal and management?

i) Maximum intervention

ii) Minimal intervention

iii) No intervention

(b) If there was any maximum intervention, what is the nature?

_____
_____
_____

(c) If there was any minimum intervention, what is the nature?

_____
_____
_____

(d) If there was any other intervention, what is the nature?

_____
_____
_____

8. (a) Do you have a family toilet? [1]Yes [0]No

(b) If "NO", where do you go for calls of nature?

[ ] In the open
[ ] Share with neighbours(s)
[ ] Other means (Please specify) _____

(c) If Yes, what kind of toilet?

[ ] Bucket latrine
[ ] Pit latrine
[ ] Flushable-cistern-type.
[ ] Septic tank
[ ] Others (Please specify) _____

(d) If your household owns a toilet, who maintains it?

[ ] Household members
[ ] House help
[ ] Soil men
[ ] No body

(e) If your answer to Q8(c) above is either (BUCKET) or (PIT), how much do you or your family members spend (in monetary terms) on average in a month? Kshs._____

9. (a) There are many residents in this town who cannot afford to own a toilet of whatever form, do you think the town needs public toilets as in big municipalities?

[1]Yes [0] No

(b) If response to Q9 (a) "YES", are you willing to share with others?

[1]Yes [0] No

(c) If your response to Q9 (b) is "NO", give reason(s) for not wanting to have public toilets?

_____
_____
_____

10. (a) Solid waste is also known to to pose lots of problems, is it a problem here in Wajir? [1]Yes [0] No

(b) Compared to faecal disposal, is solid waste a major problem?

[1]Yes [0] No

(c) Where do you dispose the the solid waste your household generates?

[ ] In the open
[ ] In dust bins
[ ] In pits
[ ] Other means, please specify._____

(d) How much does your household incur on monthly basis the disposal and management of solid waste? Ksh _____

(e) Does the Wajir County Council (WCC) in any way assist in the disposal of solid waste?[1]Yes [0] No

(f) If "YES", how?

_____
_____
_____

SECTION B: WILLINGNESS TO PAY AND ACCEPT COMPENSATION

The demand for a consumer good or service is generally regulated through the price of the good. Public goods such as air, goods like sanitation etc which affect the lives of the public are however, goods whose benefits cannot exclude any one (from the point of view of clean environment). These goods or goods often degenerate and affect all residents negatively. The degeneration of these environmental goods demand the

application of measures such as the technique of Contingent Valuation to create a contingent market so that affected parties can place monetary value or price on these implicit goods (e.g. Environmental sanitation)

In particular, the residents of Wajir are not satisfied with the present bucket latrine system and the service level for solid waste disposal. For this reason, **Wajir Residents' Sanitation Network (WARSAN) Co. Ltd**, a private entity with broad-based representation of stakeholders, was formed to dispose, manage and do all that appertains to environmental sanitation enhancement. The first task of the entity is to improve the sanitation system from the bucket system (which is widely in use) to conventional septic tanks emptied periodically. In addition, the private entity is charged with onus of disposing and properly managing solid waste in Wajir town. Given that these improvements are necessary, they nevertheless call for extra in terms of service maintenance charges, which have to be met by all concerned.

In this regard, the following questions will attempt to elicit residents' Willingness to pay (WTP) in order to meet the cost of environmental sanitation improvements. Experiences in other places have shown that community participation is a necessary condition, though not a sufficient one insofar as environmental enhancement is concerned.

11. It is often acknowledged that households in Wajir town are negatively affected by poor environmental sanitation. Suppose **Wajir Residents' Sanitation Network (WARSAN) Co. Ltd**, a private entity with a broad-based representation of

stakeholders is charged with the responsibility of faecal management, would you be willing to pay any amount in terms of service charge per month for this improvement?

[1]Yes [0] No

12 (a) If "NO", why would you not be willing to pay any monthly service charge to the **WARSAN Co. Ltd** for improved faecal management?

[ ]I cannot afford it

[ ]This improvement is of no value to me

[ ]I do not have enough information about the problem

[ ]I do not place a monetary value to sanitation improvement

[ ]I do not want to participate in this survey

[ ]I do not have trust in the private entity.

[ ]Others, please specify

(b) If "YES", what is the maximum amount of money would you be willing to pay as service charge per month to improve the faecal management in Wajir town?_____per month

(c) Suppose **WARSAN CO. Ltd** came up with an arrangement where the Ministry of Local Government compensated all residents of Wajir affected by poor faecal management. What is the minimum amount of monthly compensation that you would **accept** from the Ministry for the loss you suffer due to poor faecal management in Wajir town? Ksh _____per month.

13. It has also been observed that apart from poor faecal management, poor solid waste management negatively affects households in Wajir town. Suppose **Wajir Residents' Sanitation Network (WARSAN) Co. Ltd**, a private entity with a broad-based representation of stakeholders is also charged with the responsibility of proper solid waste management, would you be willing to pay any amount in terms of service charge per month for this improvement?

[1]Yes [0] No

14. (a) If "NO", why would you not be willing to pay any monthly service charge to the **WARSAN Co. Ltd** for improved solid waste management?

[ ]I cannot afford it

[ ]This improvement is of no value to me

[ ]I do not have enough information about the problem

[ ]I do not place a monetary value to solid waste improvement

[ ]I do not want to participate in this survey

[ ]I do not have trust in the private entity.

[ ]Others, please specify

(b) If "YES", what is the maximum amount of money would you be willing to pay as service charge per month for improved solid waste management in Wajir town?_____per month

(c) Suppose **WARSAN CO. Ltd** came up with a similar scheme where the Ministry of Local Government compensated all residents of Wajir affected by poor solid waste management. What is the minimum amount of

monthly compensation that you would **accept** from the Ministry for the loss you suffer due to poor solid management in Wajir town? Ksh _____per month.

15. (a) Suggest measures that should be taken to resolve the faecal management problems in Wajir town.

_____
_____
_____
_____
_____

(b). Also suggest measures that should be taken to resolve solid waste problems in Wajir town.

_____
_____
_____
_____

16. (a) Who is the best person/institution to manage faecal disposal in Wajir town and why?

_____
_____
_____
_____
_____

(b) Who is the best person/institution to manage solid waste in Wajir town and why?

_____
_____
_____
_____
_____

SECTION C: SOCIO-ECONOMIC AND DEMOGRAPHIC PROFILE.

17. Sex: [1] Male [o] Female

18. (a) Are you the Household head? [1] Yes [0] No

(b) If "NO", state your relation to the Household head.

[ ]Spouse
[ ]Son
[ ]Daughter
[ ]Others (specify) _____

(c) Which of the following best represents your age bracket?

[ ] Below 25 years	[ ]35-40 years	[ ]51-54 years
[ ] 25-30 years	[ ] 41-44 years	[ ]55-60 years
[ ] 31-34 years	[ ] 45-50 years	[ ]over 60 years

19. (a) Marital status:

[ ] married
[ ] Single
[ ] Divorced
[ ] Widowed

(b) How many members constitute your household (including yourself and children) _____ members.

20. What is your educational level?

[ ]No formal education
[ ]Primary education
[ ]Secondary education {Put actual number of years____ years}
[ ]College education
[ ]Others, please specify _____

21 (a) What is your main occupation? _____

(b) What is the nature of your job?_____

(c) Which of the following brackets **best** explains your household's total income per month? (Tick appropriate incomes brackets and, **IF ACCEPTABLE BY THE RESPONDENT**, fill in the actual amount in the spaces provided)

	a) Wage Income			b) Non-wage Income			c) Total Income (a+b)	
Tick	Income level (ksh)	Actual (Optional)	Tick	Income level (ksh)	Actual (Optional)	Tick	Income level (ksh)	Actual (Optional)
	Below 1,000			Below 1,000			Below 2,000	
	1,001-3000			1,001-3000			2,001-6000	
	3001-5000			3001-5000			6,001-10,000	
	5,001-7,000			5,001-7,000			10,001-14,000	
	7001-9,000			7001-9,000			14,001-18,000	
	9,001-10,000			9,001-10,000			18,001-20,000	
	Above 10,000			Above 10,000			Above 20,000	

Thank you for your cooperation.

LOCATION OF THE DISTRICT

WAJIR DISTRICT
ADMINISTRATIVE BOUNDARIES